GENERALIZED HYPERVIGILANCE IN CHRONIC PAIN PATIENTS

by

Ann J. McDermid

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ABSTRACT

Fibromyalgia is a chronic pain disorder of undetermined etiology that affects the musculoskeletal system. Previous research has indicated that fibromyalgia patients have an increased sensitivity to painful stimulation compared to normal control subjects. These findings are in keeping with the hypervigilance model of pain perception (Chapman, 1978) which states that certain chronic pain patients have a heightened responsiveness to experimentally induced pain, showing increased attention to external stimulation and a preoccupation with pain sensations. More recent research has demonstrated that the pattern of hypervigilance observed in some fibromyalgia patients extends to other sensory domains, suggesting a generalized pattern of hypervigilance which is marked by the amplification of a variety of external and internal noxious sensations (McDermid, Rollman, & McCain, 1996). Rollman and Lautenbacher (1993) refer to this altered perceptual style as "generalized hypervigilance".

Although this concept provides a useful framework for conceptualizing the behaviour of some patients, it is understood poorly at the present time because it is still in its preliminary stages of development. Accordingly, the purpose of this study is to clarify the nature of generalized hypervigilance. Two main issues were addressed: 1) Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin, like fibromyalgia, or does this pattern extend to patients who have conditions with a known etiology? Generalized hypervigilance was measured by the Somatosensory Amplification Scale, 2) What variables contribute to generalized hypervigilance? There have been no prior attempts at identifying the underlying contributing mechanisms for this concept. The roles that anxiety, monitoring, symptom attribution, and maladaptive pain coping style may play in the prediction of generalized hypervigilance were assessed.

Thirty-three fibromyalgia patients, 29 rheumatoid arthritis patients, 26 temporomandibular joint dysfunction patients, and 34 healthy volunteers participated in this study. The fibromyalgia and the temporomandibular joint dysfunction patients represented conditions of undetermined etiologies whereas patients with rheumatoid

arthritis represented a condition with a known organic basis.

Contrary to hypotheses, the results illustrated that the groups of chronic pain patients with disorders of undetermined origin did not differ from those with a disorder of determined etiology on the measure of generalized hypervigilance. Multiple regression analyses revealed that different variables are involved in the prediction of generalized hypervigilance for the various groups of chronic pain patients. Trait anxiety was shown to be the best predictor for the fibromyalgia patients whereas bodily monitoring was the strongest predictor for the arthritis patients and the TMD patients. The results of this study are discussed in terms of the clinical and research implications.

Keywords: chronic pain, pain perception, hypervigilance, somatosensory amplification, fibromyalgia , rheumatoid arthritis, temporomandibular joint dysfunction

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CHAPTER 1
INTRODUCTION

Overview

Fibromyalgia is a chronic pain disorder of undetermined etiology that affects the musculoskeletal system (Goldenberg, 1989). Previous research has indicated that fibromyalgia patients have an increased sensitivity to painful stimulation compared to normal control subjects (Scudds, Rollman, Harth, & McCain, 1987). These findings are in keeping with the hypervigilance model of pain perception (Chapman, 1978) which states that certain chronic pain patients have a heightened responsiveness to experimentally induced pain, showing increased attention to external stimulation and a preoccupation with pain sensations. More recent research has demonstrated that the pattern of hypervigilance observed in some fibromyalgia patients extends to other sensory domains, suggesting a generalized pattern of hypervigilance which is marked by the amplification of a variety of external and internal noxious sensations (McDermid, Rollman, & McCain, 1996). Rollman and Lautenbacher (1993) refer to this altered perceptual style as "generalized hypervigilance." This concept is still in its preliminary stages and is not well understood at the present time. The goal of this study is to clarify the nature of generalized hypervigilance by addressing two main issues; each is outlined below briefly.

1. Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin or does this pattern extend to pain patients who have conditions with a known etiology?

Research has shown that some fibromyalgia patients have increased perceptual sensitivity to a variety of noxious somatosensory stimuli. One of the goals of the present study is to determine if this pattern of generalized hypervigilance is common to patients with conditions of undetermined origin or if this pattern extends to pain patients with conditions that have an organic etiology.

For the present study, fibromyalgia patients and patients with temporomandibular joint dysfunction syndrome were chosen to represent disorders with an undetermined etiology whereas rheumatoid arthritis patients were selected to represent a condition with an organic basis. It is hypothesized that patients with pain disorders with an undetermined origin will respond similarly on a measure of generalized hypervigilance and will report higher scores compared to those patients with a condition with a known organic basis. Specific reasons for this hypothesis are discussed in a later section.

2. Desconstructing generalized hypervigilance: Group differences and predictive ability.

Although Rollman and Lautenbacher's concept of generalized hypervigilance provides a useful framework for conceptualizing the behaviour of some fibromyalgia patients, it is limited because it offers no explanation regarding the potential underlying mechanisms. Accordingly, one of the primary goals of the present study is to identify what variables are associated with this concept. Although generalized hypervigilance is likely influenced by a variety of factors, my main interest is in examining the contributing role of psychological variables.

It is hypothesized that the following variables are involved in generalized hypervigilance: (a) anxiety: a tendency to have high levels of trait anxiety and somatic anxiety (defined as the tendency to experience anxiety primarily as somatic distress), (b) monitoring of bodily sensations and monitoring of threatening events, (c) symptom attribution: a tendency to make physical attributions for unpleasant, yet common, bodily sensations rather than attributing such sensations to psychological or environmental causes and, (d) pain coping response: a tendency to use maladaptive or "catastrophizing" responses instead of active coping strategies to deal with pain.

These hypotheses were initially based upon previous research findings (McDermid et al., 1996; Rollman & Lautenbacher, 1993), clinical observation of fibromyalgia patients, and anecdotal reports from this patient population. Empirical support for the selection of these contributing variables was found in various bodies of

research that have examined processes related to generalized hypervigilance. More specifically, studies that have identified factors shown to influence the detection, perception, interpretation of, and response to bodily sensations provided the theoretical foundation which justifies the selection of these variables (Barsky, 1992; McHugh & Vallis, 1986; Mechanic, 1986; Miller, 1987; Robbins & Kirmayer, 1986; Robbins, Kirmayer, & Kapusta, 1991; Schwartz, Davidson, & Goleman, 1978).

Group Differences

Do fibromyalgia and temporomandibular joint dysfunction patients, patients with conditions which lack a clearly established etiology, respond similarly on the measures believed to underlie generalized hypervigilance? Do their responses differ from those given by the rheumatoid arthritis patients?

It is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will have similar scores on measures of anxiety, monitoring, symptom attribution, and pain coping style. More specifically, it is hypothesized that these patients will report higher levels of anxiety (trait and somatic) and monitoring (of bodily sensations and of threatening events), will make more somatic, versus psychological or normalizing, attributions for common bodily sensations, and will report higher scores on a measure of maladaptive pain coping compared to the rheumatoid arthritis patients. A detailed explanation of these hypotheses along with supporting research evidence is presented in a later section. As well, I am interested in examining how accurately the groups of subjects can be classified based upon their scores on these variables. Discriminant function analyses will be used to address this issue.

Predictive Ability

It is hypothesized that the variables discussed above will be significant predictors of generalized hypervigilance. The predictive ability of these variables will be addressed by performing standard and stepwise regression analyses. Standard regression analyses will allow for an examination of the relation between the dependent variable and the independent variables. Stepwise regression analyses will be performed to determine the best predictor(s) of generalized hypervigilance for each group of pain patients.

Contribution of Study

In summary, the results of the present study will contribute to the existing literature in several ways. The findings will clarify generalized hypervigilance, a concept which is understood poorly at this time. The results will illustrate if generalized hypervigilance, as measured by the Somatosensory Amplification Scale (Barsky, Wyshak, & Klerman, 1990), is unique to patients with disorders of undetermined origins (i.e., fibromyalgia and temporomandibular joint dysfunction) or if this pattern extends to chronic pain patients with a condition of determined etiology (i.e., rheumatoid arthritis). As well, the findings will show what variables are involved in the prediction of generalized hypervigilance for these groups of chronic pain patients, thus allowing for the development and implementation of appropriate treatments.

This Overview section was intended to highlight the purpose of the study and how the primary study issues will be addressed. Now the focus will turn to a description of fibromyalgia and how the research on this disorder has informed the hypotheses in the present study.

Description of Fibromyalgia

As stated earlier, fibromyalgia is a chronic musculoskeletal pain disorder of unknown origin. Individuals with fibromyalgia complain of a diffuse pattern of musculoskeletal aching, a non-restorative sleep pattern, fatigue, and muscle stiffness upon awakening (Smythe, 1986; Wolfe et al., 1990). There are no laboratory or radiographic tests which indicate the presence of this disorder (Yunus, 1992). "Tender points," specific areas of localized tenderness that are detected by a physician using digital palpation, distinguish fibromyalgia from other soft tissue rheumatic disorders (McCain & Scudds, 1988). The female to male ratio of occurrence is approximately 5:1 and the clinical prevalence of fibromyalgia has been reported at 11% (Raymond & Bergland, 1995; Wolfe et al., 1990). The estimated prevalence of fibromyalgia in the general community is 3% (Goldenberg, 1999).

Physiological Studies

Numerous studies aimed at identifying an organic cause of fibromyalgia have been conducted. As this area of research is not the focus of the present study, the review of these findings will be brief. Researchers have suggested that muscle pathology (Neeck & Riedel, 1994; Ursin, Endresen, Haland, & Mjellem, 1993), problems with muscle circulation (Lindman, Hagberg, Bengtsson, Henriksson, & Thornell, 1995), or aberrant sleep patterns (Moldofsky, 1986) may be responsible for this disorder. Others have proposed that fibromyalgia is a neuroendocrine disorder (Griep, Boersma, & de Kloet, 1993), or that it is caused by abnormalities in neurotransmitters (Russell et al., 1992), regional cerebral blood flow (Johansson, Risberg, Rosenhall, & Orndahl, 1995; Mountz et al., 1995), or that it is the result of altered central nervous system processing of nociceptive stimuli (Yunus, 1992). Thus far, the results of such studies have been inconclusive and the pathophysiological nature of this disorder remains elusive.

Psychological Studies

Because attempts at identifying an organic basis to fibromyalgia have been unsuccessful to date, there has been speculation that this disorder may be primarily psychological in nature. Studies that have examined the role of psychological factors in fibromyalgia have yielded conflicting findings, many of which are likely attributable, in part, to methodological differences and design flaws (Smythe, 1984). A summary of some of the studies that highlight these discrepancies is discussed below.

A study by Hudson et al. (1985) indicated that the rate and familial prevalence of major affective disorder was significantly higher among fibromyalgia patients than among rheumatoid arthritis patients. Based upon those results, the authors suggested that fibromyalgia may be a form of major affective disorder or that a personal or family history of major affective disorder may predispose some individuals to developing fibromyalgia. As well, Walker et al. (1997) reported that fibromyalgia patients had significantly higher lifetime prevalence rates of mood and anxiety disorders, as well as higher numbers of medically unexplained physical symptoms in multiple organ systems.

Also, 90% of the fibromyalgia patients in their sample had at least one prior psychiatric diagnosis compared with less than 50% for a group of rheumatoid arthritis patients.

A study by Nicassio, Radojevic, Schoenfeld-Smith, and Dwyer (1996) indicated that 59% of their fibromyalgia sample met the cut-off criteria for clinical depression on the Center for Epidemiological Studies of Depression scale. When a higher cut-off criterion was used, one which is typically recommended for evaluating depression in chronic pain samples, still slightly more than 50% of the fibromyalgia patients were classified as being clinically depressed. Krag, Norregaard, Larsen, and Danneskiold-Samsoe (1995) reported that fibromyalgia subjects scored significantly higher than did rheumatoid arthritis patients and patients with lumbar herniation on scales measuring depression, melancholia, and anxiety. Also, the fibromyalgia subjects had significantly higher visual analogue scale pain intensity ratings than did the other groups. A study by Kurtze, Gundersen, and Svebak (1998) indicated that there were independent additive effects of anxiety and depression on levels of pain and fatigue for fibromyalgia patients. Krag, Norregaard, Hindberg, and Larsen (1995) found that fibromyalgia patients had significantly higher scores on measures of psychological distress, state and trait anxiety, and reported significantly higher pain intensity ratings than did a group of back pain patients. Epstein et al. (1999) found that fibromyalgia patients had high lifetime and current prevalence rates of major depression and panic disorder. As well, those fibromyalgia patients reported elevated scores on measures of depression, anxiety, neuroticism, and hypochondriasis.

Although the majority of studies has reported elevated scores on measures of psychological distress, there have been a few studies which have not found such elevations. For example, Ahles, Yunus, and Masi (1987) reported no difference in depression scores between fibromyalgia and rheumatoid arthritis patients. The authors interpreted their results as support for the hypothesis that the presentation of chronic pain in the absence of a known organic pathology is not a variant of depressive disease. The results of a later study (Ahles, Khan, Yunus, Spiegel & Masi, 1991) were similar; there were no significant group differences between fibromyalgia and rheumatoid arthritis

patients in terms of lifetime history of psychiatric disorders, including major depression, somatization disorder, or anxiety disorders. The authors concluded that the results did not support a psychopathology model as a primary explanation for the symptoms of fibromyalgia.

Factors contributing to the inconsistent findings in some of the studies examining the role of psychological factors in fibromyalgia may reflect differences in the measures administered, selection bias in the patients that were studied, and failing to control for pain-related variables (Goldenberg, 1989).

Although there are a few exceptions, most of the above studies suggest that psychological disturbance and fibromyalgia are associated. It remains unclear whether psychological disturbance is an antecedent or a concomitant of this chronic pain disorder (Merskey, 1989; Boissevain & McCain, 1991).

Fibromyalgia and Pain Experience

Studies that have examined differences in pain perception between fibromyalgia patients and other groups of chronic pain patients have yielded a more stable pattern of results. Rollman (1989) and others have noted that pain appears to be the hallmark symptom of fibromyalgia. A study by Leavitt, Katz, Golden, Glickman, and Layfer (1986) revealed that fibromyalgia patients selected significantly more words to describe the nature of their pain on the McGill Pain Questionnaire (MPQ) compared to arthritis patients. Perry, Heller, and Levine (1988) administered the MPQ, along with a visual analogue pain scale, to fibromyalgia and polyarthritis patients. The results showed that the fibromyalgia patients had significantly higher scores than did the other patients on both measures.

As well, clinical data suggest that fibromyalgia patients experience widespread and intense pain; in other words pain is not limited to tender point areas. For example, Wolfe et al. (1990) reported that 60% of a group of fibromyalgia patients stated that they experienced pain in 15 or more bodily regions. Of these patients, 69% described experiencing "pain all over."

Studies that have induced experimental pain have shown that fibromyalgia patients tend to have an exaggerated response to noxious stimuli when compared to normal control subjects. For example, it has been well documented that fibromyalgia patients report lower pain threshold and tolerance compared to pain-free control subjects (Granges & Littlejohn, 1993; Granges, Gibson, Littlejohn, & Helme, 1993; Lautenschlager et al., 1991; Scudds et al., 1987; Tunks, Crook, Norman, & Kalaher,1988). These findings lend themselves to a brief discussion of two influential theories of pain perception.

Theories of Pain Perception: Adaptation-Level and Hypervigilance

Two theories have been proposed to explain the nature of pain perception in chronic pain patients: adaptation-level theory (Helson, 1954; Rollman, 1979) and hypervigilance theory (Chapman, 1978). Adaptation-level theory was first proposed by Helson and was subsequently expanded by Rollman. Helson observed that when subjects made ratings about a stimulus, the ratings were not based exclusively upon the physical characteristics of one stimulus but were dependent upon other stimuli that were in temporal or spatial contiguity to it. This model accounts for the common observation that one stimulus is perceived differently by people with varying past experiences or by the same individual in two different contexts. Rollman suggested that adaptation-level theory had implications for the assessment of experimentally-induced and clinical pain. He proposed that the internal discomfort that is experienced by pain patients serves as a point of reference to which they compare other types of pain. Consequently, it is predicted that pain patients will have a different "adaptation-level" than will pain-free control subjects, and they are expected to assign a lower rating to the magnitude of a pain stimulus.

Chapman (1978) proposed an alternate theory. He observed that certain chronic pain patients exhibit a heightened sensitivity to clinical and experimental pain and referred to this as "hypervigilance." Chapman predicted that chronic pain patients will have lower pain threshold and tolerance and will demonstrate a greater propensity to label stimulation as being painful, compared to control subjects, because he hypothesized that

pain patients pay increased attention to external stimulation and have a preoccupation with pain sensations.

Both adaptation-level and hypervigilance theories have received empirical support, making it difficult to predict how patients will respond to painful sensations (Dworkin, Chen, LeResche, & Truelove, 1983). However, Merskey and Evans (1975) observed that patients who have pain that is caused by a clearly established organic basis are more likely to respond in a fashion that is consistent with adaptation-level theory, whereas patients presenting with pain that does not have an identified physiological basis tend to respond in a hypervigilant manner. Similarly, Rollman (1979) has noted that hypervigilant responses are often observed in patients with pain disorders of undetermined etiology (fibromyalgia, temporomandibular joint dysfunction) or in patients who have conditions, such as angina, where it is adaptive to be vigilant for changes in physical sensations (Malow, Grimm, & Olson, 1980; Procacci, Zoppi, Padeletti, & Maresca, 1976).

Fibromyalgia and Hypervigilance

The findings that have been presented to this point show that fibromyalgia patients tend to respond to painful stimuli in a manner that is consistent with Chapman's hypervigilance theory (i.e., they exhibit lower pain threshold and tolerance compared to normal control subjects). Additional research has revealed that fibromyalgia patients also respond in a hypervigilant manner when compared to other groups of chronic pain patients. Numerous studies have shown that the pain severity ratings of fibromyalgia patients are significantly higher compared to those of other patients with pain disorders such as rheumatoid arthritis, polyarthritis, ankylosing spondylitis, and chronic low back pain (Leavitt et al., 1986; Perry et al., 1988).

Moreover, there is evidence that this heightened responsiveness exhibited by some fibromyalgia patients extends beyond traditional diagnostic tender points and that these patients appear to have an increased sensitivity to a variety of somatosensory stimuli. For example, Scudds et al. (1989) reported that fibromyalgia patients had significantly lower

pain threshold and tolerance at both tender and non-tender points compared to rheumatoid arthritis patients and normal control subjects. Also, it has been shown that fibromyalgia patients exhibit significantly decreased noise threshold when compared to healthy volunteers (Hadj-Djilani & Gerster, 1984; Gerster & Hadj-Djilani, 1984). Arroyo and Cohen (1993) reported that pain tolerance for electrocutaneous stimulation in fibromyalgia patients was reduced compared to normal control subjects. A study by Lautenbacher, Rollman, and McCain (1994) showed that pressure and heat thresholds were lower for fibromyalgia patients at both tender and non-tender points compared to healthy control subjects. Lautenbacher et al. indicated that a "pattern of pain hyperresponsiveness" appears to be associated with fibromyalgia and proposed that this pattern may consist of both central and peripheral factors.

More recently, the results of a study by McDermid et al. (1996) indicated that fibromyalgia patients reported significantly lower pain threshold and tolerance in response to pressure dolorimetry at non-tender points compared to rheumatoid arthritis patients and a group of healthy control subjects. Moreover, when testing was expanded to another sensory domain, that of audition, the fibromyalgia patients reported significantly lower noise tolerance ($\underline{M}$ = 66.2, $\underline{SD}$ = 9.2) than did the rheumatoid arthritis patients ($\underline{M}$ =75.9 , $\underline{SD}$ = 12.4) and the healthy volunteers ($\underline{M}$ = 100.5, $\underline{SD}$ = 7.5).

In addition to the experimental findings, there is evidence from clinical reports that confirms the hypothesis that fibromyalgia patients exhibit a heightened degree of sensitivity. For example, Smythe (1986) has remarked that fibromyalgia patients appear to have an "exquisite hypersensitivity" to various external and internal stimuli and has referred to fibromyalgia as "the irritable everything syndrome". In addition to the muscular pain experienced by fibromyalgia patients, many experience multiple symptoms in various bodily systems, many of which have no organic explanation (e.g., irritable bowel syndrome, chronic headaches, swelling feelings in soft tissues, paraesthesias, primary dysmennorhea, and irritable bladder syndrome) (Yunus, Ahles, Aldag, & Masi, 1991). Consistent with this observation is the finding that three syndromes of undetermined etiology (irritable bowel, chronic headache, and primary dysmennorhea)

were significantly more common in fibromyalgia patients compared to rheumatoid arthritis patients and normal control subjects (Yunus, Masi, & Aldag, 1989).

Block (1993) noted that fibromyalgia patients tend to have a longer history of somatic complaints dating to childhood "growing pains" compared to other pain patients. The results of Block's study are consistent with earlier findings (Kirmayer, Robbins, and Kapusta, 1988) where fibromyalgia patients, compared to the arthritis patients, reported having undergone multiple surgical procedures for non-musculoskeletal problems, visited significantly more physicians, and were more likely to view themselves as being "sickly". As well, the fibromyalgia patients were significantly more likely than were the rheumatoid arthritis patients to report a history of somatic symptoms that could not be explained by medical investigation.

Generalized Hypervigilance

The findings that indicate that fibromyalgia patients have increased perceptual sensitivity cannot be explained fully by Chapman's hypervigilance theory which was designed to account only for differences in pain perception between chronic pain patients and healthy control subjects. As indicated earlier, Rollman and Lautenbacher (1993) have elaborated upon hypervigilance theory, attempting to explain why some fibromyalgia patients respond to a variety of somatosensory stimuli, not merely to pain stimuli, in an exaggerated fashion. Based upon the responses of fibromyalgia patients to aversive stimuli, Rollman and Lautenbacher postulated that this chronic pain disorder may involve a generalized pattern of somatosensory hypervigilance which is marked by increased attention to a variety of external and internal noxious sensations. They suggested that fibromyalgia patients are acutely aware of all perceptual experiences with a negative quality, with pain being the one to which the most attention is directed. Rollman and Lautenbacher refer to this pattern of responding as generalized hypervigilance and suggest that it "reflects a perceptual style in which aversive events are amplified or in which the usual cognitive filtering mechanisms, which dampen the response to aversive

events, are not fully engaged" (p. 156). Rollman and Lautenbacher propose that generalized hypervigilance may be a predisposing factor in the onset of fibromyalgia.

Primary Study Issues

As indicated in the Overview, two main issues are addressed in the present study. A detailed description of each issue and how it will be answered is presented below.

1. Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin or does this pattern extend to pain patients who have conditions with a known etiology?

As discussed above, fibromyalgia is a chronic pain disorder which lacks an established organic etiology at this time. Patients with fibromyalgia have been shown to exhibit a pattern of generalized hypervigilance in response to aversive external and internal sensations, compared to patients with rheumatoid arthritis, a pain disorder with a known cause. One of the primary issues addressed in the present study is whether generalized hypervigilance, as measured by the Somatosensory Amplification Scale, is unique to patients who have disorders of undetermined origin or if this pattern extends to patients with pain disorders that have a known organic basis.

Based upon previous research (McDermid et al., 1996), it is hypothesized that generalized hypervigilance will be common to patients who have disorders which lack a determined etiology. The researcher believes that generalized hypervigilance may be a predisposing factor in the development of fibromyalgia and other disorders of undetermined origin, although this hypothesis is not tested directly in this study.

Previous research has shown that there are a number of similarities among patients who have conditions that do not have a determined cause. Barsky and Borus (1999) use the term "functional somatic syndrome" to refer to several related syndromes that "are characterized more by symptoms, suffering, and disability, than by disease-specific, demonstrable abnormalities of structure or function" (p. 910). According to Barsky and Borus, functional somatic syndromes include such conditions as multiple chemical sensitivity, sick building syndrome, repetitive stress injury, candidiasis

hypersensitivity, chronic whiplash, chronic Lyme disease, Gulf War syndrome, chronic fatigue syndrome, irritable bowel syndrome, and fibromyalgia. Functional somatic syndromes share similar phenomenologies, high rates of co-occurrence, similar epidemiological characteristics and higher than expected prevalences of psychiatric comorbidity. Barsky and Borus acknowledge that while discrete pathophysiological causes may be found in some patients with these syndromes, the suffering of these patients is exacerbated by a "self-perpetuating, self-validating cycle" in which common, endemic, somatic symptoms are incorrectly attributed to serious abnormality, reinforcing the patient's belief that he or she has a serious disease.

Barsky and Borus (1999) noted that the similarities seen in the functional somatic syndromes have led some to propose that they share a common pathophysiology and have been conceptualized as variants of "affective spectrum disorder" (Yunus, 1993). Similarly, Yunus et al. (1991) have suggested that patients who have chronic pain conditions with undetermined origins may not be distinct but, rather, may represent a pattern of "generalized somatic distress". Because of the considerable overlap of symptoms, the same person may often meet the diagnostic criteria for several functional syndromes simultaneously. Such a pattern of somatic distress may become differentiated into specific syndromes only when patients' symptoms are claimed by particular medical specialists (Robbins et al., 1990). The diagnostic label given to particular patients may be as strongly influenced by the context and the medical specialty of the diagnostician as by the patient's symptoms (Barsky & Borus; Robbins et al.). It may be possible for a person presenting with fatigue, pain, and bowel complaints to be diagnosed with chronic fatigue syndrome, fibromyalgia, or irritable bowel syndrome depending on what specialist is assessing the patient (Robbins & Kirmayer, 1986).

Research which has compared patients with conditions of determined and undetermined etiologies helps to increase our understanding of what factors may account for reported differences in physical and psychological distress between these groups. A number of researchers has examined psychological differences between patients with irritable bowel syndrome (IBS) and irritable bowel disease (IBD). IBS is a common

gastrointestinal disorder which is characterized by abdominal pain and a change in bowel habits (i.e., constipation, diarrhea, or both) occurring in the absence of diagnosable physical abnormalities, making it a diagnosis of exclusion (Lattimer, 1983). Unlike IBS, IBD which encompasses two major disorders, ulcerative colitis and Crohn's disease, has a definite pathophysiological basis and may lead to life threatening exacerbations and an increased risk for other disorders, particularly gastrointestinal tract cancers (Whitehead & Schuster, 1983). Studies have shown that patients with IBS tend to have elevated scores on measures of psychological distress compared to patients with IBD. Blanchard, Scharff, Schwarz, & Suls (1990) found that IBS patients had significantly more diagnosable psychopathology, particularly anxiety disorders compared to an age and sex-matched group of IBD patients. Similarly, others have reported that patients with IBS have more psychiatric diagnoses, personality disorders, and psychiatric symptoms compared to patients with IBD (Drosssman & Lowman, 1985). Walker, Roy-Byrne, Katon, & Li (1990) reported that patients with IBS had significantly more lifetime diagnoses of major depression, somatization disorder, generalized anxiety disorder, panic disorder, and phobic disorder. Some of these studies are highlighted in greater detail below.

Walker, Gelfand, Gelfand, & Katon (1995) reported that IBS patients had significantly higher lifetime prevalence rates of major depression and current panic disorder. Also, the IBS patients in that study reported significantly more medically unexplained physical symptoms and had disability ratings which were equal to or greater than the scores of patients with severe organic gastrointestinal disease. Schwarz, Blanchard, Berreman, & Scharff (1993) compared IBS patients, patients with IBD, and nonpatient controls on measures of physical and psychological symptomatology. The results showed that for 11 of the 14 measures of psychological distress that were administered, the IBS patients scored significantly higher compared to the IBD patients, who in turn had higher scores than did the nonpatient control subjects. The IBS patients had significantly higher scores on all measures of anxiety and rated their abdominal pain as being significantly more severe compared to the IBD patients. While the IBD patients

reported more episodes of diarrhea, they did not rate them as being significantly more painful compared to the IBS patients.

As illustrated above, patients with conditions that some consider to be functional (Barsky and Borus, 1999), tend to have elevated rates of psychiatric disorders. The prevalence of Axis I psychiatric disorders, both current and lifetime, tends to be higher in patients with functional somatic syndromes compared to the general population or when compared to similar groups of patients who have disorders with a determined cause (Barsky & Borus). Some researchers view psychological distress in vulnerable individuals as a predisposing factor for functional syndromes, however, the cause-and-effect relation between functional somatic syndromes and psychological distress is widely debated because it is often difficult to determine which condition is antecedent and which is consequent. This raises the question of whether psychological distress is, for some individuals, a risk factor for the development of pain disorders that lack a determined etiology or is psychological distress an inevitable result of living with a chronic pain condition?

In the last decade, there have been some studies that have suggested that psychological distress may be a predisposing factor in the onset of functional syndromes. For example, Walker et al. (1990) reported that IBS patients had significantly more unexplained somatic symptoms and most had psychiatric disorders, particularly anxiety disorders, *before* the onset of their irritable bowel symptoms, suggesting that psychological distress may play a key role in the onset of this disorder. More recently, Van Houdenhove et al. (2001) reported that chronic fatigue syndrome and fibromyalgia patients showed significantly higher prevalences of emotional neglect, emotional abuse, and of physical abuse *prior* to the onset of their disorders compared to a chronic disease group including rheumatoid arthritis and multiple sclerosis patients, and a matched control group. Van Houdenhove et al. suggested that exposure to chronic stress resulting from abusive situations may predispose some individuals to developing these disorders. The authors noted that the relationship between victimization and chronic fatigue

syndrome and fibromyalgia is likely mediated by a complex interaction of several physiological and psychological mechanisms.

Obviously, not all individuals who experience significant levels of psychological distress develop pain conditions that lack a medical explanation. In a recent article, Gagliese and Katz (2000) discussed the problems of continuing to conceptualize pain in a dualistic manner (i.e., organic or functional cause). The authors believe that medically unexplained pain is not a symptom of a psychological disorder and feel that it is "time to abandon the thinking that separates mind from body" (p. 251). Gagliese and Katz called upon those researchers who suggest that psychological distress causes pain to provide the empirical evidence which would support this hypothesis and to specify the exact mechanisms by which emotional distress may cause pain.

Clearly, just because the pathogen (or pathogens) that may be responsible for fibromyalgia or other "functional somatic syndromes" has not been discovered yet, it does not imply that an organic cause does not exist nor does it imply that the cause is purely psychological (Gagliese and Katz, 2000). A number of individuals who wrote editorials in response to Barsky's article on functional somatic syndromes, felt that Barsky had failed to include some of the studies that suggest a link between organic factors and chronic fatigue syndrome or Gulf War syndrome (Hedrick, 2000; Kurt, 2000). In his editorial, English (2000) remarked that schizophrenia was once considered to be caused by "cold, distant mothers"; with modern technology it is now considered a neurologic brain disease. Furthermore, English notes that lupus, multiple sclerosis, AIDS, and Lyme disease suffered similar fates (i.e., dismissed as being functional) before "tissue evidence" was available. Gagliese and Katz (2000) note that this type of dualistic thinking is harmful for patients; the role of both physiological and psychological factors should be considered when assessing and treating pain disorders for which a cause is not readily available.

The preceding section discussed the potential role which psychological distress may play in the onset of pain of undetermined origin. It is also important to consider how being diagnosed with a condition of undetermined origin may affect levels of

psychological distress. Schwarz et al. (1993) were struck by the finding that patients with a functional disorder, IBS, were more anxious and reported greater levels of pain and more relative distress from diarrhea than did the more physically ill IBD patients. The authors hypothesized that the patients with a chronic, debilitating, and sometimes life-threatening disease such as IBD receive sufficient validation and support from medical professionals to alleviate some of the anxiety that would be expected in these patients. Conversely, the IBS patients are suffering from a disorder which lacks a clear organic origin and is diagnosed only after all physical causes are excluded. The authors suggest that the lack of validation of their symptomatology may augment the levels of anxiety and physical distress that one would expect to see in the chronically ill in general.

This reasoning may also apply to other patients who are diagnosed with conditions of undetermined organic origin. Like the IBS patients, fibromyalgia patients are diagnosed with a condition which lacks an organic cause. Fibromyalgia patients may also feel a lack of validation for their physical complaints. Certainly, anecdotal reports and information obtained in psychological assessment interviews that I have conducted (as part of my position at The Fibromyalgia Daycare Program at London Health Sciences Centre) confirm this hypothesis. Moreover, the titles of recent articles on fibromyalgia such as "Fibromyalgia: Out of Control?"(Gordon, 1997) and "Fibromyalgia: Scourge of Humankind or Bane of a Rheumatologist's Existence?" (Solomon & Liang, 1997) suggest that some health care practitioners hold negative views about this condition, which may in turn, affect their attitude toward these patients.

The research presented to this point has shown that there are a number of similarities among patients with conditions which lack a determined organic basis, both in terms of levels of psychological distress and sensitivity to aversive stimuli. Accordingly, it is hypothesized that patients with pain disorders for which the cause is unknown (fibromyalgia and temporomandibular joint dysfunction) will report higher levels of generalized hypervigilance compared to patients with a pain disorder with a determined pathophysiological basis (rheumatoid arthritis). As with the relationship between psychological distress and pain of undetermined origin, it is not yet known

whether generalized hypervigilance is a predisposing factor in the development of these conditions or conversely, if having a condition for which there is no known cause contributes to a pattern of generalized hypervigilance. Regardless of the direction of this relationship, the hypothesis remains the same: patients with pain of unknown origin are predicted to have higher levels of generalized hypervigilance compared to those who have pain disorders with a known etiology.

To test this hypothesis, the response of fibromyalgia patients will be compared to those diagnosed with temporomandibular joint dysfunction, another painful condition with an undetermined cause.

Temporomandibular Joint Dysfunction

Temporomandibular joint dysfunction is a chronic pain disorder which is associated with clicking of the temporomandibular joint and limitation of the jaw opening (Dworkin & LeResche, 1992). Currently, there is a lack of evidence for organic dysfunction in the pathophysiology and maintenance of temporomandibular joint dysfunction (Rollman & Gillespie, 2000). There is ongoing investigation into the roles that psychosocial and physiological variables may play in the development of this disorder. A brief review of the temporomandibular joint dysfunction literature that is relevant to the present study is discussed below.

Because no specific etiological agent has been identified for temporomandibular joint dysfunction, researchers have examined the role that psychological factors may play in this disorder. The results from studies examining this issue in temporomandibular joint dysfunction patients have been inconclusive (Rollman & Gillespie, 2000). A review of the pertinent findings is presented below.

A study by Kallenberg, Wenneberg, Carlsson, and Ahlmen (1997) indicated that temporomandibular joint dysfunction patients reported that stress and anxiety aggravated their pain symptoms. Also, the temporomandibular joint dysfunction patients in that study reported higher values for a measure of "mental tension" compared to a group of rheumatoid arthritis patients. Curran, Carlson, and Okenson (1996) conducted a study

that explored the emotional and physiological responses of temporomandibular joint dysfunction patients and control subjects to two laboratory stressors (mental arithmetic and pressure-pain stimulation). The results indicated that the temporomandibular joint dysfunction patients had greater resting respiration rates and reported more anxiety, sadness, and guilt relative to the control subjects. Also, the temporomandibular joint dysfunction patients responded with more anger to the arithmetic tasks compared to the control subjects.

Vassend, Krogs, and Dahl (1995) conducted a study that examined predictors of temporomandibular joint dysfunction pain. The results suggested that the best predictors of subsequent temporomandibular joint dysfunction pain were general somatic complaints, initial pain levels, and trait anxiety. Another study found that hardiness, defined as feelings of control and commitment, was significantly lower in patients with temporomandibular joint dysfunction compared to a matched control group of non-temporomandibular joint dysfunction patients. It has been reported that temporomandibular joint dysfunction patients have elevated scores on hysteria and somatization compared to pain-free control subjects (Zach & Andreasen, 1991). Also, studies have shown that temporomandibular joint dysfunction patients tend to report higher levels of depression (Bassett, Gerke, & Goss, 1990; Gallagher, Marbach, Raphael, Dohrenwend, & Cloitre, 1991) and more prominent features of abnormal illness behaviour compared to control subjects (Goss, Bassett, & Gerke, 1990).

Southwell, Deary, and Geissler (1990) compared temporomandibular joint dysfunction patients to sex and age-matched dental patient control subjects. The results revealed that the temporomandibular joint dysfunction patients had significantly higher scores on measures of neuroticism, introversion, and trait anxiety. The authors speculated that the temporomandibular joint dysfunction patients may have personalities that are more vulnerable to life stress. Southwell et al. suggested that certain "stress-prone personalities" may express anxiety in the form of a predictable set of physical syndromes, resulting in conditions such as temporomandibular joint dysfunction.

Contrary to the studies discussed above which suggest a link between temporomandibular joint dysfunction and psychological distress, a study by Schnurr, Brooke, and Rollman (1991) reported no significant differences between a group of temporomandibular joint dysfunction patients and normal control subjects on a variety of psychological questionnaires assessing personality styles, perceived stress, abnormal illness behaviour, coping styles, and health locus of control.

As illustrated in the research findings presented above, the majority of studies has found elevated levels of psychological distress in temporomandibular joint dysfunction patients. As with fibromyalgia, the nature of the cause-and-effect relation between psychological distress and temporomandibular joint dysfunction remains unclear.

More recently, research has shown that temporomandibular joint dysfunction patients, like fibromyalgia patients, tend to exhibit a heightened responsiveness to aversive stimuli. Maixner, Fillingim, Booker, and Sigurdsson (1995) reported that temporomandibular joint dysfunction patients were more sensitive to noxious stimuli than were age-matched control subjects. More specifically, when patients with temporomandibular joint dysfunction were exposed to ischemic muscle pain, they reported significantly lower thermal pain threshold and tolerance and ischemic pain threshold and tolerance compared to the control group.

Similar results were found in a later study (Fillingim, Maixner, Kincaid, Sigurdsson, & Harris, 1996). Temporomandibular joint dysfunction patients were classified as pain-tolerant or pain-sensitive based upon their responses to an ischemic pain task. The results indicated that the pain-sensitive group exhibited greater sensitivity to thermal pain and rated innocuous visual stimuli as being more intense. The findings of that study suggest that ischemic pain tolerance may be a clinically relevant marker of pain sensitivity in temporomandibular joint dysfunction patients. A further study by Maixner, Fillingim, Kincaid, Sigurdsson, and Harris (1997) revealed comparable findings: the temporomandibular joint dysfunction patients had lower thermal and ischemic pain threshold and tolerance than did pain-free subjects, again showing that patients with

temporomandibular joint dysfunction have a greater sensitivity to painful stimuli compared to control subjects.

Maixner et al. (1995) has suggested that temporomandibular joint dysfunction may be a psychophysiological disorder of the central nervous system which modulates the physiological, emotional, and neuroendocrine responses to emotional and physical stressors. Those authors suggested that the lower threshold and tolerance levels reported by temporomandibular joint dysfunction patients may reflect alterations in the pain regulatory system. These hypotheses have not yet been tested in an empirical fashion.

The temporomandibular joint dysfunction research that has been reviewed here suggests that there may be a combination of psychological and physiological characteristics which are associated with temporomandibular joint dysfunction. Furthermore, this literature suggests that similarities may exist between fibromyalgia and temporomandibular joint dysfunction patients in terms of how they respond to noxious or aversive sensory stimuli.

It is hypothesized that a pattern of generalized hypervigilance will be common to fibromyalgia and temporomandibular joint dysfunction patients, who have disorders that lack a clearly established organic basis. More specifically, it is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will have higher scores on a measure of generalized hypervigilance compared to patients who have a condition for which the cause is known. For the current study, rheumatoid arthritis patients will represent individuals with a chronic pain condition of determined etiology. The reasons for selecting rheumatoid arthritis as a comparison group and a brief review of the pertinent literature on this chronic pain disorder are presented below.

Rheumatoid Arthritis

Rheumatoid arthritis patients were selected as the pain comparison group in this study because, like the fibromyalgia and the temporomandibular joint dysfunction patients, they suffer from a condition where chronic pain is a significant component. One key difference is that rheumatoid arthritis has a determined etiology, thus allowing for a

comparison of pain intensity ratings between conditions of determined versus undetermined origin.

The rheumatoid arthritis literature is extensive and accordingly, the findings that are of the most relevance to the issues being addressed in the current study are presented. Rheumatoid arthritis is a chronic pain disorder that involves the autoimmune system and is defined primarily by the inflammation of joint tissues (Huyser & Parker, 1998). Rheumatoid arthritis is two to three times more prevalent in females compared to males and the onset of this disorder typically occurs between 20 and 50 years of age, with increasing incidence among older individuals (Zvaifler, 1989). The nature of the pain experienced by rheumatoid arthritis patients has received considerable attention from researchers. In summary, the results suggest that rheumatoid arthritis patients experience moderately intense pain that has been rated comparably less than other pain syndromes such as back pain, cancer pain, or neuralgia (Melzack, 1975). As with many medical disorders, it should be noted that rheumatoid arthritis patients are not a homogeneous group; there is considerable within-group variability in terms of reported pain levels and perceived disability (Zvaifler, 1989). A review of the literature suggests that rheumatoid arthritis patients tend to report significantly higher tolerance to aversive stimuli compared to fibromyalgia patients (McDermid et al., 1996; Scudds et al., 1988).

There have been numerous studies that have examined the association between rheumatoid arthritis and psychological distress. In summary, many studies have reported higher levels of psychological distress (e.g., depression, anxiety) among rheumatoid arthritis patients compared to normal control subjects (Pincus, Griffith, Pearce, & Isenberg, 1996). Because many of these studies failed to include a pain control group, it is of note that the elevations on such psychological measures do not necessarily imply that these characteristics are unique to rheumatoid arthritis patients, but rather, likely reflect more general problems in coping with chronic illness (Wilson et al., 1982). For example, a study by Smedstadt, Moum, Vaglum, & Kvien (1996) showed that the rheumatoid arthritis patients rated their mental health significantly lower compared to a group of matched pain-free control subjects. Symptoms of anxiety and depression were

significantly higher among the arthritis patients. However, when the effects of pain, disability, and fatigue were controlled for statistically, the differences in psychological distress between the groups no longer existed. The authors stated that these findings illustrate how pain, disability, and fatigue are strongly related to the increased levels of psychological distress in rheumatoid arthritis.

A review of the literature suggests that rheumatoid arthritis patients, when compared to fibromyalgia patients, typically tend to report lower levels of psychological distress. For example, a study by Ekselius, Bengtsson, and von Knorring (1998) reported that rheumatoid arthritis patients had significantly lower scores than did fibromyalgia patients on scales measuring somatic anxiety, muscular tension, and psychasthenia. Similarly, Walker et al. (1997) reported that rheumatoid arthritis patients reported significantly less functional disability and were better adapted to their illness compared to a group of fibromyalgia patients. Some authors have remarked upon the relative absence of serious psychopathology among patients with rheumatoid arthritis as being a sign of their resilience and their capacity to cope effectively with the difficulties of their disease (Parker et al., 1990).

Predictions for Issue 1

The primary measure of generalized hypervigilance used in the present study is the Somatosensory Amplification Scale (SSAS; Barsky et al., 1990). The SSAS was chosen because its items most closely approximate Rollman and Lautenbacher's (1993) definition of generalized hypervigilance. The SSAS is a 10-item questionnaire that assesses a subject's perceived sensitivity to several unpleasant bodily sensations, most of which are not pathological symptoms of serious disease. It has been shown to be a reliable and valid measure (Barsky et al., 1990; Wise & Mann, 1993). It has been used in chronic pain populations. Raphael, Marbach, & Gallagher (2000) found that SSAS scores were significantly higher in patients with myofascial pain compared to a group of control subjects. Gregory & Manring (2000) found that SSAS scores were significantly higher in patients with pain in central locations compared to those patients whose pain was

primarily in the extremities. Epstein et al. (1999) found that SSAS scores were associated with dolorimetry pain pressure thresholds in a sample of 73 patients diagnosed with fibromyalgia. The SSAS has also been used in psychiatric populations. Barsky et al., (1990) found that hypochondriacal patients have reported higher SSAS scores compared to a medical patient control group (Barsky et al., 1990).

Previous research has shown that fibromyalgia and temporomandibular joint dysfunction patients tend to respond to aversive stimuli with increased sensitivity, suggesting that generalized hypervigilance may be common to patients with pain disorders of undetermined etiology. Rheumatoid arthritis patients seem to be less likely to amplify bodily sensations (McDermid et al., 1996; Robbins & Kirmayer, 1986). It is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will have higher scores on a measure of generalized hypervigilance compared to the rheumatoid arthritis patients. In keeping with previous research (Raphael et al., 2000), all patient groups are expected to have elevated generalized hypervigilance scores compared to the control group.

2. Deconstructing generalized hypervigilance: Group differences and predictive ability

Although Rollman and Lautenbacher's (1993) concept of generalized hypervigilance provides a skeletal framework for conceptualizing the behaviour of some fibromyalgia patients, it is still in its developmental stages and has significant limitations. The primary problem with this concept is that it offers no explanation for why some fibromyalgia patients, compared to other chronic pain patients, respond to sensory stimuli in an exaggerated manner. As well, it would be more informative if the name of the concept reflected its somatosensory focus. Perhaps, "generalized somatosensory hypervigilance" would be a more descriptive term; however, for consistency, the term "generalized hypervigilance" will continue to be used for the remainder of this paper.

To date, there has been only speculation regarding potential mechanisms that may explain fibromyalgia patients' magnified response to pain. For example, it has been suggested that fibromyalgia patients may have a dysfunctional central nervous system that

does not minimize pain perception effectively (Yunus, 1992). Other researchers have proposed that fibromyalgia patients may have a central cognitive mechanism that amplifies relatively moderate pain resulting from muscular hypertonia or hyperreactivity (Graber, 1991). While these suggestions are interesting, they remain vague and have not been tested empirically. As well, it should be noted that these suggestions have focussed upon potential explanations regarding the exaggerated response of fibromyalgia patients to pain in particular. Few, if any, attempts have been made at moving beyond the pain domain, and trying to identify factors that may account for the more generalized perceptual amplification of somatosensory experiences observed in some fibromyalgia patients. Accordingly, this is one of the aims of the present study.

Generalized hypervigilance is likely influenced by a combination of biological, developmental, and psychological variables. The focus of the current study is on the latter; this is not intended to minimize the contribution of the other factors. It is hypothesized that the following variables contribute to generalized hypervigilance: anxiety, monitoring, somatic attribution (i.e., the tendency to appraise bodily sensations as being symptomatic of disease rather than attributing such sensations to psychological or environmental causes), and a tendency to engage in maladaptive or "catastrophizing" pain coping strategies.

Initially, the hypothesis that these variables contribute to generalized hypervigilance was based upon previous research findings (McDermid et al., 1996; Rollman & Lautenbacher, 1993), clinical observation, and anecdotal reports from fibromyalgia patients. A review of the literature examining factors shown to affect the detection, perception, and interpretation of somatic sensations provided the theoretical foundation that supports these hypotheses. More specifically, it has been shown that anxiety (trait and somatic), monitoring (of body and of threatening events), attributional style, and pain coping strategies each influence the perception and expression of somatic sensations (Barsky, 1992; McHugh & Vallis, 1986; Mechanic, 1986; Miller, 1987; Robbins & Kirmayer, 1986; Robbins et al.,1990; Schwartz et al., 1978) and are therefore

likely to predict generalized hypervigilance. The views of these researchers on the importance of these factors is highlighted below.

Robbins and Kirmayer (1986) have proposed that there are three key factors that influence the experience and expression of physical symptoms: attention focussed on the self or the body, illness worry or vulnerability (i.e., the belief that one has a serious illness or is vulnerable to illness), and symptom attribution. The authors noted that while it is most convenient to present these factors as stages, in reality "the feedback and feedforward loops knit these processes into an interactive whole that defies any simple sequential analysis" (Robbins & Kirmayer, 1986, p. 73). However, with longitudinal studies, it may become possible to examine the temporal unfolding of the illness experience and associated behaviours.

Similarly, Barsky (1992) has discussed several variables that he believes influence the perceived intensity of physical symptoms. They are: attention paid to bodily sensations, the interpretation of these sensations, and mood, specifically the role of anxiety. Mechanic (1986) proposed that there are four variables that affect how individuals are likely to respond to bodily sensations. These include how individuals monitor their bodies, the ways in which symptoms are defined and interpreted, what types of remedial action are taken, and how formal and informal health-care services are utilized. McHugh and Vallis (1986) believe that illness experience involves four factors: the monitoring of somatic or visceral sensations, the cognitive processes involved in the interpretation of these bodily sensations, the attachment of meaning to the sensations that is carried out in the context of emotional state and concurrent environmental events in a manner that results in perceived distress or the sense of being unwell, and cultural factors influencing coping responses and health-seeking behaviours. McHugh and Vallis emphasize that these variables are interactive and of equal importance. As well, Miller (1987) and her colleagues have shown that how individuals cope with threat can influence illness behaviour. More specifically, Miller has found that people who use a monitoring or information-seeking approach when faced with threat demonstrate higher levels of physiological arousal and psychological distress (Miller & Mangan, 1983). A monitoring

style has been shown to be associated with a number of health care utilization and health outcome measures. Finally, Schwartz et al. (1978) have demonstrated that individuals with somatic anxiety (i.e., the tendency to express anxiety primarily in somatic terms) tend to report more physiological arousal and a heightened sensitivity to aversive or noxious stimuli.

Although the terminology may differ, there seems to be agreement among the researchers referred to above that mood, monitoring of bodily sensations, symptom attribution, and coping style influence the experience of somatic sensations. Arguably, these variables are likely to be involved in generalized hypervigilance which is defined as an exaggerated or amplified response to somatosensory sensations (Rollman & Lautenbacher, 1993).

The researchers cited above do not specify any direction for the relationship among the variables they propose to be involved in symptom experience and expression, emphasizing that all of the variables are interactive and of equal importance. This is tested in the current study by entering the variables of interest simultaneously into a standard regression equation. The results of this analysis will provide important information about the degree of association between the contributing variables and the dependent variable, generalized hypervigilance. As well, stepwise regression analyses will be performed to determine the best predictor(s) of generalized hypervigilance for each group of chronic pain patients.

Contributing variables: Hypotheses re: group differences and predictive ability

It is hypothesized that anxiety, monitoring, somatic attribution, and catastrophizing coping style will predict generalized hypervigilance scores, as measured by the SSAS. In terms of group differences, the fibromyalgia and the temporomandibular joint dysfunction patients are predicted to report higher levels of anxiety and monitoring compared to the rheumatoid arthritis patients. As well, they are expected to make more somatic attributions for common physical symptoms and to have higher catastrophizing scores. It is not known whether these variables are predisposing factors in the

development of chronic pain conditions of undetermined origin or if these variables are the result of living with a disorder which lacks a known cause; regardless of the direction of this relationship, the hypotheses will remain the same. Also, in keeping with previous research findings, it is hypothesized that the pain groups will differ from the control group on each of these variables. Now, a discussion of each variable, along with its rationale for selection, is presented below.

a) Anxiety

Trait anxiety.

Research has shown that mood, particularly anxiety, can influence the experience and expression of somatosensory sensations (Barsky and Klerman, 1983; Barsky 1992). Considerable attention has been directed toward the role of anxiety in such processes. Studies have shown that trait anxiety is associated with decreased pain threshold and tolerance (Flor & Turk, 1989), decreased threshold and tolerance for a variety of unpleasant stimuli (Sternbach, 1986), increased symptom reporting (Pennebaker, 1994), increased body awareness (Barsky, 1992), and a tendency to engage in maladaptive or "catastrophizing" pain coping responses (Flor & Turk, 1989). The causal nature of the direction that exists between anxiety and these variables has not been established yet. Most of these studies that have examined the link between anxiety and somatosensory variables have been correlational and retrospective in nature and were consequently fraught with the associated memory and recall-related problems inherent with this type of study design. There is ongoing debate in the literature about the nature of the causal link between pain and anxiety; additional longitudinal studies are needed to address this issue.

How is trait anxiety potentially linked to generalized hypervigilance? One possible explanation is proposed by Barsky (1992). He suggested that individuals with elevated levels of trait anxiety tend to be self-conscious and that the apprehensive self-scrutiny in which they tend to engage amplifies pre-existing physical symptoms and causes these individuals to notice innocuous somatic symptoms that would otherwise be ignored.

Further support for this hypothesis comes from the cognitive literature. It has been found that anxious individuals have an increased tendency to be vigilant in scanning for threat. For example, Eysenck, MacLeod, and Matthews (1987) reported that individuals who were high in trait anxiety had a tendency to favour threat over non-threat interpretations when presented with ambiguous stimuli. Eysenck et al. suggested that selective processing of threat-related information may be partially responsible for the tendency of high anxiety individuals, compared to low anxiety individuals, to be more anxious even in relatively stress-free conditions. In other words, the authors proposed that high trait anxiety individuals may have a pre-attentive selection bias in favour of threat whereas individuals low in trait anxiety may not have this predisposition. Eysenck et al. suggested that if anxiety affects attentional processes, then this, in turn, will affect a range of subsequent physiological and behavioural measures.

Applying this reasoning to chronic pain patients, it is possible that when they are presented with ambiguous stimuli such as innocuous bodily sensations, they may favour a threat interpretation of these stimuli. That is, patients may perceive these bodily sensations as being threatening and may respond to this perceived threat by amplifying them. Again, this is speculation and the direction of the relationship has not been determined.

Somatic anxiety.

In addition to trait anxiety, I am interested in determining if the way in which anxiety is expressed contributes to generalized hypervigilance. Schwartz et al. (1978) proposed that anxiety has both somatic and cognitive components. They developed The Cognitive Somatic Anxiety Questionnaire (CSAQ) to assess whether individuals experience anxiety as primarily somatic distress or cognitive distress. Research has shown that chronic pain patients, in comparison to healthy control subjects, report higher somatic anxiety scores (DeGood, Buckelew, & Tait, 1985).

Tamaren, Carney, and Allen (1985a) performed a study that tested the predictive validity of the CSAQ. Subjects with either predominantly cognitive or somatic anxiety, as assessed by the CSAQ, received a treatment that matched their primary anxiety mode

("matched group") and 12 patients received a treatment that addressed the secondary anxiety mode ("unmatched group"). After five sessions, the "matched group" reported significantly fewer anxiety symptoms than did the "unmatched group".

Another study by the same researchers (Tamaren, Carney, and Allen, 1985b) showed that somatic anxiety correlated with a number of measures of physiological sensitivity. Similarly, Heimberg, Gansler, Dodge, & Becker (1987) found that somatic anxiety scores were associated with increased physiological arousal (measured by heart rate scores).

Based upon the research presented above, it seems reasonable to test whether this variable is involved in generalized hypervigilance, the amplification of somatosensory sensations. As well, it will be interesting to see if the patients who have conditions of undetermined origin will differ from those with a known etiology in terms of their scores on this measure; it is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will have higher somatic anxiety scores compared to the rheumatoid arthritis patients.

Summary for anxiety variables.

Based upon previous research, it is predicted that trait anxiety and the expression of anxiety as somatic distress will be predictors of generalized hypervigilance. In terms of expected group differences, it is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will report higher levels of trait anxiety and somatic anxiety compared to the rheumatoid arthritis patients. Again, all patient groups are predicted to have higher anxiety scores (trait and somatic) compared to the control subjects.

b) Monitoring

Monitoring of bodily sensations.

Previous research has shown that fibromyalgia patients tend to be more aware of various bodily sensations and tend to report more physical symptoms, many of obscure

origin, compared to other groups of chronic pain patients (Block, 1993; Ferguson & Ahles, 1998; Robbins & Kirmayer, 1991, Yunus, Masi, & Aldag, 1989).

Robbins, Kirmayer, and Kapusta (1990) have suggested that the uncertainty and ambiguity that often surrounds the diagnosis of fibromyalgia may be associated with an increased tendency for patients to worry that their symptoms might have been misdiagnosed and may be indicative of a more serious disorder. Consequently, Robbins et al. (1990) hypothesized that this may, in turn, lead fibromyalgia patients to monitor bodily sensations and become preoccupied or "vigilant" about such perceptual sensations because they begin to fear that every noxious signal is suggestive of disease.

The belief that one has a serious illness or is vulnerable to illness, combined with a preoccupation with disease, is likely to motivate vigilant bodily scanning for unusual sensations and the recognition of those sensations as symptoms of illness (Robbins et al., 1990). As well, having persistent pain and somatic distress be discounted repeatedly by physicians as being "functional", something that often occurs with fibromyalgia patients, may result in symptom preoccupation and fear of disease (Kirmayer, 1986).

Others suggest that bodily monitoring or awareness of somatic sensations is the result of psychological distress. For example, subjects who are anxious or who have high scores on measures of neuroticism tend to be more aware of their bodily sensations and report more physical symptoms (Barsky, Orvan, Delamater, Clancy, & Hartley, 1998; Neitzer, Davis, & Kennedy).

In the present study, the Pennebaker Inventory of Limbic Languidness (PILL) is used to measure how much attention is paid to bodily sensations. The PILL is a symptom checklist which measures how frequently subjects experience a variety of common physical symptoms. As well, another score was calculated which reflected the total number of symptoms endorsed, regardless of frequency. Although, it could be argued that the PILL is an indirect measure of bodily monitoring, others have used this questionnaire to measure symptom perception, somatic awareness, and attentiveness to bodily sensations (van Vliet, Willemsen, Radder, Lemkes, & Jacobi, 1997; Woods, Miltenberger, & Flach, 1996).

It is hypothesized that monitoring of bodily sensations will be more prevalent among patients with conditions of undetermined origins. As well, it is predicted that all patient groups will have higher scores on the bodily monitoring measure compared to the control subjects.

Monitoring of threatening events.

In addition to bodily monitoring, there is research that suggests that some individuals may be vigilant in terms of responding to or coping with threatening aspects of their environment. Miller (1987) has researched extensively the cognitive informational styles that are used to cope with threat and frustration. According to Miller, when individuals are threatened with aversive events, information processing behaviour can vary along two dimensions: monitoring and blunting. Monitors selectively attend to and seek knowledge about the aversive event or stressor whereas blunters cognitively avoid and psychologically "blunt" objective sources of danger and avoid threat-relevant information. Miller developed the Miller Behavioral Style Scale (MBSS) that indicates if individuals are high or low on the monitoring and blunting dimensions. The MBSS has been shown to predict behavioural strategies in response to both physical and psychological stressors (Miller).

Miller and her colleagues have conducted many studies examining the relation between monitoring / blunting and health behaviour and health status. Her research on information processing behaviour in threatening medical situations has indicated that, at least under short-term threat, monitoring is more anxiety-arousing than is blunting. For example, Miller and Mangan (1983) reported that monitors who underwent colposcopy, a medically benign but subjectively threatening procedure, exhibited more behavioural and subjective arousal compared to blunters. In addition, among patients receiving chemotherapy, blunting was associated with less anxiety, less depression, and fewer physical side-effects than was monitoring. As well, those subjects with a monitoring style experienced a significantly higher incidence rate and longer episodes of nausea (Gard, Edwards, Harris, & McCormack, 1988). Moreover, Phipps and Zinn (1986) found

that pregnant women who were high monitors had higher levels of anxiety during amniocentesis than those who were blunters.

Miller, Brody, and Summerton (1988) reported that high monitors are more likely to attend to external threat-relevant cues and to internal bodily symptoms compared to low monitors. Miller et al. found that high monitors visited physicians with less severe medical problems but reported equivalent levels of discomfort, distress, and dysfunction compared to the low monitors. Also, high monitors exhibited less improvement in both physiological and psychological symptoms at physician follow-up visits and demanded more tests, information, and counselling, but desired a less active role in their health care than did low monitors. Miller et al. suggested that high monitors may seek medical attention to decrease their distress. This may partially explain why high monitors are more likely to utilize medical services than are low monitors.

Muris and van Zuuren (1992) performed a study that examined the relation between monitoring and blunting, fear of medical situations, and scanning for internal bodily sensations. The authors concluded that high monitors were more anxious than low monitors of medical affairs in particular, but not of other situations. In addition, high monitors reported experiencing more common physical symptoms and complaints compared to blunters.

The studies discussed above have focused upon how people cope with acute conditions. It is important to determine if the same types of responses would be used by individuals with chronic conditions. Miller, Leinbach, and Brody (1989) addressed this issue by comparing the coping styles and health behaviours of chronic hypertensive patients to the responses of a control group of normotensive patients who were attending a primary care setting for acute medical problems. The chronic hypertensive patients were significantly more likely to exhibit a monitoring coping style and reacted to their medical problems with significantly higher levels of concern and worry compared to the normotensive patients with acute medical conditions.

Miller and her colleagues have suggested that patients who are characterized by a monitoring method of coping may show an increased susceptibility to developing such

disorders as hypertension and other chronic diseases such as diabetes, heart disease, and cancer. It was suggested that training in blunting strategies such as relaxation techniques may help to decrease this vulnerability. While this is an interesting suggestion, the authors have not tested this hypothesis and to date, there is no empirical evidence that suggests that a monitoring coping style predisposes individuals to these chronic diseases.

Summary for monitoring variables.

In summary, research has shown that bodily monitoring is associated with increased reporting of physical symptoms and with the tendency to perceive symptoms as being noxious or intense in nature. Therefore, it is hypothesized that bodily monitoring will be a significant predictor of generalized hypervigilance.

In addition to bodily monitoring, the present study examines how patients respond to or cope with threatening events. Research has shown that individuals with a monitoring coping style (i.e., those who selectively attend to and seek knowledge about an aversive event or stressor) are more likely to exhibit greater levels of physiological and psychological arousal compared to those who adopt a blunting coping style (i.e., tend to avoid threat-relevant information). It is predicted that monitoring in response to threatening events will be a significant predictor of generalized hypervigilance.

In addition to examining the role of bodily monitoring and monitoring of threat, this study will examine the relation between these variables. It is expected that individuals with high scores on the bodily monitoring measure will also report high monitoring of threat scores. This issue has not been investigated in previous research studies with chronic pain populations.

In terms of expected group differences, the fibromyalgia and the temporomandibular joint dysfunction patients are predicted to report higher scores on a measure of bodily monitoring (The Pennebaker Inventory of Limbic Languidness) compared to the rheumatoid arthritis patients. As well, it is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will report higher monitoring scores on Miller's Behavioural Style Scale, the measure of monitoring of

threatening events. All patient groups are predicted to have higher scores on bodily monitoring and monitoring of threat compared to the control group.

c) Attribution

Another variable that is hypothesized to predict generalized hypervigilance is attributional style (i.e., the perceived cause of bodily sensations). When changes in bodily sensations have been detected, cognitive processes are used to help interpret the meaning of these sensations (Mechanic, 1986). McHugh and Vallis (1986) emphasize that individuals are not passive recipients of information from their environments but are actively involved in the processing of information.

The area of research on symptom attribution has received considerable attention. It is generally agreed upon that bodily sensations are intensified when they are attributed to a serious disease rather than to more benign causes, such as fatigue or emotional stress (Barsky, 1992). Robbins and Kirmayer (1991) describe attributional styles as reflections of individuals' underlying schemata that are used to interpret, label, and express new bodily and emotional sensations. Research on cognitive schemata has allowed for the identification of how individuals organize information. It is hypothesized that schemata guide attentional processes so that information that is consistent with the schemata is processed more easily and efficiently than information that is inconsistent with the schemata (Lau & Hartman, 1983). It has been shown that these unconscious processes can serve to maintain or exacerbate chronic illness behaviour (Meyer, Leventhal, & Gutmann, 1985).

Robbins and Kirmayer (1991) conducted a prospective study to examine the antecedents and consequences of attributional styles in family medicine patients. The results indicated that previous physical illness and psychiatric problems influenced the interpretation of new symptoms. For example, patients with acute or chronic physical illnesses made more somatic attributions for common physical symptoms, presented with more somatic symptoms, and more somatic complaints of obscure origin. This effect remained statistically significant when history of severe physical illness was controlled.

Robbins and Kirmayer suggested that being afflicted with an acute or chronic physical illness is likely to increase an individual's vigilance toward future illness and may provide a schema for the interpretation of new symptoms.

Conversely, Robbins and Kirmayer (1991) reported that patients with psychiatric difficulties made more psychological attributions for the same common physical symptoms. As well, patients with a psychological attributional style presented to physicians with more psychological symptoms over a six month period, an effect that remained significant when psychiatric history was controlled.

Similarly, Bishop and Converse (1986) have reported that people with a somatic attributional style tend to focus their attention on bodily manifestations of distress that may lead them to perceive physical symptoms that, in the absence of such attributions, would likely have been perceived as being emotional in nature, or would not have been perceived at all. Also, attributional styles have implications in terms of health-seeking behaviours. For example, research has shown that subjects are less likely to visit a physician for symptoms that they attribute to psychological origins whereas they are more likely to seek help for symptoms for which they would assign a physical cause (Bishop, 1987).

Barsky and Klerman (1983) noted that the amplification of bodily symptoms may result, in part, when people misattribute benign bodily sensations to serious illness instead of discounting sensations that most people would attribute to fatigue, aging, dietary indiscretion, or normal physiological processes. A study that compared the causal attributions for common somatic sensations made by individuals who visited their family physicians frequently ("frequent attenders") and control subjects indicated that the frequent attenders generated fewer normalizing (i.e., psychological or environmental) attributions for common bodily sensations. When the groups were given a common bodily sensation along with a pathological explanation, the frequent attenders were less able than the control subjects to generate reasons why the pathological explanation may be untrue (Sensky, MacLeod, & Rigby, 1996).

Attributional style and hypochondriasis.

Several researchers have examined the relationship between attributional style and hypochondriasis. Barsky and Klerman (1983) noted that non-hypochondriacal individuals who experience the same benign symptoms as a hypochondriacal group are more likely to attribute their physical symptoms to non-disease processes such as over-exertion, environmental stress, or aging. Barsky and Klerman suggested that benign bodily sensations are interpreted as being indicative of disease when cognitive meaning is attached to the sensations, a process that is influenced by such variables as external cues, interpersonal communications, and situational information. Barsky and Klerman suggested that these variables are more important when the person lacks an obvious, immediate, and adequate explanation for the symptoms. Typically, this misinterpretation occurs when the symptoms are ambiguous, diffuse, common, and in a part of the body that is not directly observable. When symptoms are severe, disabling, very unusual, or externally induced, there is less room for differing interpretations. The authors suggest that this may help to explain why symptoms such as fatigue, nausea, weakness, or diffuse pain are so common in hypochondriacal patients.

Once the incorrect attribution is formed (i.e., a benign sensation is believed to be indicative of a serious disease), future perceptions are interpreted within this framework or cognitive schema so that hypochondriasis becomes a "self-perpetuating and self-validating cognitive scheme" (Barsky & Klerman, 1983, p.278). Experimental and clinical studies support this conceptualization. For example, Chapman (1978) has shown that noxious sensory input undergoes a process involving cognitive assessment and clarification that has been found to amplify or reduce the intensity of these sensations. That is, how people view their physical state and the ideas offered by others can influence the level of distress and arousal associated with that distress (Pennebaker, 1994; Sternbach, 1978). Experimental research has shown that subjects' self-reported distress and arousal can be reduced when ideas about the causes of the physical discomfort are manipulated. For example, subjects who were told that the increased level of autonomic arousal they were experiencing was caused by the medication that had been administered

reported a higher pain tolerance compared to subjects who were informed that their symptoms were being caused by the painful stimulus to which they had been exposed (Haenen and Schmidt, 1997).

Clinically, it has been shown that normal control subjects with elevated scores on a hypochondriasis scale reported more health concerns that were based on the misattribution of bodily sensations (Rodin, 1978). As well, medical students often experience transient hypochondriasis when they begin to interpret normal bodily sensations in the context of newly acquired information about disease processes (Mechanic, 1983). Sensations that they would likely have ignored or considered insignificant in the past are now reinterpreted as being indicative of disease within their new cognitive framework. These findings have clinical implications. For example, providing preoperative surgical patients with accurate and detailed attributional information about the procedures and the postoperative symptoms has been shown to reduce postoperative analgesic requirements (Egbert, Battit, and Welch, 1964; Barsky & Klerman, 1983).

It is interesting to note that there is a body of research that suggests that hypochondriacal somatic complaints do not result from a finely tuned discriminative ability to detect normal physiological sensations that non-hypochondriacal patients are unable to perceive (Barsky, Brener, Coeytaux, & Cleary, 1995). For example, the findings of a study by Haenen, Schmidt, Schoenmakers, and van den Hout (1997) indicated that hypochondriacal patients reported more distress and discomfort with benign bodily sensations and considered themselves to be more sensitive to such sensations but they were not better able to discriminate between two tactual bodily signals. As well, there have been a number of studies that have shown that individuals with elevated scores on a measure of hypochondriasis are no better at estimating their heart beats compared to a non-hypochondriacal group (Barsky et al., 1995; Haenen, Schmidt, Kroeze, & van den Hout, 1996).

Summary for attribution variable.

The research discussed in this section has shown that the way in which individuals interpret common bodily sensations can serve to maintain and/or exacerbate chronic illness behaviour, in addition to influencing patterns of health care utilization. More specifically, it has been found that a somatic attributional style (i.e., the tendency to believe that common bodily sensations are indicative of a physically-based illness or disorder) is associated with increased symptom reporting (often, many of the somatic symptoms that are reported are of unknown origin) and the amplification of bodily sensations. Based upon these findings, it is hypothesized that somatic attributional style will be a predictor of generalized hypervigilance. In terms of expected group differences, it is hypothesized that the fibromyalgia and the temporomandibular joint dysfunction patients will make more somatic attributions for common bodily sensations compared to the rheumatoid arthritis patients. Also, it is predicted that the pain patients will make more somatic attributions compared to the control subjects.

d) Coping

There has been significant research interest in examining what strategies patients use to cope with their chronic pain (Turk & Okifuju, 1997). However, there have been relatively few studies that have compared the coping strategies of patients with pain disorders of determined versus undetermined origin. The literature examining coping and chronic pain is vast and is beyond the scope of this paper. Thus, specific issues related to coping cognitions will be discussed, primarily from a cognitive-behavioural perspective.

The importance of specific cognitions in coping with pain problems has been examined by several researchers. Turk, Meichenbaum, & Genest (1983) conceptualize cognitions as mediators between situations that evoke pain and emotional or behavioural reactions. Cognitions have been shown to play a significant role in determining a person's level of physical and psychological functioning (Keefe et al., 1987). For example, the results of a study by Flor, Behle, and Birmbaumer (1993) indicated that personal evaluation of pain and the ability to cope with it were key factors in determining

how disabled a person becomes or remains, independent of the medical diagnosis or the extent of physical damage.

Research has shown that many chronic pain patients tend to have negative expectations about their ability to exert control over their pain. The assessment of specific cognitive activity (thoughts and images) has resulted in the identification of self-statements that are related to coping outcomes: "catastrophizing" self-statements (i.e., statements that focus upon the negative aspects of the pain experience) are believed to increase pain perception and to decrease the possibility of engaging in adaptive coping, whereas "active coping" self-statements (i.e., statements focussing on methods to actively deal with painful sensations) are believed to be associated with a decrease in pain perception and an increase in adaptive or active coping responses (Turk et al., 1983).

Experimental studies provide empirical support for these beliefs. The type of self-statement used during exposure to a painful stimulus has been shown to affect pain tolerance and pain intensity ratings. For example, catastrophizing self-statements have been found to be associated with lower pain tolerance and higher pain intensity ratings, whereas active coping self-statements have been associated with higher pain tolerance and lower ratings of pain intensity (Fernandez, 1986; Spanos, Radtke-Bodorik, Ferguson, & Jones, 1979).

Sullivan, Stanish, Waite, Sullivan, & Tripp (1998) examined the role of catastrophizing in predicting levels of pain and disability in a group of patients with soft tissue injuries. Catastrophizing correlated significantly with patients' reported levels of pain intensity and perceived disability. As well, catastrophizing was shown to contribute to the prediction of disability after the effects of pain intensity were controlled. Furthermore, catastrophizing was associated with disability independent of the levels of depression and anxiety. Another study which examined catastrophizing in dental patients showed that those patients classified as "catastrophizers" (according to their scores on the Pain Catastrophizing Scale) reported significantly higher levels of dental anxiety, emotional distress, and pain when compared to those patients classified as being "noncatastrophizers" (Sullivan & Neish, 1998).

It appears that cognitive factors may play a significant role in the onset, maintenance, and exacerbation of pain, affective distress, and adjustment to chronic pain (Lawson, Reesor, Keefe, & Turner, 1990). Newman, Fitzpatrick, Lamb, and Shipley (1990) have reported that the pattern of coping exerts a significant influence on symptom perception, disability, and psychological well-being. It has been suggested that negative appraisals of coping ability and personal efficacy may serve to reinforce inactivity, feelings of discouragement, and a tendency to over-react to nociceptive stimulation (Biederman, McGhie, Monga, & Shanks, 1981; Turk et al., 1983).

Recent developments in the assessment of cognitive strategies have led to the creation of psychometric instruments that evaluate how individuals cope cognitively with their pain. For example, several scales have been developed to assess general coping by chronic pain patients (e.g., Coping Strategy Questionnaire (CSQ) by Rosenstiel & Keefe, 1983; and the Pain Management Inventory (PMI) by Brown and Nicassio, 1987). Flor et al. (1993) noted that these scales were designed to assess behavioural and cognitive coping strategies, but have only a minimal focus on cognitions that accompany the pain experience. Flor et al. (1993) developed the Pain Related Self-Statements Scale (PRSS) to assess situation-specific cognitions that either promote or hinder attempts to cope with pain. The results of studies that have used the PRSS have shown that chronic pain patients tend to differ from healthy control subjects in that they report more catastrophizing statements and fewer active coping statements when they are in pain (Flor et al.).

Summary for coping variable.

Studies have shown that maladaptive coping, particularly the use of negative self-statements when patients are experiencing pain, is associated with decreased threshold and tolerance for unpleasant sensations. In the present study, it is hypothesized that the "catastrophizing" subscale of the Pain Related Self-Statements Scale (PRSS) will be a significant predictor of generalized hypervigilance.

In terms of expected group differences, it is predicted that the fibromyalgia and the temporomandibular joint dysfunction patients will report more maladaptive or

"catastrophizing" coping strategies compared to the rheumatoid arthritis patients. All patient groups are predicted to have higher scores on the catastrophizing subscale compared to the normal control subjects.

Predictions for Issue 2

In summary, it is predicted that trait anxiety (measured by the trait anxiety scale of The State-Trait Anxiety Inventory), somatic anxiety (measured by the somatic subscale of The Cognitive-Somatic Anxiety Questionnaire), bodily monitoring (measured by the Pennebaker Inventory of Limbic Languidness), monitoring in response to threatening events (measured by the Miller Behavioural Style Scale), somatic attribution (measured by the somatic attribution scale from the Symptom Interpretation Questionnaire), and a maladaptive pain coping style (measured by the catastrophizing subscale of the Pain Related Self-Statements Scale) will contribute to the prediction of generalized hypervigilance, measured by the Somatosensory Amplification Scale.

Both standard and stepwise multiple regression analyses will be used to determine how well these variables predict generalized hypervigilance. For each group of pain patients, standard multiple regression analyses will be used to evaluate the overall relation between the independent variables and the dependent variable, generalized hypervigilance. In addition to standard regression, stepwise multiple regression analyses will be performed for each group of pain patients to determine the best predictor(s) of generalized hypervigilance. As well, group differences on the variables believed to underlie generalized hypervigilance will be examined.

Summary of Study Issues

The purpose of this study is to clarify generalized hypervigilance, a concept which is not well understood at this time. Two primary study issues are addressed, the results of which will increase our understanding of this concept: (a) The findings will show whether generalized hypervigilance, as measured by the Somatosensory Amplification Scale, is unique to patients with pain disorders of

undetermined origin or if this pattern extends to patients who have conditions with a known etiology, (b) As well, a number of variables that are believed to underlie generalized hypervigilance will be examined. This study will show whether pain patients with disorders of unknown origin differ from those patients who have a condition with an established etiology on these variables. Furthermore, the results will illustrate the extent to which these variables are involved in the prediction of generalized hypervigilance, an area that has not been examined in other studies.

In addition to the primary study issues, questions of secondary importance will be examined. For example, a number of measures assessing pain experience and pain perception will be administered to the different patient groups. Again, this allows for a comparison between pain patients who have conditions of determined versus undetermined origin.

CHAPTER 2
METHOD

Subjects

Four groups of female subjects were studied: (1) 33 fibromyalgia out-patients fulfilling the diagnostic criteria of Wolfe et al. (1990), (2) 29 out-patients fulfilling the diagnostic criteria for rheumatoid arthritis, (3) 26 out-patients diagnosed with temporomandibular joint dysfunction and, (4) 34 healthy individuals without chronic pain.

The fibromyalgia and the rheumatoid arthritis patients were recruited from the Department of Rheumatology at The London Health Sciences Centre (University and Victoria Campuses). The temporomandibular joint dysfunction patients were recruited from the Faculty of Dentistry at The University of Western Ontario. The normal control group consisted of volunteers from the community who responded to a posted advertisement. Control subjects were paid ten dollars for their participation.

A total of 65 fibromyalgia patients was contacted. Of those contacted, 42 agreed to participate, 33 of whom completed the study. The age range of the fibromyalgia group was 18 to 61 years with a mean age of 42.0 and a standard deviation of 10.3 years. The average pain duration reported by this group was 8.4 years, with a range of 2 to 20 years, and a standard deviation of 5.7 years.

Sixty-five rheumatoid arthritis patients were contacted. Thirty-six patients agreed to participate, 29 of whom completed the study. Ages ranged from 26 to 68 years with a mean age of 51.6 years and a standard deviation of 11.3 years. The average pain duration reported by this group was 16.0 years, with a range of 3 to 43 years, and a standard deviation of 10.5 years.

65 patients with temporomandibular joint dysfunction were contacted. Thirty-nine patients agreed to participate, 26 of whom completed the study. The age range was from 19 to 56 years with a mean age of 32.7 years and a standard deviation of 9.5 years.

The average pain duration for this group was 8.2 years with a range of 1 to 36 years, and a standard deviation of 9.1 years.

The following reasons were provided by those patients who initially agreed to participate but decided not to complete the study: family illness, moving, feeling too ill to participate, or no longer interested in the study.

The normal control group consisted of 34 subjects who responded to a posted advertisement. All subjects completed the study. The mean age was 34.6 years, with a range of 22 to 55 years and a standard deviation of 9.4 years. None of the control subjects had a chronic pain disorder.

Materials

Generalized Hypervigilance Measure

Somatosensory Amplification Scale (SSAS). This self-report scale assesses an individual's perceived sensitivity to ten uncomfortable visceral and somatic sensations, most of which are not the pathological symptoms of disease (Barsky et al., 1990). Sample items include: "I am often aware of various things happening within my body", "I am quick to sense the hunger contractions in my stomach", "Even something minor, like an insect bite or a splinter, really bothers me". Subjects are asked to rate the degree to which each statement is "characteristic of you in general" on a 5-point ordinal scale. The total SSAS score consists of the mean of the sum of the 10 items. Scores can range from 1 to 5 with higher scores indicating greater levels of amplification. The SSAS has adequate internal consistency (Cronbach alpha = .82) and test-retest reliability (.79).

This scale has been used in psychiatric populations and in chronic pain populations (Wise & Mann, 1993; Epstein et al., 1999; Gregory & Manring, 2000; Raphael et al., 2000). Studies have shown that patients with more diffuse pain reported higher SSAS scores compared to those with pain primarily in the extremities; also patients with myofascial pain have reported higher SSAS scores compared to normal control subjects. Epstein et al. (1999) demonstrated an association between SSAS scores and ratings of aversive stimuli in a sample of fibromyalgia patients.

Pain Perception Measures

Visual Analogue Scale. To obtain measures of pain intensity, subjects were asked to complete two visual analogue scales (VAS); one for present pain intensity and one for "typical" pain intensity over the previous 30 days. Each VAS consisted of a 10 centimetre line on a piece of paper with word delimiters at opposite ends ("no pain" and "worst pain ever"). On a 10-point scale, "no pain" corresponds with a rating of 0, and "worst pain ever" corresponds with a rating of 10. The VAS ratings were the first tasks that subjects were instructed to complete.

Body Map Ratings. Subjects were provided with a body map (drawings of the front and back views of the body) and were asked to mark the locations where they had experienced any type of pain (including pain not associated with their chronic pain disorder), during the past week. Subjects were asked only to refer to pain and not to other unpleasant, disturbing, or nagging experiences such as nausea or dizziness. Also, subjects were instructed to rate the intensity of pain at each marked location using a 10-point visual analogue scale (0 = "very weak pain", 10 = "extremely strong pain"). The body map and VAS rating scale used in the present study was based upon ones developed by Lautenschläger et al., (1991).

McGill Pain Questionnaire (MPQ). The MPQ was designed to provide quantitative measures of clinical pain (Melzack, 1975). Patients use three classes of word descriptors (sensory, affective, and evaluative) to specify their subjective pain experiences. Three scores are derived. The first score is the pain rating index which is based on the numerical values assigned to each word descriptor. There are 20 groups of adjectives (8 sensory, 7 affective, 1 evaluative, and 4 miscellaneous). Subjects are asked to chose the one word in each category that best describes the kind of pain that they have experienced during the last week. The word in each category implying the least pain is given a value of 1, the next word is given a value of 2, etc. The values of the words chosen by a patient are summed to obtain a score for each category, as well as a total score for all categories. The second score is the number of words chosen to describe pain and can range from 0 to 20. The third score reflects present pain intensity which is based

on a 5-point intensity rating scale. For the present study, only the first two scores were used since patients had already completed a visual analogue scale measuring pain intensity. Adequate reliability and validity have been established for this measure (Melzack, 1975).

Anxiety Measures

Spielberger State and Trait Anxiety Inventory (STAI). State anxiety is defined as a transitory state of anxiety whereas trait anxiety is the tendency that an individual has to respond to situations perceived as threatening with an increase in anxiety (Spielberger, Gorusch & Lushene , 1975). The STAI consists of 40 self-report statements, 20 of which measure state anxiety and 20 which measure trait anxiety. For the State Anxiety scale, subjects are asked to respond to each statement by describing how they "feel right now", using a 4-point scale (1"not at all" to 4 "very much so"). For the Trait Anxiety scale, subjects are asked to rate each statement by indicating "how you generally feel", using the following 4-point scale (1 "almost never" to 4 "almost always"). For each scale, the minimum and maximum scores are 20 and 80, respectively. The STAI possesses high internal consistency and concurrent and construct validity (Spielberger et al.). For the present study, the primary focus was on comparing subjects' scores on trait, rather than state, anxiety.

Cognitive-Somatic Anxiety Questionnaire (CSAQ). The CSAQ is a 14-item questionnaire which measures a person's tendency to experience anxiety as predominantly somatic distress or cognitive distress (Schwarz et al., 1978). Subjects are asked to rate the degree to which they typically experience a variety of symptoms when they are feeling anxious on a 6-point scale (0 "never" to 5 "always"). This questionnaire has two subscales: somatic anxiety which measures the degree to which the subject experiences somatic symptoms when anxious (e.g., "My heart beats fast", "I perspire", "I feel jittery in my body") and cognitive anxiety which measures the degree to which subjects experience cognitive symptoms when anxious (e.g., "I find it difficult to concentrate because of uncontrollable thoughts", "I worry too much over something that

doesn't really matter"). Each scale consists of 7 items and scores for each can range from 0 to 35. It has been shown that chronic pain patients have elevated scores on the somatic scale of the CSAQ compared to subjects without pain (Schwartz et al.). Adequate reliability and validity for this questionnaire have been demonstrated (Schwarz et al.). For this study, the primary focus was on somatic anxiety.

Monitoring Measures

Pennebaker Inventory of Limbic Languidness (PILL). The PILL was selected as the measure of bodily monitoring. It is a checklist that assesses the frequency of occurrence of 54 common physical symptoms and sensations (Pennebaker, 1982). Although the PILL could be considered an indirect measure of bodily monitoring, it has been used in other studies to measure bodily awareness and bodily monitoring (van Vliet et al., 1997; Woods et al.,1996). Subjects are asked to indicate on a 5-point scale how often they have experienced each symptom (1 "have never or almost never experienced the symptom" to 5 "more than once every week"). The PILL has high internal consistency, with a Cronbach alpha of 0.88. In addition, the PILL has been shown to possess adequate test-retest reliability (e.g., 0.70 for a 2-month period) (Pennebaker, 1982). Typically, the total PILL score consists of the sum of the ratings for the 54 items. For the present study, 8 items (i.e., swollen ankles, leg cramps, swollen joints, stiff muscles, back pains, numbness or tingling in any part of the body, stiff joints, sore muscles) which would likely be endorsed by the fibromyalgia, rheumatoid arthritis, or temporomandibular joint patients were omitted for it was assumed that including these items might artificially inflate the scores for these pain patients. Thus, the ratings for 46 items were used to create total scores; scores can range from 46 to 230.

A second score was derived from the PILL. The total number of symptoms experienced by the subjects, regardless of frequency, was calculated by summing the number of items that they endorsed (i.e., those items which subjects rated between a 2 and a 5 on the 5-point scale). Total scores can range from 0 to 46.

Miller Behavioural Style Scale (MBSS). The MBSS (Miller, 1987) was used to measure subjects' responses to threatening events in the environment. According to Miller (1987), when individuals are threatened with aversive events, information processing behaviour can vary along two dimensions: monitoring and blunting. Monitors selectively attend to and seek knowledge about the aversive event or stressor whereas blunters cognitively avoid and psychologically "blunt" objective sources of danger and avoid threat-relevant information. The MBSS is designed to measure coping responses to situations involving threat or frustration. It consists of four hypothetical stress situations. Each scene is followed by eight statements that represent different ways of dealing with the situation. Four of the statements are of a monitoring or information-seeking variety and four are of a blunting or distracting variety. The number of monitoring and blunting items that were endorsed are totalled, giving a monitoring and blunting score. Scores can range from 0 to 16 on each scale. The MBSS scale has been shown to possess adequate discriminant and predictive validity (Miller, 1987). For the purposes of the present study, the monitoring scale was of primary interest.

Symptom Attribution Measure

Symptom Interpretation Questionnaire (SIQ). The SIQ (Robbins & Kirmayer, 1991) consists of 13 common somatic symptoms each of which is followed by three items: an item addressing the likelihood that the cause of the symptom is a physical disorder or disease, an item addressing the likelihood of an emotional / stress-related cause, and an item addressing the likelihood of an environmental / normalizing cause. For example, the first SIQ question states,

If I had a prolonged headache, I would probably think that it is because:

1. I am emotionally upset. (emotional / stress-related cause)
2. There is something wrong with my muscles, nerves, or brain. (physical disorder / disease cause)
3. A loud noise, bright light, or something else has irritated me. (environmental / normalizing cause).

Subjects are asked to indicate on a 4-point scale (1"not at all" to 4 "a great deal") how well each of the three potential causes explains each of the 13 symptoms. Summing the items with similar causal explanations yields three scale scores representing the extent to which physical illness, emotional distress, or environmental / normalizing events were endorsed as possible causes of the symptoms. Scores for each of the scales can range from 13 to 52. As well, subjects are asked if they have experienced each of the 13 symptoms in the past three months (0 "no", 1 "yes").

The results of a study by Robbins and Kirmayer (1991) showed that family medicine patients with an acute or chronic physical illness made more somatic attributions on the SIQ whereas patients with psychiatric difficulties reported more psychological attributions for common physical symptoms. In that study, a somatic attributional style was predictive of the number of somatic complaints and the number of somatic complaints of obscure origin which were presented to the physician. A psychological attributional style was predictive of the number of psychosocial complaints presented to the family physician whereas a normalizing attributional style was predictive of few complaints or psychosocial symptoms.

When the SIQ was administered to university students, they reported higher mean scores on the environmental / normalizing scale compared to the psychological and somatic scales. Robbins and Kirmayer (1991) noted that this is consistent with the Discounting Principle (Kelley, 1971) which suggests that common physical symptoms are most often attributed to environmental or non-pathological causes.

All SIQ scales have been shown to exhibit satisfactory reliability with Cronbach alphas of .86 for the psychological attribution scale, .71 for the somatic attribution scale, and .81 for the normalizing attribution scale (Robbins and Kirmayer, 1991). Adequate validity for this measure has been demonstrated.

Pain Coping Measure

Pain Related Self-Statements (PRSS). The PRSS is an 18-item questionnaire which was designed to measure how patients cope cognitively with their pain (Flor et al.,

1993). It assesses situation-specific cognitions that either promote or hinder attempts to cope with pain. The PRSS lists "typical thoughts of people in pain", referred to as pain related self-statements. The items were derived from detailed interviews with chronic pain patients regarding the pain related thoughts and attitudes experienced during painful episodes. The PRSS has two subscales, "catastrophizing" and "active coping"; each scale consists of 9 items. Subjects are asked to indicate how often they have each of the 18 thoughts when they are experiencing severe pain using a 6-point scale (0 "almost never" to 5 "almost always"). The mean score for each scale is calculated. Scores can range from 0 to 5.

The "catastrophizing" subscale consists of statements which focus on the negative aspects of the pain experience. Examples of items include: "This pain is driving me crazy", "I cannot stand this pain any longer", and "I am a hopeless case". The "active coping" scale consists of statements which focus on methods to actively deal with painful sensations. Examples of items on this scale include: "I'll cope with it", "I can help myself", and "If I stay calm and relax, things will be better".

Catastrophizing self-statements have been found to be associated with increased pain perception whereas active coping statements tend to be associated with a decrease in pain perception. Both PRSS scales possess adequate reliability (coefficient alphas of .92 and .88 for the catastrophizing and active coping scales, respectively). As well, construct validity has been demonstrated (Flor et al., 1993).

Demographic and Medical History Measure

Demographic and Medical History Questionnaire. The McGill Pain Assessment Questionnaire (Melzack, 1975) was modified to obtain demographic, medical, and pain information (age, marital status, employment status, past medical history, number and frequency of health-care visits, number of specialists consulted regarding pain condition since onset) from all subjects.

Screening Questionnaire

Fibromyalgia Screening Questionnaire. This measure was developed by White, Harth, Speechley, & Ostbye (1995) as a quick screening device to determine if a person has fibromyalgia. It consists of 6 items which ask about the location and severity of muscle and joint pain, in addition to fatigue symptoms. This measure was used in the present study to confirm that members of the rheumatoid arthritis, temporomandibular joint dysfunction, and normal control groups did not score positively on this measure (a positive score indicates the presence of fibromyalgia). There was one TMD patient who screened positively for fibromyalgia, according to her responses on this questionnaire. White et al. (1999) suggest that a personal interview is required for those with a positive screen; when the patient's information was reviewed, it was discovered that she did not have pain above and below the waist, a requirement for the diagnosis of fibromyalgia. For this patient, the dentist's diagnosis prevailed over the FSQ result.

Affective Distress Measure

For the purpose of the present study, a measure of affective distress was used primarily to examine group differences in depressive symptomatology and to determine how psychological distress is related to somatosensory amplification.

Symptom Checklist 90 - Revised. The SCL90-R is a multidimensional symptom self-report inventory which consists of 90 symptoms (Derogatis, 1977). Subjects are asked to rate "how much discomfort the problem has caused you in the past 7 days including today" on a 5-point scale of distress (0 "not at all" to 4 "extremely"). The SCL-90-R defines 9 primary symptom dimensions: somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and a global index of distress. The SCL-90-R has excellent test-retest reliability and inter-rater reliability and possesses criterion and construct validity (Derogatis, 1977).

Illness Behaviour Measure

A measure of illness behaviour was included in this study primarily to measure hypochondriasis and to examine how illness behaviour is related to somatosensory amplification.

Illness Behavior Questionnaire (IBQ). The IBQ (Pilowsky & Spence, 1975) is a 62-item scale that taps patients' attitudes and feelings about illness, their perception of the reaction of significant others to their illness, and patients' views of their current psychosocial situation. Subjects are asked to indicate if each item is applicable to them (0 "no", 1 "yes"). The IBQ yields scores on 7 subscales: general hypochondriasis, disease conviction, psychological versus somatic perception of illness, affective inhibition, affective disturbance, denial, and irritability. Each subscale score is the mean of the summed items. This scale possesses adequate reliability and validity and has been used extensively with pain patients (Pilowsky & Spence, 1975).

Procedure

The fibromyalgia and the rheumatoid arthritis patients were recruited from the practices of three rheumatologists at London Health Sciences Centre. Two of the rheumatologists were employed at University Campus and one was employed at Victoria Campus. Each rheumatologist provided the researcher with a list of names and addresses of their current fibromyalgia and rheumatoid arthritis patients. The researcher reviewed the medical charts of these patients in alphabetical order and made a list of patients who met the following study criteria: (1) did not have more than one rheumatological disorder (e.g., patients diagnosed with both rheumatoid arthritis and osteoarthritis; also, patients' charts were screened to ensure that they did not have TMD), (2) did not have another chronic illness which was not well controlled medically (e.g., diabetes), (3) did not have a serious psychiatric disorder (e.g., personality disorder, severe depression), (4) patients who were able to speak and read English, and (5) were not dependent upon narcotic medications for pain control.

A list of patients' names who fulfilled the above criteria was made. Patients were contacted in random order. The fibromyalgia list was completed first. (All of the names of the fibromyalgia patients, which were selected randomly, were female, so the other groups were matched in terms of gender). The researcher mailed each fibromyalgia patient a Letter of Information along with a postage-paid postcard. Patients were asked to complete and return the postcard if they were interested in participating in the study. When the researcher received the postcards, a packet consisting of another Letter of Information, a Consent Form, the questionnaires, and a postage-paid envelope was mailed to each patient. (Note: Many of the patients lived more than two hours from London so it was decided that questionnaires would be mailed to patients instead of requesting them to travel to London for study participation). Participants were asked to return the questionnaires along with the Consent form in the envelope within two weeks of receiving the packet. The Letter of Information emphasized that participants must complete the questionnaires by themselves; they were instructed not to ask for any assistance from family members or friends. If the participants had any questions about the questionnaires, they were given the researcher's phone number and were asked to contact her for assistance. If the researcher did not receive the packet within the two week period, she phoned to remind the participant to return the packet.

For the recruitment of the temporomandibular joint dysfunction patients, the researcher provided the Dean of Dentistry at The University of Western Ontario with copies of the Letter of Information with attached postcards. He gave these to patients during clinic visits. Patients were asked to read the letter and to return the postcard if they were interested in participating. When the researcher received the completed postcards, the same screening procedure which was used for the fibromyalgia and rheumatoid arthritis groups was followed.

For the normal control group, notices describing the study were posted in various locations in the community (campus of University of Western Ontario, a local art gallery, a childrens' agency). Subjects were asked to contact the researcher if they were interested in participating. Questionnaire packets were distributed to the volunteers and completed

packets were returned via mail. Subjects were asked to complete a form indicating their name and address so that cheques (10 dollars per subject) could be forwarded to them. For the questionnaires that asked about pain, the normal control subjects were asked to respond to these questionnaires with respect to a painful event that they had experienced (e.g., headache, menstrual pain, or other acute pain condition). In keeping with previous studies (Flor et al., 1993; Toomey et al., 1988), the normal control subjects were administered the pain-related questionnaires so that the results of the chronic pain patients could be compared with individuals who suffer from non-pathological pain.

CHAPTER 3
RESULTS

The results of this study are organized in the following manner. First, the subject characteristics are presented. This section includes a discussion of the following: the demographic characteristics of the sample, differences in the medical histories of the four groups (i.e., number of current medications, number of surgeries, number of past and present illnesses, number of monthly and yearly physician visits), differences in pain related variables for the three patient groups (i.e., the number of years since the onset of the pain problem, the number of professionals consulted since the onset of the pain problem, the number of yearly physician visits for pain and non pain-related problems), and differences among the pain groups in pain intensity ratings and the distribution of their pain.

In the subsequent section, the two primary study issues will be addressed. To summarize, these issues are:

1. Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin or does this pattern extend to pain patients who have conditions with a known etiology?

2. Deconstructing generalized hypervigilance: Group differences and predictive ability

   Anxiety (trait and somatic), monitoring (of bodily sensations and of the threatening events), somatic attribution of common bodily sensations, and a catastrophizing pain coping style are hypothesized to be the underlying factors responsible for generalized hypervigilance.

(a) Do group differences exist on the anxiety, monitoring, somatic attribution, and pain coping style variables?

(b) How accurately can group members be classified according to their scores on measures of anxiety, monitoring, symptom attribution, and coping style? Discriminant function analyses will be used to address this question.

(c) How well do anxiety (trait and somatic), monitoring (of bodily and of threatening events), somatic attributional style, and catastrophizing pain coping style predict generalized hypervigilance, as measured by The Somatosensory Amplification Scale (SSAS)? Standard and stepwise regression analyses will be performed to answer this question.

Subject Characteristics

First, a brief description of the statistical analyses which were used to examine the subject characteristics is necessary. The primary statistical procedure used to evaluate between-group differences was a one-way multivariate analysis of variance (MANOVA) (Tabachnick & Fidell, 1989). Separate MANOVAs were performed on conceptually-related variables (e.g., medical history variables, pain-related variables). The MANOVA procedure was chosen to control the Type I error rate (Tabachnick & Fidell, 1989). It has been shown that MANOVA becomes increasingly conservative as the number of dependent variables increases, thereby adding increased protection against Type I error (Hummel & Sligo, 1971). Pillais' statistic was chosen to examine the significance of the multivariate results because it is one of the most robust multivariate tests; it is not influenced easily by violations of assumptions and has been shown to retain its power and robustness when the sample size is small (Olson, 1976).

If the results of the MANOVA indicated that there was a significant multivariate effect, univariate ANOVAs were computed for each dependent variable. If the univariate ANOVA was statistically significant, Scheffé's test (evaluated at the .05 level of significance) of multiple comparisons was used to determine which groups differed significantly. Scheffé's test was chosen because it is considered to be one of the more conservative tests of significance (Kirk, 1982).

Prior to performing the multivariate and univariate analyses of variance, the data were evaluated for violations of the assumptions of normality, linearity, and homogeneity of variance. Unless there were marked deviations from these assumptions, the analysis was performed because the primary interest was at the univariate level and ANOVA has been shown to be robust to moderate violations of normality and homogeneity (Kirk,

1982; Tabachnick & Fidell, 1989). There were no cases where the analyses were not completed because of significant violations of assumptions.

In addition to the MANOVA and ANOVA procedures, analyses of covariance (ANCOVAs) were performed. ANCOVA is an extension of analysis of variance where the effects of the independent variables are assessed after scores on the dependent variable are adjusted for differences associated with one or more covariates (Tabachnick & Fidell, 1989). For the present study, ANCOVA is used as a statistical matching procedure where the group means are adjusted to what they would be if all subjects scored identically on each covariate. Covariates included the following variables: age, VAS present pain intensity, duration of pain problem, depression (measured by the SCL90-R depression subscale), anxiety (measured by the STAI trait anxiety subscale), and hypochondriasis (measured by the IBQ general hypochondriasis subscale). Not every dependent variable was adjusted for all of the covariates. The rationale for the choice of covariates which was used for each analysis is discussed in turn.

Demographic Characteristics

Demographic data collected for each subject included age, marital status, highest level of education attained, and employment status. These findings are described below and are presented in Table 1.

Age

Four groups of women participated in the present study: 33 fibromyalgia (FM) patients, 29 rheumatoid arthritis (RA) patients, 26 temporomandibular joint dysfunction (TMD) patients, and 34 normal control (NC) subjects. The results of an univariate analysis of variance (ANOVA) indicated that there were significant group differences in age (F (3, 118) = 20.46, $p < .01$). The RA patients (M = 51.61, SD = 11.25) were significantly older than were the FM patients (M = 42.03 SD = 10.26), the TMD patients (M = 32.72, SD = 9.54), and the NC subjects (M = 34.58, SD = 9.34). Also, the FM group was significantly older compared to the TMD and the NC groups.

Table 1
Demographic Characteristics of Subject Groups

Variable		Group			
		FM (n=33)	TMD (n=26)	RA (n=29)	NC (n=34)
Age[1]	M	42.03_a	32.72_b	51.61_{ac}	34.58_b
	SD	10.26	9.54	11.25	9.34
	Range	18 - 61	19 - 56	26 - 68	22 - 55
Marital Status (% of Ss)					
Single		15.2	26.9	6.9	38.2
Married		69.7	46.2	65.5	32.4
Common-Law		3.0	15.4	6.9	11.8
Separated		3.0	3.8	10.3	11.8
Divorced		3.0	3.8	6.9	5.9
Widowed		6.1	3.8	3.4	0
Highest level of Education (% of Ss)					
Did not graduate highschool		27.3	15.4	27.6	5.9
Highschool		33.3	42.3	48.2	14.7
College / university		33.3	26.9	24.1	76.5
Post-graduate degree		6.1	15.4	0	2.9
Employment Status (% of Ss)					
Employed		48.5	73.1	37.9	94.1
Unemployed		51.5	26.9	62.1	5.9
. because of pain		88.2	0	33.3	0
. for other reason		11.8	100	66.7	100

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = 20.46$, $p < .01$.

Marital Status

Patients were asked to indicate which of the following best described their current marital status: single, married, common law relationship, separated, divorced, or widowed. The majority of the FM (69.7%), TMD (46.2%), and RA patients (65.5%) patients were married. In contrast, 32.4% of the NC subjects were married and 38.2% were single.

Education Level

Subjects were asked to indicate the highest level of education attained. The choices were: did not graduate from high school, graduated from high school, graduated from college or university, and post-graduate degree. For the NC subjects, 76.5% reported having a college or university degree compared to 33.3% of the FM group, 24.1% of the RA group, and 26.9% of the TMD group.

Employment Status

Subjects were asked to indicate if they were currently employed or unemployed. For subjects who indicated that they were unemployed, they were asked to specify if they were unemployed because of their pain condition.

94.1 % of the NC subjects were employed compared to 73.1% of the TMD patients, 48.5% of the FM patients, and 37.9% of the RA patients. For those patients who were unemployed, 88.2% of the FM patients and 33.3% of the RA patients indicated that they were not working because of their pain. Of the TMD patients who were unemployed, no patient indicated that it was because of their pain problem.

Differences in Medical History among the FM, TMD, RA, and NC Groups

A single-factor between-subjects multivariate analysis of variance (MANOVA) was performed to test for the overall statistical significance of the following medical history variables for the four groups: the total number of current medications (prescription and non-prescription medications) taken for both pain and non-pain problems, the number of lifetime surgeries (for pain and other problems), the number of present illnesses, the number of past illnesses, the number of physician visits in the past

month for any type of health concern, and the number of physician visits during the past year for any type of health concern. A significant multivariate effect was obtained (Pillais = 0.4653, approximate F (18, 345) = 3.37, p < .01). There were significant univariate effects for the following variables: the number of medications (F (3,118) = 23.05, p < .01), the number of lifetime surgeries (F (3,118) = 4.04, p < .01), the number of past illnesses (F (3,118) = 4.50, p <.01), the number of physician visits during the past month (F (3,118) = 4.36, p <.01) and the number of physician visits during the past year (F (3,118) = 7.61, p <.01). A brief description of the findings is discussed below. The means, standard deviations, and the ranges for all groups are presented in Table 2.

Number of Current Medications

The RA patients (M = 5.14, SD = 3.14) reported taking significantly more medications (for pain and other problems) at the present time compared to the FM patients (M = 3.48, SD = 2.14), the TMD patients (M = 2.04, SD = 1.54), and the NC group (M =.97, SD = .83). Also, the FM patients reported taking significantly more medications than did the NC group. These differences remained statistically significant when the effects of age (F(3,117) = 12.08, p <.001) and present pain intensity (F(3, 117) = 19.01, p < .001) were controlled for statistically by performing separate ANCOVAs.

Number of Lifetime Surgeries

The RA patients (M = 3.52, SD = 4.05) reported significantly more lifetime surgeries (for pain and other problems) than did the NC group (M = 1.35, SD = 1.23). There were no other between-group differences. Not surprisingly, there were no longer any statistically significant differences between the RA and the NC groups when age was used as a covariate (F (3,117) = 1.17, p > .05).

Number of Past Illnesses

Similarly, the RA patients (M = 1.10, SD = 1.32) reported experiencing significantly more previous illnesses in their lifetime compared to the NC group (M = .27, SD = .57). Again, the group differences between the RA and the NC group on this variable were no longer statistically significant when age was used as a covariate (F(3,117) = 1.52, p >.05).

Table 2
Means, Standard Deviations, and Ranges for Medical History Variables for All Groups

Variable		Group			
		FM	TMD	RA	NC
Number of medications [1]	M	3.48_a	2.04_{ac}	5.14_b	$.97_c$
	SD	2.14	1.54	3.14	.83
	Range	1 - 10	0 - 5	1 - 11	0 - 3
Number of surgeries [2]	M	2.55_{ab}	2.31_{ab}	3.52_a	1.35_b
	SD	1.91	2.00	4.05	1.23
	Range	0 - 6	0 - 7	0 - 21	0 - 6
Number of past illnesses [3]	M	$.51_{ab}$	$.58_{ab}$	1.10_a	$.27_b$
	SD	.83	.86	1.32	.57
	Range	0 - 3	0 - 3	0 - 4	0 - 2
Number of physician visits during the past month [4]	M	1.09_{ab}	1.00_{ab}	1.59_a	$.56_b$
	SD	1.07	1.13	1.52	.71
	Range	0 - 4	0 - 3	0 - 7	0 - 2
Number of physician visits during the past year [5]	M	10.58_a	6.92_{ab}	12.00_a	3.68_b
	SD	10.63	5.00	9.29	2.91
	Range	0 - 60	0 - 24	0 - 36	1 - 13

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = 23.05$, $p < .01$
[2] $F(3,118) = 4.04$, $p < .01$
[3] $F(3,118) = 4.50$, $p < .01$
[4] $F(3,118) = 4.36$, $p < .01$
[5] $F(3,118) = 7.61$, $p < .01$

Number of Physician Visits during the Past Month

The RA patients (M = 1.59, SD = 1.52) reported significantly more physician visits (for any type of health concern) during the past month than did the NC group (M = .56, SD = .71). Group differences between the RA and the NC subjects remained statistically significant when age ($F(3,117) = 4.15$, $p < .01$), VAS past month pain intensity ratings ($F(3,117) = 3.39$, $p < .05$), anxiety ($F(3,117) = 5.02$, $p < .01$), depression ($F(3,117) = 3.90$, $p < .05$), and hypochondriasis ($F(3,117) = 4.23$, $p < .01$) were used as covariates.

Number of Physician Visits during the Past Year

The RA patients (M = 12.00, SD = 9.29) and the FM patients (M = 10.58, SD = 10.63) each reported significantly more physician visits (for any type of health concern) during the past year compared to the NC group (M = 3.68, SD = 2.91). Differences remained statistically significant when age ($F(3,117) = 8.93$, $p < .01$), anxiety ($F(3,117) = 7.26$, $p < .01$), depression ($F(3,117) = 6.02$, $p < .01$), and hypochondriasis ($F(3,117) = 6.84$, $p < .01$) were used as covariates.

Summary

In terms of differences in medical history among the four groups of subjects, the results indicated that the RA patients take significantly more medications (prescription and non-prescription) for pain and non-pain complaints compared to the FM, the TMD, and the control subjects. As well, the FM patients take significantly more medications than did the control group. Compared to the control group, the RA patients reported more lifetime surgeries (for pain and non-pain related problems) and more past illnesses. These differences were no longer statistically significant when age was used as a covariate. The RA patients made more physician visits during the past month (for any type of health concern) compared to the control subjects. Finally, the results showed that the RA and the FM patients reported significantly more physician visits during the past year (for any type of health concern) compared to the control subjects.

Differences in Pain History among the FM, TMD, and RA Groups

A MANOVA was performed to examine differences among the pain groups on the following variables: the number of years since the onset of the pain problem, the number of current treatments for pain, the number of health-care professionals consulted since the pain problem began, the number of physician visits for the pain problem during the past year, and the number of physician visits for non-pain related problems during the past year. A significant multivariate effect was obtained (Pillais = .4430, approximate F (14, 160) = 3.26, $p < .001$). Univariate ANOVAs were significant for the following variables: the number of years since the onset of the pain problem (F (2,85) = 6.77, $p < .01$), the number of health care professionals consulted for the pain problem since its onset (F (2, 85) = 5.48, $p < .01$), and the number of physician visits for non-pain related problems during the past year (F (2,85) = 5.86, $p < .01$). The results are presented briefly below; a more detailed summary is found in Table 3.

Number of Years Since the Onset of the Pain Problem

The duration of pain in years reported by the RA patients (M = 15.79, SD = 10.34) was significantly greater than the duration reported by the FM patients (M = 9.12, SD = 5.93) and the TMD patients (M = 8.19, SD = 9.10).

Number of Professionals Consulted Since the Onset of the Pain Problem

The results showed that the RA patients (M = 7.21, SD = 3.12) and the FM patients (M = 6.82, SD = 3.69) each reported consulting significantly more health-care professionals regarding their pain since its onset compared to the TMD group (M = 4.58, SD = 2.40). This effect remained statistically significant after the effects of depression ($F(2,84) = 5.44$, $p < .001$), anxiety ($F(2,84) = 5.26$, $p < .01$), and hypochondriasis ($F(2,84) = 5.51$, $p < .01$) were controlled for statistically. When age was used as a covariate, the group differences were no longer significant ($F(2,84) = 1.82$, $p > .05$).

Number of Physician Visits for Non-Pain Related Problems during the Past Year

The results revealed that the RA patients (M = 6.89, SD = 8.60) reported significantly more physician visits during the past year for non-pain related complaints compared to the FM patients (M = 3.09, SD = 3.75) and the TMD patients (M = 2.11, SD

Table 3
Means, Standard Deviations, and Ranges for Pain History Variables for the FM, TMD, and RA Groups

Variable		Group		
		FM	TMD	RA
Pain Duration[1] (in years)	M	9.12_a	8.19_a	15.79_b
	SD	5.93	9.10	10.34
	Range	2 - 25	1 - 36	3 - 43
Number of professionals consulted for pain since onset[2]	M	6.82_a	4.58_b	7.21_a
	SD	3.69	2.40	3.12
	Range	2 - 14	1 - 10	2 - 13
Number of physician visits for non pain-related problems in past year[3]	M	3.09_a	2.11_a	6.89_b
	SD	3.75	2.10	8.60
	Range	0 - 15	0 - 8	0 - 35

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(2, 85) = 6.77$, $p < .01$.
[2] $F(2, 85) = 5.48$, $p < .01$.
[3] $F(2, 85) = 5.86$, $p < .01$.

= 2.10). This effect remained statistically significant when the effects of age ($F(2,84)$ = 5.12, $p < .001$), depression ($F(2,84) = 6.34$, $p < .01$), anxiety ($F(2,84) = 5.66$, $p < .01$), and hypochondriasis ($F(2,84) = 6.60$, $p <. 01$) were controlled for statistically.

Summary

In terms of differences in pain history among the three groups of chronic pain patients, the results showed that the RA patients have had pain for significantly more years compared to the FM and the TMD patients. As well, the RA and the FM patients have consulted significantly more health professionals regarding their pain since its onset compared to the TMD patients. Finally, the results indicated that the RA patients reported significantly more physician visits for non-pain related problems during the past year compared to the FM and the TMD patients. There were no significant differences among the patient groups in terms of the number of physician visits per year for pain problems.

Pain Perception Measures

A MANOVA was performed to test for the overall significance of the following variables: the VAS present pain intensity ratings, the VAS "typical" pain intensity ratings for the past month, the number of painful areas marked on the body map, and the average VAS pain intensity rating for the pain sites marked on the body map. A significant multivariate effect was obtained (Pillais = .50148, approximate F (12,351) = 5.87, $p < .0$ 01). There was a significant univariate effect for each variable: the VAS present pain intensity ratings (F (3,118) = 17.19, $p < .0001$), the VAS past month typical pain intensity ratings (F (3,118) = 18.30, $p < .0001$), the number of pain sites marked on the body map (F (3,118) = 19.26, $p < .0001$), and the VAS pain intensity ratings for the body map (F (3, 118) = 8.49, $p < .0001$). A separate MANOVA was conducted for the McGill Pain Questionnaire; the results are presented at the end of this section.

VAS Pain Intensity Ratings

Patients were asked to make two visual analogue scale ratings: present pain intensity and typical pain intensity during the past month. The scale had delimiters of 0

"no pain" and 10 "worst pain imaginable". It was predicted that the FM and the TMD patients would report higher pain intensity ratings for both present and past month typical pain compared to the RA patients. All patient groups were expected to have higher pain intensity ratings than the control subjects.

Present pain intensity ratings.

The results showed that the FM patients (M = 5.30, SD = 2.24) , the TMD patients (M = 4.44, SD = 3.08), and the RA patients (M = 3.97, SD = 2.56) reported significantly higher present pain intensity ratings than did the NC subjects (M = 1.28, SD = 2.24). These group differences remained statistically significant after the effects of pain duration ($F(3,117) = 13.49$, $p < .01$), depression ($F(3,117) = 11.11$, $p < .01$), hypochondriasis ($F(3,117) = 14.29$, $p < .01$), and anxiety ($F(3,117) = 13.47$, $p < .01$) were controlled for in separate ANCOVAs. Contrary to predictions, there were no significant differences in present pain intensity ratings among the patient groups. The VAS present pain intensity ratings are illustrated in Figure 1.

Past month typical pain intensity ratings.

For the VAS typical pain intensity ratings over the past month, the FM patients (M = 6.22, SD = 2.14), the TMD patients (M = 5.72, SD = 2.89), and the RA patients (M = 4.47, SD = 2.59) each reported significantly higher ratings compared to the NC group (M = 2.23, SD = 1.94). As well, the ratings of the FM patients were significantly higher than the ratings of the RA patients. Group differences remained statistically significant after controlling for the effects of pain duration ($F(3,117) = 13.98$, $p < .01$), depression ($F(3,117) = 11.82$, $p < .01$), hypochondriasis ($F(3,117) = 15.72$, $p < .01$), and anxiety ($F(3,117) = 13.72$, $p < .01$). The VAS past month pain intensity ratings are illustrated in Figure 2.

Comparison of pain intensity ratings.

The results of paired t-tests indicated that the FM group ($t(32) = -3.16$, $p < .01$), the TMD group ($t(25) = -2.75$, $p < .05$), and the NC group ($t(33) = -3.34$, $p < .01$) each reported VAS past month pain intensity ratings as being more intense than VAS present pain intensity ratings.

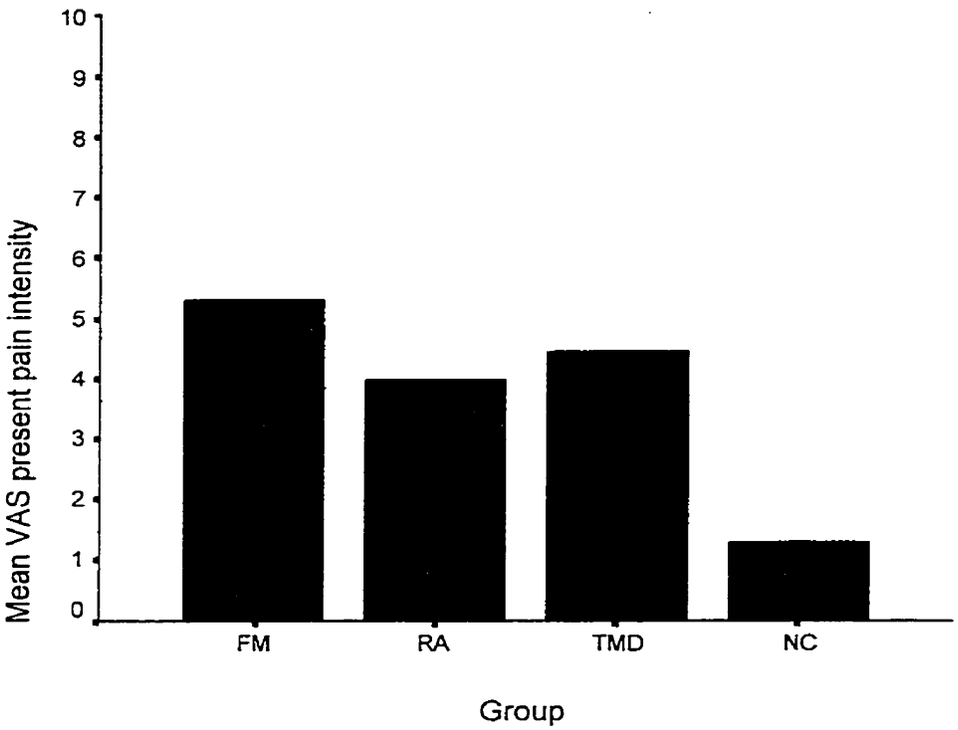

Figure 1. Mean VAS present pain intensity ratings for all groups. The patient groups had significantly higher ratings than the control subjects. There were no differences among the pain groups.

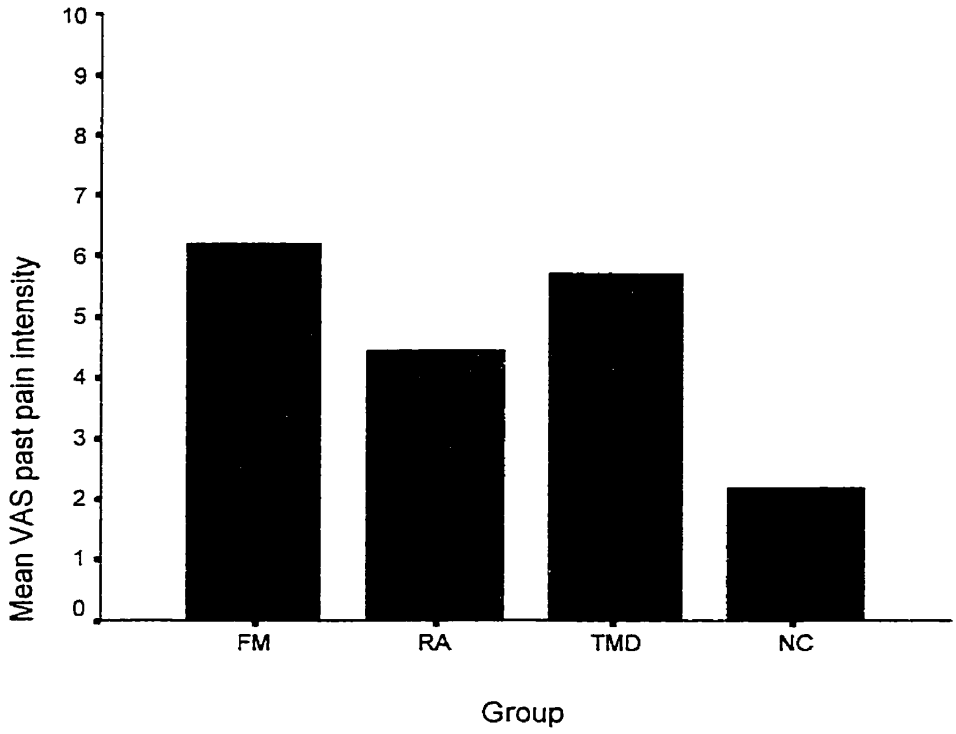

Figure 2. VAS past month typical pain intensity ratings for all groups. The patient groups differed from the control group. As well, the FM group had significantly higher ratings than did the RA group.

Body Map Ratings

Subjects were provided with a body map (drawings of the front and back views of the body) and were asked to mark the locations where they had experienced any type of pain (including pain which was not associated with their chronic pain disorder), during the past week. Also, subjects were instructed to rate the intensity of pain at each marked location using a 10-point VAS scale (0 "very weak pain", 10 "extremely strong pain").

As predicted, the results indicated that the FM patients (M = 22.24, SD = 14.13), the RA patients (M = 12.93, SD = 8.37), and the TMD patients (M = 12.04, SD = 13.93) marked significantly more painful sites than did the NC group (M = 2.53, SD = 1.90). Also, the FM patients marked significantly more sites than did the RA and the TMD patients. These results are illustrated in Figure 3. These group differences remained statistically significant after controlling for the effects of pain duration ($F(3,117) = 14.71$, $p < .01$), depression ($F(3,117) = 13.01$, $p < .01$), hypochondriasis ($F(3,117) = 16.00$, $p < .01$), and anxiety ($F(3,117) = 14.91$, $p < .01$).

VAS ratings for the body map.

For the VAS pain intensity ratings for the painful locations marked on the body map, the FM group (M = 6.03, SD = 1.81) and the TMD group (M = 5.48, SD = 2.19) each reported significantly higher ratings than did the NC group (M = 3.57, SD = 2.37). No other group differences were found (RA group: M = 4.90, SD = 1.90). Group differences among the FM, TMD, and NC groups remained statistically significant after the effects of pain duration ($F(3,117) = 6.37$, $p < .01$), depression ($F(3,117) = 5.86$, $p < .01$), hypochondriasis ($F(3,117) = 8.14$, $p < .01$), and anxiety ($F(3,117) = 5.90$, $p < .01$) were controlled for statistically. These results are displayed in Figure 4.

McGill Pain Questionnaire

A separate MANOVA was conducted for The McGill Pain Questionnaire (MPQ) variables (the total number of words chosen to describe pain, the pain rating indices (PRI) based on the rank values of the sensory, affective, evaluative, and miscellaneous words, and the total MPQ score for the four categories). The results showed that there were significant univariate effects for the following variables: the total number of words

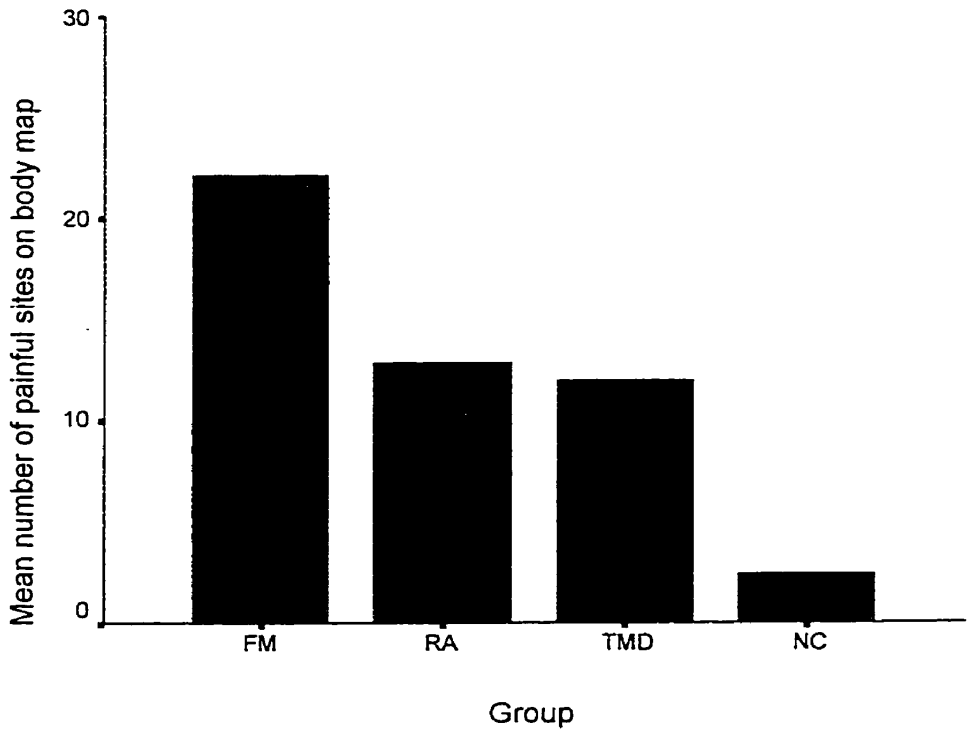

Figure 3. Mean number of painful sites marked on the body map for all groups. The patient groups marked more sites than did the control group. As well, the FM group marked more sites compared to the TMD and the RA groups.

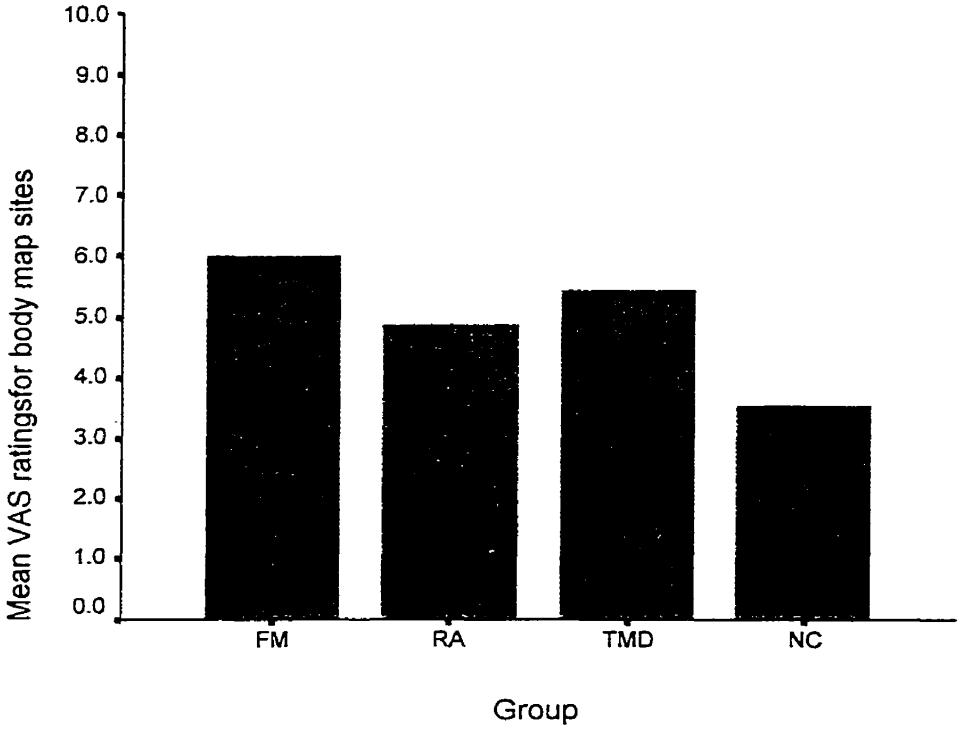

Figure 4. Mean VAS ratings for the painful sites marked on the body map. The FM and the TMD groups reported significantly higher pain intensity ratings compared to the NC group.

chosen ($F(2, 85)= 4.85$, $p < .05$), the pain rating index for sensory words ($F(2,85) = 4.15$, $p < .05$), the pain rating index for the miscellaneous words ($F(2,85) = 4.41$, $p < .05$), and the total MPQ score ($F(2,85) = 3.49$, $p < .05$). The MPQ results are summarized in Table 4.

Number of words chosen to describe pain.

The FM patients ($M = 11.97$, $SD = 4.49$) chose significantly more words to describe their pain compared to the RA patients ($M = 8.31$, $SD = 4.02$). Scores can range from 0 to 20. To put these scores in perspective, it is helpful to compare the results of the present study with the published responses of other groups of pain patients. Melzack (1975) reported the following mean scores for the number of words chosen for the following patient groups: back pain (10.9), post-herpetic pain (10.4), cancer (8.8), dental pain (8.3), and arthritis (8.1). The number of pain descriptor words chosen by the RA patients (8.31) in the current study is comparable to those reported by the arthritis subjects in Melzack's study. Interestingly, the number of words endorsed by the FM patients in this study (11.97) is elevated compared to the pain groups reported by Melzack.

Pain rating index for sensory words.

The FM patients ($M = 18.12$, $SD = 7.34$) had significantly higher scores compared to the RA patients ($M = 14.03$, $SD = 6.23$) on the pain rating index for sensory words (e.g., "pinching", "throbbing", "burning"). Melzack (1975) reported the following mean sensory PRI scores for these patient groups: cancer (17.3), post-herpetic pain (14.4), back pain (14.0), dental (11.8), and arthritis (10.3). Interestingly, the FM patients in the present study had elevated scores compared to each of the groups reported by Melzack. Also, the RA patients in this study reported higher scores compared to the arthritis patients in Melzack's study.

Pain rating index for miscellaneous words.

The FM patients ($M = 5.30$, $SD = 3.91$) had significantly higher scores than did the RA patients ($M = 2.79$, $SD = 2.69$) on the pain rating index for miscellaneous words (e.g., "spreading, radiating, piercing, tearing, torturing").

Table 4
Means, Standard Deviations, and Ranges for the McGill Pain Questionnaire for the FM, TMD, and RA Groups

Variable		Group		
		FM	TMD	RA
Number of words chosen [1]	M	11.97_a	10.04_{ab}	8.31_b
	SD	4.49	5.38	4.02
	Range	3 - 20	3 - 20	1 - 20
PRI Affective [2]	M	3.24_a	2.58_a	1.79_a
	SD	3.55	3.44	1.61
	Range	0 - 19	0 - 14	0 - 7
PRI Sensory [3]	M	18.12_a	16.81_{ab}	14.03_b
	SD	7.34	6.98	6.23
	Range	5 - 33	6 - 32	4 - 26
PRI Evaluative [4]	M	2.28_a	2.19_a	1.97_a
	SD	1.42	1.70	1.64
	Range	0 - 5	0 - 5	0 - 5
PRI Miscellaneous [5]	M	5.30_a	4.23_{ab}	2.79_b
	SD	3.91	3.87	2.69
	Range	0 - 16	0 - 13	0 - 9
MPQ Total [6]	M	29.00_a	25.77_{ab}	20.52_b
	SD	13.33	13.94	10.52
	Range	6 - 61	7 - 64	4 - 43

Note. Means that do not share subscripts differ significantly at $p < .05$

PRI = Pain Rating Index

[1] $F(2, 85) = 4.85$, $p < .05$
[2] $F(2,85) = 2.50$, $p > .05$
[3] $F(2,85) = 4.15$, $p < .05$
[4] $F(2,85) = .67$, $p > .05$
[5] $F(2, 85) = 4.41$, $p < .05$
[6] $F(2, 85) = 3.49$, $p < .05$

MPQ total score.

As indicated earlier, the total score is calculated by summing the pain rating index scores for the sensory, affective, evaluative, and miscellaneous categories. The FM patients ($M = 29.00$, $SD = 13.33$) had significantly higher total scores than did the RA patients ($M = 20.52$, $SD = 10.52$). It is helpful to compare the total scores obtained in the present study with the published responses of other groups of pain patients (Melzack, 1975). The mean MPQ total scores reported by Melzack for a number of pain groups include the following: back pain (26.3), cancer (26.0), post-herpetic pain (22.6), dental (19.5) and arthritis (18.8).

Again, the scores reported by the RA patients in the current study are comparable to those reported by Melzack's arthritis subjects. The scores of the FM and the TMD patients are elevated compared to those reported by the cancer and back pain patients in Melzack's study.

Summary of pain perception measures.

As predicted, the results showed that the FM, the TMD, and the RA patients had significantly higher VAS present and typical past month pain intensity ratings compared to the control subjects. With respect to differences among the chronic pain patients, the FM patients reported significantly higher ratings for past month pain intensity compared to the RA patients. Surprisingly, there were no differences in present pain intensity ratings among the pain patients.

With respect to the number of painful sites marked on the body map, all pain groups reported significantly more painful sites compared to the control subjects. As well, the FM patients marked significantly more painful sites compared to the RA and the TMD patients. The FM and the TMD patients had significantly higher VAS pain intensity ratings for the painful sites that they marked on the body map compared to the NC group.

The results of the McGill Pain Questionnaire revealed that the FM patients used more words to describe their pain and had higher scores on the sensory pain rating index compared to the RA patients. Also, the FM patients rated their pain as being quite intense

when compared to the published scores of a number of other chronic pain patients (Melzack, 1975).

This concludes the presentation of the demographic, medical, pain history, and pain perception data. Now, the focus turns to the examination of the two primary study issues.

Primary Study Issues

1. Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin or does this pattern extend to pain patients who have conditions with a known etiology?

This issue was addressed by comparing scores on the Somatosensory Amplification Scale (SSAS) which served as the measure of generalized hypervigilance. The results of an univariate ANOVA indicated that there were significant group differences on the SSAS (F (3,118) = 5.02, $p < .05$). Scores on this scale can range from 1 to 5. The FM patients (M = 3.36, SD = .53) and the TMD patients (M = 3.28, SD = .63) had significantly higher scores compared to the NC group (M = 2.84, SD = .58); the RA patients (M = 3.08, SD = .62) did not differ from the NC subjects.

Contrary to predictions, there were no differences in SSAS scores among the pain patient groups. As well, the hypothesis that each group of patients would report higher scores compared to the NC group was not confirmed. The means, standard deviations, and ranges for all groups are presented in Table 5.

Group differences among the FM, TMD, and NC subjects remained statistically significant when pain duration ($F(3,117) = 4.20$, $p < .01$), and hypochondriasis ($F(3,117) = 3.02$, $p < .001$) were used as covariates. However, when present pain intensity ($F(3,117) = 2.57$, $p > .05$), depression ($F(3,117) = 2.08$, $p > .05$), and anxiety ($F(3,117) = 2.44$, $p > .05$) were used as covariates, these group differences were no longer statistically significant. In other words, controlling for the effects of present pain intensity, depression, and anxiety eliminates the group differences in SSAS scores.

To place these results in a broader context, it is helpful to compare the SSAS scores with those reported in other studies. Epstein et al. (2000) reported a mean SSAS score of 2.90 (SD = .70) in a sample of fibromyalgia outpatients. Gregory et al. (2000)

Table 5
Means, Standard Deviations, and Ranges for the Somatosensory Amplification Scale for All Groups

Variable		Group			
		FM	TMD	RA	NC
SSAS [1]	M	3.36_{a}	3.28_{a}	3.08_{ab}	2.84_{b}
	SD	.53	.63	.62	.58
	Range	2.20 - 4.10	1.80 - 4.60	1.80 - 4.20	1.40 - 4.00

Note. Means that do not share subscripts differ significantly at $p < .01$.

[1] $F(3,118) = 5.02$, $p < .05$

administered the SSAS to two groups of chronic pain patients, one group had diffuse pain whereas the other group had pain localized to the back or extremities. The group with diffuse pain had higher SSAS scores (M = 2.09, SD = .80) compared to the patients with more localized pain (M = 1.48, SD = .73). Kosturek et al. (1998) reported a mean SSAS score of 1.17 (SD = .78) in a group of heterogenous pain patients. Barsky et al. (1990) found that patients with hypochondriasis (M = 2.78) had higher SSAS scores compared to a medical patient control group (M = 1.98). The subjects in the present study had elevated scores compared to other populations.

A series of correlational analyses were conducted to examine how the SSAS scores relate to measures of pain intensity, health care utilization, psychological distress, and illness behaviour. The results of these analyses are highlighted in Table 6. Correlations were calculated for each of the groups individually, for the pain groups combined, and for the total sample. When the results of the individual groups were examined, many of the correlations were nonsignificant; scatterplots revealed that there was a restricted range of values for many of the variables which minimizes the correlation coefficient. When the pain groups were combined, many of the correlations were significant, likely reflecting greater variability in scores. As illustrated in Table 6, the SSAS appears to be related to several measures of psychological distress and illness behaviour for the chronic pain patients, when grouped together. The implications of these findings are highlighted in the Discussion.

2. Deconstructing generalized hypervigilance: Group differences and predictive ability

(a) Do group differences exist on the anxiety, monitoring, attribution, and pain coping style variables?

MANOVAs and univariate ANOVAs were used to analyze group differences on the anxiety, monitoring, symptom attribution, and coping variables believed to underlie generalized hypervigilance. These results are presented below.

Table 6
Correlations of the Somatosensory Amplification Scale with Pain Intensity Measures, Health Care Utilization Measures, SCL90-R Subscales and IBQ Subscales

Variable	Group					
	FM (n=34)	RA (n=29)	TMD (n=26)	NC (n=34)	Pain Pts. (N=88)	Total Sample (N=122)
Pain Intensity Measures						
VAS present pain intensity	-.11	-.15	.38**	.19	.10	.25*
VAS past pain intensity	-.03	-.11	.47**	.12	.17	.25*
# pain sites on body map	.08	.18	.45*	-.01	.26*	.33*
MPQ # words chosen	-.13	.13	.45**	n/a	.21*	n/a
Health Care Utilization						
# consults since onset	-.14	.09	.23	n/a	.07	n/a
# doctor visits/yr	-.04	.37*	.41*	.12	.17*	.24*
# pain visits/yr	.03	.34*	.48*	.11	.23*	.28*
# non-pain visits/yr	-.19	.23	-.05	.08	0	.04
SCL90-R Subscales						
depression	.38*	.00	.67**	.20	.38*	.40**
anxiety	.42*	.20	.56*	.25	.43**	.45**
phobic anxiety	.12	.06	.41**	.26	.24*	.27*
somatization	.14	.22	.74**	.29*	.40**	.45**
hostility	.31*	-.07	.60*	.14	.30*	.30*
obsessive-compulsive	.36*	.34*	.66**	.33	.47*	.49*
paranoid ideation	.25	.37*	.11	.29*	.26*	.28*
psychoticism	.44**	.11	.25	.20	.31*	.33*
interpersonal sensitivity	.44*	.23	.30	.27	.35*	.36*
IBQ Subscales						
hypochondriasis	.34*	.24	.27	.48*	.31*	.31*
denial	-.13	-.22	-.02	.09	-.18*	-.18*
disease conviction	.04	.07	.59**	.42**	.30**	.30**

irritability	.37*	.12	.47**	.46**	.35**	.35*
perception of illness	.33*	.31*	-.24	.11	.14	.14
affective distress	.30*	-.10	.35*	.44*	.23*	.23*
affective inhibition	.27	-.37*	-.24	.05	-.11*	.11

* $p < .05$, ** $p < .01$ (one-tailed)

Anxiety Measures

A MANOVA was performed to test for the overall significance of the following anxiety measures: the State-Trait Anxiety Inventory (STAI) subscales (state anxiety and trait anxiety), and the Cognitive Somatic Anxiety Questionnaire subscales (cognitive and somatic anxiety). A significant multivariate effect was found (Pillais = .197, approximate F (12,351) = 2.06, $p < .01$). Significant univariate effects were found for the STAI trait anxiety scale (F (3,118) = 5.53, $p < .01$) and for the CSAQ somatic anxiety subscale (F (3,118) = 4.20, $p < .01$). (Note: Although the main interest was on trait and somatic anxiety, the state anxiety and cognitive anxiety scales were also analyzed to determine what differences, if any, existed among the groups).

The State Trait Anxiety Inventory (STAI)

As indicated earlier, the STAI consists of two scales: State Anxiety and Trait Anxiety. Scores on each scale can range from 20 to 80, with higher scores reflecting greater levels of reported anxiety. The STAI findings are highlighted in Table 7.

Trait anxiety scale.

The results revealed that the FM group (M = 49.76, SD = 11.41) reported significantly higher trait anxiety scores compared to the RA group (M = 42.31, SD = 8.86) and the NC group (M = 42.29, SD = 7.85). Contrary to predictions, the TMD patients did not report significantly higher trait anxiety scores compared to the RA patients nor did the RA patients have higher scores than did the NC group on this measure. Group differences among the FM, RA, and NC groups remained statistically significant after controlling for the effects of present pain intensity (F(3,117) = 2.64, $p <$ .05), pain duration (F(3,117) = 5.39, $p <$.05), and hypochondriasis (F(3,117) = 2.98, $p <$ .05). When depression was used as the covariate, these group differences were no longer statistically significant (F(3,117) = 1.66, $p > .05$). This latter finding is not surprising give the high degree of association between the depression and anxiety measures for these groups (correlations between trait anxiety and depression for the FM , RA, and the NC groups, respectively are .83, .56, and .54; all correlations are significant at $p < .01$).

Table 7
Means, Standard Deviations, and Ranges for State-Trait Anxiety Inventory (STAI) for All Groups

Variable		Group			
		FM	TMD	RA	NC
STAI					
Trait Anxiety [1]	M	49.76_a	47.04_{ab}	42.31_b	42.29_b
	SD	11.41	5.87	8.86	7.85
	Range	29 - 74	33 - 62	21 - 59	26 - 57
State Anxiety [2]	M	42.73_a	42.78_a	41.45_a	38.79_a
	SD	7.72	7.12	7.60	9.85
	Range	25 - 60	30 - 56	27 - 57	22 - 65

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = 5.53$, $p < .01$
[2] $F(3,118) = 1.66$, $p > .05$

State anxiety scale (STAI).

The results indicated that there were no significant between-group differences on the state anxiety subscale ($F(3,118) = 1.66$, $p > .05$). ANCOVAS were performed, using the same covariates as were used for the trait anxiety subscale, to determine if the pattern of results was affected; no differences were noted (evaluated at $F(3,117)$, all $p > .05$).

Comparison of state and trait anxiety scales.

The results of paired t-tests showed that the FM patients ($t(32) = -2.71$, $p < .01$), the TMD patients ($t(25) = -2.43$, $p < .01$), and the NC subjects ($t(33) = -2.58$, $p < .01$) each reported significantly higher scores on the trait anxiety scale compared to the state anxiety scale.

The Cognitive Somatic Anxiety Questionnaire (CSAQ)

The CSAQ asks subjects the degree to which they experience cognitive distress and somatic distress when they are feeling anxious. The scores can range from 0 to 35 on each subscale, with higher scores reflecting greater levels of reported anxiety. The CSAQ results are illustrated in Table 8.

Somatic anxiety scale.

As predicted, the FM group ($M = 14.24$, $SD = 6.04$) reported significantly more somatic distress symptoms when anxious than did the RA group ($M = 9.55$, $SD = 5.92$). Group differences between the FM and the RA groups remained statistically significant after the effects of present pain intensity ($F(3,117) = 3.49$, $p < .05$) and pain duration ($F(3,117) = 4.50$, $p < .05$) were controlled for statistically. When hypochondriasis ($F(3,117) = 2.55$, $p > .05$) and depression ($F(3,117) = 1.89$, $p > .05$) were used as covariates, these group differences were no longer statistically significant.

The predictions that the FM patients would have higher somatic anxiety scores than would the NC group and that the TMD patients would have higher scores than would the RA patients and the NC subjects were not confirmed.

Table 8
Means, Standard Deviations, and Ranges for the Cognitive-Somatic Anxiety Questionnaire (CSAQ) for All Groups

Variable		Group			
		FM	TMD	RA	NC
CSAQ					
Somatic Anxiety [1]					
	M	14.24_{a}	11.69_{ab}	9.55_{b}	10.38_{ab}
	SD	6.04	5.18	5.92	5.34
	Range	1 - 28	1 - 23	0 - 26	0 - 20
Cognitive Anxiety [2]					
	M	11.09_{a}	9.60_{a}	8.69_{a}	8.65_{a}
	SD	7.40	6.73	6.69	5.25
	Range	0 - 28	0 - 26	0 - 23	0 - 19

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = 4.20$, $p < .01$
[2] $F(3,118) = .99$, $p > .05$

Cognitive anxiety scale.

No statistically significant differences were found for the cognitive anxiety subscale of the CSAQ ($F(3,118) = .99$, $p > .05$). There was no change in the results when ANCOVAs were performed using pain intensity, pain duration, depression, and hypochondriasis as covariates (evaluated at $F(3,117)$, all $p > .05$).

Comparison of somatic and cognitive scales.

Paired t-tests revealed that the FM patients had significantly higher scores on the somatic anxiety subscale compared to the cognitive anxiety subscale ($t(32) = -3.19$, $p < .01$). No other group differences were reported.

Monitoring Measures

A MANOVA was performed on the following monitoring variables: the revised Pennebaker Inventory of Limbic Languidness (PILL) total score (frequency of symptom occurrence), the total number of symptoms endorsed by subjects (sum of symptoms, regardless of symptom frequency), and the MBSS monitoring and blunting scales. The results indicated that there was a significant multivariate effect (Pillais = .3861, approximate $F(12,351) = 4.32$, $p < .01$). A significant univariate effect was obtained for the PILL total score (frequency of symptom occurrence) ($F(3,118) = 19.74$, $p < .01$) and the PILL score for the total number of symptoms endorsed ($F(3,118) = 7.79$, $p < .05$). There were no significant group differences on the MBSS monitoring ($F(3, 118) = .49$, $p > .05$) or blunting scales ($F(3,118) = .69$, $p > .05$).

The Pennebaker Inventory of Limbic Languidness (PILL)

The PILL was used as the measure of bodily monitoring. The results are highlighted in Table 9. This questionnaire measures how frequently a number of common physical symptoms are experienced by the subject. As indicated in the Method section, the scoring of the PILL was revised: eight items which might artificially inflate the scores of the chronic pain patients were removed. Subjects are asked to rate the frequency of occurrence of each symptom using a 5-point scale (1 "have never or almost never experienced the symptom", 5 "more than once every week"). Scores on the

Table 9
Means, Standard Deviations, and Ranges for the Pennebaker Inventory of Limbic Languidness (PILL) for All Groups

Variable		Group FM	TMD	RA	NC
PILL score [1] (frequency of symptom occurrence)					
	M	125.91_{a}	108.92_{b}	93.45_{bc}	89.44_{c}
	SD	23.77	22.47	22.32	16.44
	Range	85-187	74-157	54-145	52-115
# PILL symptoms endorsed [2] (out of a possible 46)					
	M	34.6_{a}	30.8_{ab}	26.1_{b}	26.6_{b}
	SD	6.6	5.6	10.4	10.4
	Range	19-44	19-40	4-42	5-41

Note. Means with different subscripts differ significantly at $p < .05$

[1] $F(3,118) = 19.74$, $p < .01$
[2] $F(3,118) = 7.79$, $p < .01$

revised version of the PILL can range from 46 to 230, with higher scores indicating a greater frequency of symptom occurrence.

The FM patients (M = 125.91, SD = 23.77) reported experiencing common physical symptoms significantly more frequently compared to the TMD patients (M = 108.92, SD = 22.47), the RA patients (M = 93.45, SD = 22.32) and the NC group (M = 89.44, SD = 16.44). Also, the TMD patients had significantly higher PILL scores than did the NC group. The group differences reported above remained statistically significant after the effects of depression ($F(3,117) = 12.82$, $p < .01$), hypochondriasis ($F(3,117) = 16.28$, $p < .01$), anxiety ($F(3,117) = 12.99$, $p < .01$), pain duration ($F(3,117) = 18.76$, $p < .01$), and age ($F(3,117) = 24.6$, $p < .01$) were controlled for statistically.

In addition to the score reflecting frequency of symptom occurrence, the total number of PILL symptoms endorsed (i.e., items rated as "2"or greater on the 5-point scale) by each group of subjects was calculated. The range of scores was between 0 and 46. The results showed that the FM patients endorsed significantly more symptoms (M = 34.6, SD = 6.6) compared to the RA patients (M = 26.1, SD = 10.4) and the NC subjects (M = 26.6, SD = 10.4). The scores of the TMD patients (M = 30.8, SD = 5.6) did not differ significantly from any of the other groups. The differences between the FM, RA, and NC subjects remained statistically significant after the effects of anxiety ($F(3,117) = 4.22$, $p < .01$), depression ($F(3,117) = 4.22$, $p < .01$), hypochondriasis ($F(3,117) = 4.22$, $p < .01$), pain duration ($F(3,117) = 4.22$, $p < .01$), and age ($F(3,117) = 4.22$, $p < .01$) were accounted for statistically.

The Miller Behavioral Style Scale (MBSS)

The MBSS was used to determine how individuals respond to threat in the environment. It has two subscales: monitoring and blunting. The results showed that there were no significant group differences on either scale. Scores can range from 0 to 16 for each scale. Although the main interest was in the monitoring scale, the results for the blunting scale are also presented. The results for the MBSS are summarized in Table 10.

Table 10
Means, Standard Deviations, and Ranges for the Miller Behavioural Style Scale for All Groups

Variable		Group			
		FM	TMD	RA	NC
MBSS					
Monitoring [1]	M	9.24_a	9.35_a	10.00_a	9.38_a
	SD	2.56	2.87	3.19	2.99
	Range	3 - 14	1 - 10	1 - 10	3 - 14
Blunting [2]	M	4.45_a	4.46_a	4.10_a	4.85_a
	SD	2.68	2.32	1.84	2.73
	Range	0 - 11	2 - 14	0 - 9	0 - 11

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = .49, p > .05$
[2] $F(3,118) = .69, p > .05$

Monitoring scale.

The means and standard deviations are presented in Table 10. There was no change in the pattern of results when the effects of depression, anxiety, and hypochondriasis were used as covariates (evaluated at F (3,117), all p > .05).

Blunting scale.

The means and standard deviations are presented in Table 10. As with the monitoring scale, there was no change in the pattern of results when the effects of depression, anxiety, and hypochondriasis were used as covariates (evaluated at F(3,117), all p > .05).

Comparison of monitoring and blunting scales.

Paired t-test analyses revealed that the FM group (t (32) = 6.63, p < .01), the RA group (t (28) = 8.57, p < .01), the TMD group (t (25) = 6.28, p < .01), and the NC group (t (33) = 6.15, p < .01) each made significantly more monitoring responses than blunting responses.

Symptom Attribution Measure

Symptom Interpretation Questionnaire

The three subscales of the Symptom Interpretation Questionnaire (SIQ) (somatic attribution, psychological attribution, and environmental/normalizing attribution) were entered into a MANOVA. There was a significant multivariate effect (Pillais = .1761, approximate F (9,354) = 2.45 p < .05). The results indicated that there was a significant univariate effect for the environmental attribution subscale (F(3,118) = 3.10, p < .05). Contrary to predictions, there were no significant univariate effects for the somatic attribution subscale (F(3,118) = 2.21, p > .05) or for the psychological attribution subscale (F(3,118) = 1.28, p > .05). The means and standard deviations for each of the three SIQ scales are presented in Table 11.

Environmental attribution scale.

The results indicated that the FM patients (M= 31.42, SD = 8.23) made significantly fewer environmental/normalizing attributions for common physical

Table 11
Means, Standard Deviations, and Ranges for the Symptom Interpretation Questionnaire (SIQ) for All Groups

Variable		Group			
		FM	TMD	RA	NC
SIQ					
Somatic [1]	M	23.24_a	23.23_a	24.48_a	20.97_a
	SD	6.10	4.36	5.62	5.65
	Range	14 - 37	15 - 31	16 - 36	13 - 35
Psychological [2]	M	24.73_a	27.96_a	26.21_a	27.97_a
	SD	7.63	8.92	7.66	7.08
	Range	13 - 39	13 - 48	13 - 44	15 - 46
Environmental [3]	M	31.42_a	34.69_{ab}	34.17_{ab}	36.56_b
	SD	8.23	6.67	6.20	6.03
	Range	16 - 46	20 - 49	23 - 47	22- 48

Note. Means that do not share subscripts differ significantly at $p < .05$.

[1] $F(3,118) = 2.21$, $p > .05$
[2] $F(3,118) = 1.28$, $p > .05$
[3] $F(3,118) = 3.10$, $p < .05$

symptoms compared to the NC group (M= 36.56, SD = 6.03). There were no changes in the results after the effects of depression, anxiety, and hypochondriasis were controlled for statistically (evaluated at (F(3,117), all p > .05).

Psychological and environmental attribution scales.

As stated above, there were no significant differences on these scales. The means, standard deviations, and ranges for these scales are presented in Table 11.

Comparison of SIQ scales.

Results of paired t-tests indicated that the FM patients (t (32) = 5.32, p < .01), the RA patients (t (28) = 5.50, p < .01), the TMD patients (t (25)= 3.97, p , .01) and the NC subjects (t (33) = 7.87, p < .01) each made significantly more environmental attributions for common physical symptoms compared to psychological attributions. As well, the RA patients (t (28) = 6.39, p < .01), the TMD patients (t (25) = 8.28, p < .01) and the NC group (t (33) = 14.58, p < .01) each made significantly more environmental attributions compared to somatic attributions. Finally, the TMD patients (t (25) = 2.89, p < .01) and the NC group (t (33) = 6.51, p < .01) made significantly more psychological attributions than somatic attributions.

The results of the SIQ conflict with previous studies which have shown that patients with chronic or acute illness report significantly more somatic attributions compared to a control group of health subjects (Robbins & Kirmayer, 1990).

Coping Measure

Pain Related Self-Statements Scale

The PRSS was designed to assess how chronic pain patients cope with their pain. It consists of two scales: catastrophizing and active coping. The catastrophizing scale was used as the measure of maladaptive coping with pain. Scores can range from 0 to 5 on each scale. The results of an ANOVA indicated that there was a significant univariate effect for both of the subscales: active coping (F (3,118 = 8.22, p < .05) and catastrophizing (F (3,118) = 8.31, p < .05). The means and standard deviations for all groups are presented in Table 12. The PRSS was normed on chronic back pain patients,

Table 12
Mean, Standard Deviations, and Ranges for the Pain Related Self-Statements Scale (PRSS) for All Groups

Variable		Group				*Normative Values*		
		FM	TMD	RA	NC	*CBP*	*TMD*	*NC*
PRSS								
Catastrophizing [1]	M	2.63_a	2.33_a	2.05_{ab}	1.45_b	*2.03*	*2.26*	*.85*
	SD	1.19	1.34	.89	.93	*1.22*	*1.02*	*.80*
	Range	.56 - 4.67	.22 - 4.22	.33 - 3.89	0 - 3.89	*n/a*	*n/a*	*n/a*
Active Coping [2]	M	3.36_{ab}	2.87_a	3.64_b	3.36_{ab}	*2.96*	*2.80*	*3.37*
	SD	.68	1.11	.88	1.00	*.91*	*.70*	*1.13*
	Range	2.11 - 4.89	.33 - 4.89	.78 - 4.89	.89 - 4.89	*n/a*	*n/a*	*n/a*

Note. Means that do not share subscripts differ significantly at $p < .05$

[1] $F(3,118) = 8.22$, $p < .05$
[2] $F(3,118) = 8.31$, $p < .05$

n/a = not available

* Normative values obtained from CBP (chronic back pain), TMD, and NC subjects from Flor et al. (1993).

TMD patients, and NC subjects. For comparison purposes, normative values for each scale are also presented in Table 12.

Catastrophizing scale.

For the catastrophizing subscale, the results showed that the FM patients (M = 2.63, SD = 1.19) and the TMD patients (M = 2.33, SD = 1.34) engaged in significantly more catastrophizing strategies to deal with their pain compared to the NC group (M= 1.45, SD = .93). This difference remained statistically significant when the effects of anxiety ($F(3,117) = 3.61$, $p < .05$) and hypochondriasis ($F(3,117) = 4.45$, $p < .01$) were controlled for statistically. However, when present pain intensity ($F(3,117) = 1.55$, $p > .05$) and depression ($F(3,117) = 2.56$, $p > .05$) were used as covariates, group differences on the catastrophizing subscale were no longer statistically significant.

The hypotheses that the FM and the TMD patients would have significantly higher catastrophizing scores than would the RA patients (M = 2.05, SD = .89) and that the RA patients would have higher scores than would the NC subjects were not confirmed.

Active coping scale.

For the active coping subscale, the RA patients (M = 3.64, SD = .88) had significantly higher scores than did the TMD patients (M = 2.87, SD = 1.11). Group differences between the RA and the TMD patients remained statistically significant after the effects of present pain intensity ($F(3,117) = 3.21$, $p < .05$), anxiety ($F(3,117) = 2.78$, $p < .05$), and hypochondriasis ($F(3,117) = 3.17$, $p < .05$) were controlled for statistically. Group differences were no longer statistically significant when depression ($F(3,117) = 3.01$, $p > .05$) was the covariate. The hypothesis that the RA patients would have higher active coping scores compared to the FM patients was not supported.

Comparison of PRSS scales.

Paired t-test analyses revealed that the FM patients (t (32) = 2.78, $p < .01$), the RA patients (t (28) = 6.55, $p < .01$), and the NC group (t (33) = 7.81, $p < .01$) each had significantly higher scores on the active coping subscale compared to the catastrophizing subscale. This was an unexpected finding.

Summary of Group Differences

In summary, there were a number of differences between the pain patients and the control subjects on the measures of anxiety, monitoring, attribution, and coping. Contrary to predictions, there were fewer significant differences among the groups of chronic pain patients than was expected. The results suggest that the patient groups that were studied are more similar on a number of these measures than had been anticipated. The implications of these findings are examined in the Discussion.

(b) How accurately can group members be classified according to their scores on measures of anxiety, monitoring, symptom attribution, and pain coping style?

Discriminant Function Analysis for All Groups with Six Variables

Discriminant function analyses were used to address this question. It was predicted that the anxiety, monitoring, symptom attribution, and coping variables would discriminate among the four groups of subjects. First, a discriminant function analysis was performed where the six variables (trait anxiety, somatic anxiety, bodily monitoring, monitoring of threatening events, somatic attribution, and catastrophizing pain coping style) were used as discriminators.

Typically, a discriminant function analysis is used for two main reasons: to interpret the dimension(s) along which the groups differ, and to determine what proportion of subjects is classified correctly (Tabachnick & Fidell, 1989). For the present study, the primary interest was in evaluating the accuracy of group membership.

Each of the six variables was entered directly into the analysis because no a priori assumption was made regarding the relative importance of the variables. When a direct analysis is performed, all predictors enter the equation at once and each predictor is assigned only the unique association it has with the groups (Tabachnick & Fidell, 1989). Three discriminant functions were derived with $\chi^2(18) = 66.99$, $p < .01$. After the first function was removed, the association between the groups and the predictors was χ^2 (10) = 14.62, $p > .05$, implying that the second discriminant function was not statistically significant. The eigenvalue associated with the first discriminant function indicated that

81% of the between-group variability was accounted for by this function. The correlations between the six variables and the canonical discriminant function are presented in Table 13.

Interpreting the meaning of a discriminant function is inferred from the pattern of correlations between the variables and the discriminant function. These correlations are referred to as structure coefficients. Typically, loadings greater in magnitude than .30 are considered when defining a discriminant function (Tabachnick et al., 1989). The variables which had the largest absolute correlation with the first discriminant function, in decreasing order of magnitude, were: the PILL total score reflecting high levels of bodily monitoring, the PRSS catastrophizing score reflecting the use of maladaptive coping strategies when in pain, the STAI trait anxiety score reflecting high levels of trait anxiety, and the CSAQ somatic anxiety score reflecting the tendency to experience anxiety as somatic distress. Scheffé's test was used to determine if the four group centroids (i.e., group means) for the first discriminant function differed significantly from each other. If univariate tests are applied to multivariate data, it is recommended that a conservative test (e.g., Scheffé) be used and should be evaluated at a conservative alpha level (e.g., .01) (Gardner, 1992). Results of Scheffé's post-hoc test ($F(3,121) = 22.45$, $p < .001$) indicated that the FM group had significantly higher scores on this function compared to the TMD, RA, and the NC groups. Also, the TMD group had significantly higher scores compared to the RA and the NC groups.

Table 14 presents the actual group membership and the group membership which was assigned by this discriminant function. Of all the cases, 45.1% were classified correctly. The FM group was classified with 60.6% accuracy, with 15.2 % of FM patients being misclassified as RA patients, 15.2% as TMD patients, and 9.1% as NC subjects. The members of the RA group were classified with 37.9% accuracy, with 34.5% misclassified as belonging to the NC group, 17.2% belonging to the FM group, and 10.3% belonging to the TMD group. The TMD patients were classified with only 3.8% accuracy, with 46.2% being misclassified as FM patients, 34.6% as NC subjects, and

Table 13
Correlations between the 6 Discriminating Variables and the Canonical Discriminant Function for All Groups

	Discriminant Function I
PILL	.94
PRSS	.52
STAI	.49
CSAQ	.41
SIQ	.11
MBSS	- .08

PILL- Pennebaker Inventory of Limbic Languidness, measure of bodily monitoring
PRSS - Catastrophizing subscale from the Pain Related Self-Statements Scale
STAI - Trait anxiety subscale from the State-Trait Anxiety Inventory
CSAQ- Somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire
SIQ - Somatic attribution scale from the Symptom Interpretation Questionnaire
MBSS - Monitoring scale from Miller Behavioral Style Scale, measure of response to threat

Table 14
Discriminant Function Classification Using 6 Variables for All Groups

Actual Group		Predicted Group Membership			
		FM	TMD	RA	NC
FM	n	20	5	5	3
	%	(60.6)	(15.2)	(15.2)	(9.1)
TMD	n	12	1	4	9
	%	(46.2)	(3.8)	(15.4)	(34.6)
RA	n	5	3	11	10
	%	(17.2)	(10.3)	(37.9)	(34.5)
NC	n	0	2	9	23
	%	(0)	(5.9)	(26.5)	(67.6)

Percent of "grouped" cases classified correctly: 45.1%

15.4% as RA patients. Finally, the NC group was classified with 67.6% accuracy, with 26.5% being misclassified as RA patients and 5.9% as TMD patients.

Discriminant Function Analysis for the FM, TMD, and RA Groups with Six Variables

A discriminant function analysis was performed for the pain groups, using the same six variables. Two discriminant functions were derived with $\chi^2(12) = 33.02$, $p < .001$. When the first function was removed, the results indicated that the second function was not statistically significant ($\chi^2(5) = .74$, $p > .05$). The eigenvalue associated with the first discriminant function accounted for 98.1% of the between-group variability. The correlations between the variables and the discriminant function are presented in Table 15.

As illustrated in Table 15, the following variables loaded on the first function: the PILL total score reflecting a high frequency of symptom occurrence, the catastrophizing subscale of the PRSS reflecting maladaptive coping with pain, the trait anxiety subscale of the STAI reflecting high levels of trait anxiety, and the CSAQ somatic anxiety subscale reflecting the tendency to experience anxiety as somatic distress. Results of Scheffé's post-hoc test ($F(2,87) = 20.34$, $p < .001$) indicated that the FM group had significantly higher scores on this function compared to the TMD and the RA groups. As well, the TMD group had significantly higher scores than the RA group.

The classification results for this analysis are highlighted in Table 16. Of all the cases, 52.3% were classified correctly. The FM group was classified with 66.7% accuracy, with 21.2% being misclassified as RA patients and 12.1% as TMD patients. The members of the RA group were classified with 65.5% accuracy with 13.8% being misclassified as FM patients and 20.7% as TMD patients. Finally, the TMD group was classified with 19.2% accuracy with 42.3% being misclassified as FM patients and 38.5% being classified as RA patients.

Summary of Discriminant Function Analyses

The results from the discriminant function analyses illustrated that most of the subjects within the groups could be differentiated by their scores on trait anxiety, somatic

Table 15
Correlations Between the 6 Discriminating Variables and the Canonical Discriminant Function for the FM, TMD, and RA Groups

	Discriminant Function I
PILL	.87
PRSS	.50
STAI	.49
CSAQ	.31
SIQ	-.14
MBSS	-.16

PILL- Pennebaker Inventory of Limbic Languidness, measure of bodily monitoring
PRSS - Catastrophizing subscale from the Pain Related Self-Statements Scale
STAI - Trait anxiety subscale from the State-Trait Anxiety Inventory
CSAQ- Somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire
SIQ - Somatic attribution scale from the Symptom Interpretation Questionnaire
MBSS - Monitoring scale from Miller Behavioral Style Scale, measure of response to threat

Table 16
Discriminant Function Classification Using 6 Variables for the FM, TMD, and RA Groups

Actual Group		Predicted Group Membership		
		FM	TMD	RA
FM	n	22	4	7
	%	(66.7)	(12.1)	(21.2)
TMD	n	11	5	10
	%	(42.3)	(19.2)	(38.5)
RA	n	4	6	19
	%	(13.8)	(20.7)	(65.5)

Percent of "grouped" cases classified correctly: 52.3%

anxiety, bodily monitoring, and catastrophizing; the somatic attribution and monitoring of threat variables, however, were shown to be poor discriminators. Generally, the FM, RA, and NC groups were classified with a satisfactory degree of accuracy. It is interesting to note that the TMD patients were the most difficult group of subjects to classify accurately.

The results from the discriminant function analyses presented should be interpreted with caution. It should be noted that the classification results obtained from discriminant function analyses tend to be an overestimation because they capitalize on chance. The classification coefficients used to assign a case to a particular group are derived partially from that case, thus biassing the results. Cross-validation procedures are recommended so that the utility of the coefficients can be tested on another sample (Tabachnick & Fidell, 1989).

c) How well do anxiety, monitoring, somatic attribution, and catastrophizing pain coping style predict generalized hypervigilance, as measured by The Somatosensory Amplification Scale?

This question was addressed by using multiple regression. Both standard and stepwise regression analyses were used. Standard multiple regression analyses were performed on the current data set in order to determine the overall relationship between the dependent variable (generalized hypervigilance, measured by the SSAS) and the six independent variables Stepwise regression analyses were performed to determine the best predictor(s) of generalized hypervigilance for each group of chronic pain patients.

The following variables were used in the regression analyses: Anxiety Variables: trait anxiety was measured by the trait anxiety subscale of the State Trait Anxiety Inventory (STAI), and somatic anxiety was measured by the somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire (CSAQ), Monitoring Variables: bodily monitoring was measured by the Pennebaker Inventory of Limbic Languidness (PILL) and monitoring of threatening events was measured by the monitoring scale from the Miller Behavioural Style Questionnaire (MBSS); Attribution Variable: the tendency to make somatic attributions for common physical sensations was measured by the

somatic attribution subscale from the Symptom Interpretation Questionnaire (SIQ), and Coping Variable: maladaptive pain coping style was measured by the catastrophizing subscale of the Pain Related Self-Statements Scale (PRSS). For all analyses, the dependent variable was the Somatosensory Amplification Scale(SSAS), the measure of generalized hypervigilance.

Standard Multiple Regression Analysis for the FM Group

A standard multiple regression analysis was performed to determine the overall relationship between the six independent variables and the dependent variable, SSAS scores, for the FM group. The results indicated that the overall regression equation was not statistically significant (F (6,26) = 1.44, $p > .05$, $R = .50$, $R^2 = .25$, adjusted $R^2 = .08$). The results for this analysis are summarized in Table 17.

Contrary to predictions, trait anxiety was the only variable which had a statistically significant correlation with the generalized hypervigilance scores. An examination of scatterplots between the dependent variable and each of the other independent variables suggested that the correlation coefficients for the bodily monitoring, monitoring of threat, and the catastrophizing variables are likely deflated because of a problem with a restricted range of values.

Stepwise Multiple Regression Analysis for the FM Group

Stepwise multiple regression is recommended when the researcher is interested in determining the best prediction equation (Tabachnick & Fidell, 1989; Myers & Well, 1991). In stepwise regression, variables are added and deleted, based upon statistical criteria until the best prediction equation is developed. Variables with the strongest correlation with the dependent variable enter the equation on the first step. At each subsequent step, the variable with the strongest partial correlation is added if it meets entry criteria. As well, once variables are in the equation, they are tested for removal if they no longer contribute significantly to prediction.

Not surprisingly, the results of this analysis indicated that trait anxiety, the only variable which correlated with SSAS scores, was the best predictor of generalized hypervigilance for the FM group ($F(1,31) = 7.59$, $p < .05$, $R^2 = .197$, adjusted $R^2 = .171$,

Table 17
Summary of the 6 Variable Standard Multiple Regression Analysis for the FM Group

	SSAS	STAI	CSAQ	PILL	MBSS	SIQ	PRSS	Part R	Partial R	Beta	sr^2
STAI	.44**	1.0						.34*	.37*	.74	.12
CSAQ	.26	.62**	1.0					-.02	-.02	-.02	0
PILL	.25	.49**	.47**	1.0				-.02	-.02	-.02	0
MBSS	.18	.11	.18	.13	1.0			.08	.09	.09	0
SIQ	.11	.35*	.48**	.09	.29	1.0		-.04	-.04	-.05	0
PRSS	.24	.82**	.50**	.26	-.10	.37**	1.0	-.16	-.19	-.32	.03
M	3.36	49.76	14.24	125.91	9.42	23.24	2.63				
SD	.53	11.41	6.04	23.77	2.56	6.10	1.19				

$F(6,26) = 1.44$, $p > .05$, $R = .50$, $R^2 = .25$, adjusted $R^2 = .08$

STAI - Trait anxiety subscale from the State-Trait Anxiety Inventory
CSAQ- Somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire
PILL- Pennebaker Inventory of Limbic Languidness, measure of bodily monitoring
MBSS - Monitoring scale from Miller Behavioral Style Scale, measure of response to threat
SIQ - Somatic attribution scale from the Symptom Interpretation Questionnaire
PRSS - Catastrophizing subscale from the Pain Related Self-Statements Scale

sr^2 = squared part correlation represents unique contribution of the IV to the DV
* $p < .05$ ** $p < .01$

Beta = .44), accounting for 17.1% of the variance in generalized hypervigilance scores. Trait anxiety was the only variable which met entry criteria.

Follow-Up Analyses

As seen in Table 17, trait anxiety correlates with four of the other independent variables: somatic anxiety, bodily monitoring, somatic attribution, and catastrophizing pain coping style. To determine if trait anxiety remains a statistically significant predictor of SSAS scores when the effects of these correlated variables are controlled for statistically, separate regression analyses were performed where each of these four variables was entered on the first step of a regression equation, followed by the entry of trait anxiety on the last step (i.e., somatic anxiety/trait anxiety; bodily monitoring/trait anxiety; somatic attribution/trait anxiety; catastrophizing/trait anxiety). The results of these regression analyses indicated that trait anxiety remains a significant predictor of SSAS scores for the FM group after the effects of somatic anxiety (R^2change = .20, Fchange (1,30) = 4.84, $p < .05$), bodily monitoring (R^2change = .19, Fchange (1,30) = 5.03, $p < .05$), somatic attribution (R^2change = .22, Fchange (1,30) = 7.00, $p < .05$), and catastrophizing (R^2change = .24, Fchange (1,30) = 7.34, $p < .05$) are controlled for statistically.

Controlling for the Effects of Depression, Hypochondriasis, and Pain Intensity

As illustrated above, trait anxiety was the only variable shown to be involved in the prediction of SSAS scores for the FM group. It was hypothesized that present pain intensity (measured by the visual analogue scale), depression (measured by the depression subscale of the SCL90-R), and hypochondriasis (measured by the general hypochondriasis subscale of the Illness Behaviour Questionnaire), variables that were not included in the regression analysis, may correlate with trait anxiety and consequently affect the relationship between trait anxiety and SSAS scores. When the zero-order correlations were examined, it was shown that each of these variables is a significant correlate of trait anxiety: depression ® = .83, $p < .05$), hypochondriasis ® = .48, $p < .05$), and present pain intensity($r = .33$, $p < .05$).

To determine if trait anxiety would contribute to the prediction of SSAS scores after the effects of these variables were controlled for statistically, separate regression analyses were performed where each of these variables was entered on the first step, followed by the entry of trait anxiety on the last step (i.e., depression/trait anxiety; hypochondriasis/trait anxiety; pain intensity/trait anxiety). The results of these analyses revealed that adding trait anxiety to the equation, after depression had been entered, did not significantly improve the prediction of SSAS scores for the FM patients (R^2change = .055, Fchange (1,30) = 2.04, $p > .05$). This finding is not particularly surprising given the high correlation which exists between the depression and anxiety variables. Further analyses revealed that trait anxiety reliably increased the prediction of SSAS scores after the effects of hypochondriasis had been controlled for statistically (R^2change = .10, Fchange (1,30) = 3.90, $p < .05$) and after the effects of present pain intensity had been eliminated (R^2change = .26, Fchange (1,30) = 10.44, $p < .05$).

Summary of Regression Analyses for the FM Group

In summary, the results of the standard multiple regression analysis, using six independent variables, was not statistically significant. Trait anxiety was the only variable which correlated significantly with the SSAS scores.

The stepwise regression analysis was used to determine the best predictor of generalized hypervigilance for the FM group. The results revealed that trait anxiety is the best predictor of SSAS scores. Follow-up analyses revealed that trait anxiety remains a statistically significant predictor of SSAS scores after the effects of somatic anxiety, bodily monitoring, somatic attribution, and catastrophizing pain coping style (all correlates of trait anxiety) were controlled for statistically. As well, the effects of depression, hypochondriasis, and present pain intensity ratings were assessed; the results revealed that trait anxiety remains a statistically significant predictor of SSAS scores after the effects of hypochondriasis and present pain intensity ratings were controlled for but no longer contributed to prediction after the effects of depression were removed.

Standard Multiple Regression Analysis for the TMD Group

A standard multiple regression was performed for the TMD group where the six independent variables (trait anxiety, somatic anxiety, bodily monitoring, monitoring of threat, somatic attribution, and catastrophizing pain coping style) were entered simultaneously into the equation. The results indicated that the regression equation was statistically significant ($F(6,19) = 3.10$, $p < .05$, $R = .70$, $R^2 = .50$, adjusted $R^2 = .34$), accounting for 34% of the variance in SSAS scores for the TMD group.

As illustrated in Table 18, the trait anxiety, somatic anxiety, bodily monitoring, somatic attribution, and catastrophizing pain coping style variables correlated with the SSAS scores; the monitoring of threat variable was the only variable which did not correlate with the SSAS. Given that five of the six independent variables correlated with the dependent measure, it was surprising that bodily monitoring was the only variable with a statistically significant regression coefficient. A further examination of the data suggested that the other four variables did not emerge as being significant predictors because of the considerable degree of intercorrelation among these variables.
In standard regression, all independent variables enter into the regression equation simultaneously; each variable is assessed as if it had entered the regression after all of the other independent variables had entered. When variables are highly intercorrelated, it is possible for a variable which is correlated with the dependent variable to appear unimportant in the solution (Tabachnick & Fidell, 1989). The results of this analysis are misleading; they suggest that bodily monitoring is the only variable involved in prediction of SSAS scores for the TMD group where in reality, trait anxiety, somatic anxiety, catastrophizing pain coping style, and somatic attribution are each associated with SSAS scores.

Stepwise Multiple Regression Analysis for the TMD Group

The results of the stepwise regression analysis, using the same six independent variables which were discussed above, showed that the best predictor of SSAS scores for the TMD group was bodily monitoring, as measured by the PILL ($F(1,24) = 12.85$, $p < .01$, $R^2 = .35$, adjusted $R^2 = .32$, Beta = .59). The bodily monitoring variables accounts

Table 18
Summary of the 6 Variable Standard Multiple Regression for the TMD Group

	SSAS	STAI	CSAQ	PILL	MBSS	SIQ	PRSS	Part R	Partial R	Beta	sr^2
STAI	.49**	1.0						.18	.24	.23	.03
CSAQ	.35*	.48**	1.0					-.05	-.07	-.06	0
PILL	.59**	.53**	.38*	1.0				.35*	.44**	.46*	.12
MBSS	0	- .19	.11	- .33*	1.0			.18	.25	.21	.03
SIQ	.35*	.28	.38*	.40*	- .26	1.0		.04	.05	.05	0
PRSS	.49**	.31	.39*	.36*	.01	.51**	1.0	.20	.28	.25	.04
M	3.28	47.04	11.69	108.92	9.35	23.23	2.33				
SD	.63	5.87	5.18	22.47	2.87	4.36	1.34				

$F(6,19) = 3.10$, $p < .05$, $R = .70$, $R^2 = .50$, adjusted $R^2 = .34$

STAI - Trait anxiety subscale from the State-Trait Anxiety Inventory
CSAQ- Somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire
PILL- Pennebaker Inventory of Limbic Languidness, measure of bodily monitoring
MBSS - Monitoring scale from Miller Behavioral Style Scale, measure of response to threat
SIQ - Somatic attribution scale from the Symptom Interpretation Questionnaire
PRSS - Catastrophizing subscale from the Pain Related Self-Statements Scale

sr^2 = squared part correlation represents unique contribution of the IV to the DV
* $p < .05$ ** $p < .01$

for 32% of the variance in SSAS scores for this patient group. It was the only variable which met entry criteria.

Follow-Up Analyses

As seen in Table 18, bodily monitoring correlates with monitoring of threat, trait anxiety, somatic anxiety, somatic attributional style, and catastrophizing pain coping style. Separate regression analyses were performed where the variable of interest was entered on the first step, followed by the bodily monitoring variable on the last step (i.e., trait anxiety / bodily monitoring, etc.). The results of these analyses revealed that bodily monitoring remains a significant predictor of SSAS scores after the effects of monitoring of threat (R^2change = .39, Fchange (1,23) = 14.76, $p < .05$), trait anxiety (R^2change = .16, Fchange (1,23) = 5.87, $p < .05$), somatic anxiety (R^2change = .25, Fchange (1,23) = 8.90, $p < .05$), somatic attributional style (R^2change = .24, Fchange (1,23) = 8.77, $p < .05$), and catastrophizing ((R^2change = .20, Fchange (1,23) = 8.14, $p < .05$) were controlled for statistically.

Controlling for the Effects of Depression, Hypochondriasis, and Pain Intensity

Again, the roles of depression, hypochondriasis, and pain intensity were assessed because it was thought that they may affect the relationship between the dependent variable, SSAS scores and bodily monitoring, which was shown to be a significant predictor. The results showed that depression ® = .53, $p < .01$), and present pain intensity ® = .42, $p < .01$) were significant correlates of bodily monitoring whereas hypochondriasis ® = .24, $p > .05$) did not correlate with the bodily monitoring score. Further analyses revealed that bodily monitoring remained a significant predictor of SSAS scores after the effects of depression (R^2change = .08, Fchange(1,23) = 3.74, $p = .05$) and pain intensity (R^2change = 8.18, Fchange (1,23) = 8.18, $p < .05$) were controlled for statistically.

Summary of Regression Analyses for the TMD Group

The results of the standard regression analysis revealed that bodily monitoring was a significant predictor of SSAS scores for the TMD group. As well, all variables with the exception of monitoring of threat, were shown to be statistically significant correlates

of the SSAS. Although bodily monitoring was the only variable with a statistically significant regression coefficient, four other independent variables correlated with SSAS scores but did not emerge as being significant predictors because of problems with shared variance.

The results of the stepwise regression analysis, designed to determine the best prediction equation, showed that bodily monitoring was the best predictor of generaiized hypervigilance scores for this group, accounting for 32% of the variance in SSAS scores. Bodily monitoring was shown to remain a significant predictor of SSAS scores after the effects of the other independent variables that correlated with it were controlled for statistically. As well, bodily monitoring continued to contribute to the prediction of SSAS scores after the effects of depression and present pain intensity were statistically eliminated.

Standard Multiple Regression Analysis for the RA Group

The results of a standard multiple regression analysis, using six independent variables, revealed that the regression was not statistically significant ($F(6,22) = 1.51$, $p > .05$, $R = .54$, $R^2 = .29$, adjusted $R^2 = .09$). The results of this analysis are summarized in Table 19. Bodily monitoring was the only variable which was shown to correlate significantly with SSAS scores for this group. An examination of scatterplots revealed that the lack of significant correlations between the SSAS and the remaining independent variables was not caused by a restriction of range.

Stepwise Multiple Regression Analysis for the RA Group

As with the FM and TMD groups, a stepwise analysis was performed to determine the best predictor(s) of generalized hypervigilance. The results of this analysis showed that bodily monitoring, measured by the PILL, was the best predictor of generalized hypervigilance for the RA group ($F(1,27) = 7.89$ $p < .01$, $R^2 = .27$, adjusted $R^2 = .20$, Beta = .48), accounting for 20% of the variance in SSAS scores. Bodily monitoring was the only variable which met entry criteria.

Table 19
Summary of the 6 Variable Standard Multiple Regression for the RA Group

	SSAS	STAI	CSAQ	PILL	MBSS	SIQ	PRSS	Part R	Partial R	Beta
STAI	.07	1.0						-.05	-.05	-.06
CSAQ	.21	.34*	1.0					-.12	-.14	-.16
PILL	.48**	.23	.53**	1.0				.41**	.44**	.49
MBSS	.26	.05	.21	.11	1.0			.23	.26	.25
SIQ	.23	- .12	.45**	.35*	.23	1.0		.03	.03	.03
PRSS	.18	.43**	.49**	.32*	- .09	.25	1.0	.11	.13	.14
M	3.09	42.31	9.55	93.45	10.00	24.48	2.05			
SD	.62	8.86	5.92	22.32	3.19	5.62	.89			

$F(6,22) = 1.51$, $p > .05$, $R = .54$, $R^2 = .29$, adjusted $R^2 = .09$

STAI - Trait anxiety subscale from the State-Trait Anxiety Inventory
CSAQ- Somatic anxiety subscale from the Cognitive Somatic Anxiety Questionnaire
PILL- Pennebaker Inventory of Limbic Languidness, measure of bodily monitoring
MBSS - Monitoring scale from Miller Behavioral Style Scale, measure of response to threat
SIQ - Somatic attribution scale from the Symptom Interpretation Questionnaire
PRSS - Catastrophizing subscale from the Pain Related Self-Statements Scale

sr^2 = squared part correlation represents unique contribution of the IV to the DV
* $p < .05$ ** $p < .01$

Follow-Up Analyses

The above analyses show that bodily monitoring is the only variable which is a statistically significant predictor of SSAS scores for the RA patients. An examination of the zero-order correlations indicate that bodily monitoring correlates with somatic anxiety, somatic attribution, and catastrophizing pain coping style. To determine if bodily monitoring remains a significant predictor of SSAS scores once the effects of these three correlated variables were controlled for statistically, separate regression analyses were conducted where each of these variables was entered into a regression equation, followed by the bodily monitoring variable (i.e., somatic anxiety / bodily monitoring, etc.). The results of these analyses revealed that bodily monitoring remains a significant predictor of SSAS scores for the RA group after the effects of somatic anxiety (R^2change = .18, Fchange(1,26) = 6.15, $p < .05$), somatic attribution (R^2change = .18, Fchange(1,26) = 6.04, $p < .05$), and catastrophizing (R^2change = .20, Fchange(1,26) = 6.58, $p < .05$) are each controlled for statistically.

Controlling for the Effects of Depression, Hypochondriasis, and Pain Intensity

Again, it was thought that depression, hypochondriasis, and present pain intensity could affect the relationship between the independent variable of interest, bodily monitoring, and the dependent variable, the SSAS scores. An examination of the zero-order correlations indicated that none of these variables (depression ($r = .24$, $p > .05$), hypochondriasis ($r = .18$, $p > .05$), and present pain intensity ($r = -.05$, $p > .05$)) correlated significantly with bodily monitoring scores so no further follow-up analyses were performed.

Summary of Regression Analyses for the RA Group

The results of the standard multiple regression analysis were not statistically significant. Bodily monitoring was the only variable which correlated significantly with SSAS scores for this group. The results from the stepwise regression analysis showed that bodily monitoring is the best predictor of SSAS scores for the RA patients and remains a significant predictor after the effects of somatic anxiety, somatic attribution, and

catastrophizing pain coping style are controlled for statistically. As well, when the potential contributing effects of depression, hypochondriasis, and pain intensity were examined, none of these variables was shown to correlate significantly with bodily monitoring scores.

CHAPTER 4
DISCUSSION

As outlined in the Introduction, two main issues were addressed in the current study. The results of each will be presented in turn, along with a discussion of the clinical implications, study limitations, and suggestions for future research.

1. Is a pattern of generalized hypervigilance unique to patients with pain disorders of undetermined origin or does this pattern extend to patients who have conditions with a known etiology?

Previous research has shown that some fibromyalgia patients exhibit increased sensitivity to a variety of internal and external sensations. Rollman and Lautenbacher (1993) refer to this pattern as generalized hypervigilance. Some researchers have suggested that conditions with undetermined etiologies may not be distinct, but may represent a pattern of generalized somatic distress (Yunus, 1993; Barsky & Borus, 1999). Robbins et al. (1990) have proposed that such a pattern may become differentiated into specific syndromes or disorders only when patients are claimed by particular medical specialists.

One of the goals of this study was to determine if generalized hypervigilance is common to patients with chronic pain conditions like fibromyalgia and TMD that currently lack a determined etiology, or if this pattern extends to a condition with a defined organic basis, such as rheumatoid arthritis. It was hypothesized that the fibromyalgia and the TMD patients would respond similarly on a measure of generalized hypervigilance, the SSAS, and that their scores on this scale would be higher compared to the rheumatoid arthritis patients. As well, it was hypothesized that all patient groups would have higher SSAS scores compared to the normal control group.

Contrary to predictions, the results indicated that there were no statistically significant differences in generalized hypervigilance scores among the fibromyalgia, TMD, and rheumatoid arthritis patients. These findings do not support the hypothesis that generalized hypervigilance would be more prevalent among patients with disorders

that lack clearly established etiologies. Rather, the results show that there are no meaningful differences in generalized hypervigilance among these groups of chronic pain patients, regardless of the etiological nature of their disorder.

The results of the present study conflict with previous research which has shown that fibromyalgia patients tend to report an increased sensitivity to a variety of external and internal noxious stimuli compared to rheumatoid arthritis patients and normal control subjects (McDermid et al., 1996; Scudds et al., 1988). A similar pattern of heightened sensitivity has been reported for patients with tempormandibular joint dysfunction (Fillingim et al., 1996; Maixner et al., 1995). Typically, increased perceptual sensitivity in these studies has been measured by threshold and tolerance to aversive stimuli.

The current results suggest that chronic pain patients are more similar in terms of generalized hypervigilance, as measured by the SSAS, than was initially thought. What factors may account for this unanticipated finding? One explanation may be a problem of insufficient power in the present study which resulted from the small sample sizes. To minimize this problem in future studies, larger numbers of subjects should be included in each group. Another explanation for the lack of differences among chronic pain patients may be that the SSAS is a poor measure of generalized hypervigilance. Although this is possible, the items on this questionnaire appear to tap the construct of generalized hypervigilance as defined by Rollman and Lautenbacher (1993). Future studies need to assess the degree to which the SSAS correlates with broader measures of somatic and visceral perception in pain patients, an area of research which is currently being pursued by Raphael and her colleagues (personal communication, 2001).

Another explanation for the lack of group differences among the pain patients may be found in the nature of the population studied. Of those patients contacted for participation, 65% of the fibromyalgia patients, 55% of the rheumatoid arthritis patients, and 60% of the TMD patients agreed to participate in this study. While it is not known what factors affected patients' decisions to participate, it is possible that patients with higher levels of hypervigilance may have been more likely to participate in this type of research study, one which examines and tries to increase the understanding of their pain

disorders. If hypervigilant patients were more likely to volunteer, this would presumably result in a restricted range of scores on the SSAS which would minimize group differences.

This study was conducted in tertiary care centres. It is important to note that these results may not be an accurate reflection of patients who seek medical attention from family physicians or of those individuals in the community who fulfill diagnostic criteria for a chronic pain disorder but who do not seek treatment. It seems likely that patients referred to tertiary care facilities differ from those patients treated in other settings. Presumably, there may be a number of reasons why individuals are referred to tertiary settings, some of which may include the following: perhaps, these patients present to their family physician with greater symptom severity, perhaps they convey greater distress or anxiety about their symptoms, or perhaps they are more demanding health care consumers who request a referral to a specialist. The populations that were examined in this study were selective ones; research needs to be conducted with broader populations, including family physician and community samples, to determine the degree to which the results of the present study can be generalized to other groups of fibromyalgia, TMD, and rheumatoid arthritis patients.

Interestingly, Granges, Zilko, and Littlejohn (1994) reported a better outcome, defined as less reported pain and disability, in fibromyalgia patients treated by family physicians compared to those treated by specialists. Similarly, Crook, Weir, & Tunks (1989) noted that individuals in the community with chronic pain have a better outcome than do tertiary referral patients. This trend has been noted with other chronic pain conditions such as chronic fatigue syndrome, irritable bowel syndrome, and headaches (Goldenberg, 1999). It will be important to determine what factors account for the reported differences between those patients seen in tertiary versus family physician facilities, an area which has received surprisingly little research attention.

In addition to the hypothesis that there would be differences among the chronic pain patients, it was predicted that each group of pain patients would have higher generalized hypervigilance scores compared to the normal control subjects. This

hypothesis was partially supported; the fibromyalgia and the TMD patients reported significantly higher SSAS scores than did the control subjects. These differences remained statistically significant when pain duration and hypochondriasis were used as covariates but when present pain intensity ratings, depression, and anxiety were used as covariates, these group differences were no longer significant. In other words, controlling for the effects of present pain intensity, depression, and anxiety eliminates the reported differences in SSAS scores. There were no significant differences between the rheumatoid arthritis patients and the control subjects in generalized hypervigilance scores.

To place the findings into a broader context, the scores in this study were compared with SSAS scores that have been reported in published studies. The subjects in the present study had the following scores: fibromyalgia group ($\underline{M}$ = 3.36, $\underline{SD}$ = .53), TMD group ($\underline{M}$ = 3.28, $\underline{SD}$ = .63), arthritis group ($\underline{M}$ = 3.08, $\underline{SD}$ = .62), and control group ($\underline{M}$ = 2.84, $\underline{SD}$ = .58). Epstein et al. (1999) reported a mean SSAS score of 2.90 with a standard deviation of .70 for a sample of fibromyalgia outpatients. Gregory et al. (2000) administered the SSAS to two groups of chronic pain patients, one group had pain primarily in the back and the extremities whereas the second group reported more diffuse pain. The patients with diffuse pain had significantly higher SSAS scores ($\underline{M}$ = 2.09, $\underline{SD}$ = .80) compared to the patients with back/extremity pain ($\underline{M}$ = 1.48, $\underline{SD}$ = .73). Kosturek et al. (1998) reported a mean SSAS score of 1.17 with a standard deviation of .78 in a heterogeneous sample of chronic pain patients. In addition to chronic pain samples, the SSAS has been administered to psychiatric populations. Barsky et al. (1990) found that subjects fulfilling the DSM-III-R diagnostic criteria for hypochondriasis ($\underline{M}$ = 2.78) had significantly higher SSAS scores compared to a group of medical patient control subjects ($\underline{M}$ = 1.98).

There appears to be considerable variation in the published SSAS scores for chronic pain patients. It is of note that the SSAS scores reported in the present study are elevated compared to the published scores of other pain patients. As well, the fibromyalgia, TMD, and rheumatoid arthritis patients in the present study had elevated mean SSAS scores compared to Barsky's hypochondriacal sample ($\underline{M}$ = 2.78).

Replication with more diverse groups of fibromyalgia, TMD, and arthritis patients is required before it can be determined if the SSAS results are representative of these populations.

Of particular interest was the unexpected finding that the control subjects in the current study reported SSAS scores which were comparable to those of Barsky's hypochondriacal group and which exceeded his medical patient control group. Based upon this information, it appears that the present normal control subjects had an unusually strong tendency to amplify somatic sensations. This finding suggests that the normal control subjects may be characterized as the "worried well", a term which is used in the literature to describe healthy individuals who tend to be preoccupied with health matters and who often overuse medical services (Wagner & Curran, 1988). While the "worried well" share characteristic features of hypochondriasis, the severity of their symptoms is less intense and these individuals typically do not fulfill the diagnostic criteria for hypochondriasis (Paganini-Hill, Hsu, Chao, & Ross, 1993; Wagner & Curran, 1988).

An examination of the normal control subjects' responses to specific items on The Illness Behaviour Questionnaire provides support for the "worried well" hypothesis. For example, 15% of the normal control subjects stated that they "think about their health more than other people" compared to 36% of the fibromyalgia patients, 19% of the TMD patients, and 10% of the rheumatoid arthritis patients. As well, 41% of the control subjects reported that they "are afraid of illness" compared to 49% percent of the fibromyalgia patients, 42% of the TMD patients, and 17% of the rheumatoid arthritis patients. In addition, 18% of the control subjects stated that they "worry about getting a disease which is brought to my attention through the radio or television". Fifteen percent of the TMD patients and 12% of the fibromyalgia patients agreed with this statement whereas no rheumatoid arthritis patients endorsed this item. Almost 1/4 (24%) of the normal control subjects indicated that they were "always on the lookout for symptoms which may indicate a serious illness". Twenty-one percent of the rheumatoid arthritis patients, 18% of the fibromyalgia patients, and 12% of the TMD patients endorsed this item. Interestingly, 35% of the normal control subjects believe that their "physical

symptoms may be caused by worry", compared to 27% of the TMD patients, 18% of the fibromyalgia patients, and 14% of the rheumatoid arthritis patients.

The responses of the normal control subjects, in comparison to those of the chronic pain patients, suggest that this group of healthy volunteers may be preoccupied with their health. Normative data for pain-free subjects who have completed the IBQ are not available, so it makes the interpretation difficult because there is no basis for comparison.

While the responses of the normal control subjects were revealing, it is also interesting to note the pattern of the IBQ responses reported by the rheumatoid arthritis patients. In general, for most of the IBQ items mentioned above, the responses of the rheumatoid arthritis patients suggest that they tend to be less worried about and focussed upon their health compared to the fibromyalgia and the TMD patients. In some cases, the responses of the arthritis patients would appear to suggest that they may be less worried about their health compared to the control subjects, who do not suffer from a chronic health condition. These findings provide support for the suggestion proposed by Parker et al. (1990) that the absence of serious psychopathology which has been noted among many rheumatoid arthritis patients may be an indication of their resilience and their capacity to cope effectively with the difficulties of their disease.

The differences noted between the rheumatoid arthritis patients and the other groups of subjects on the above IBQ items raise an interesting question for future research: are rheumatoid arthritis patients typically less concerned about health issues compared to chronic pain patients with disorders of undetermined origins? If so, what effect might health attitudes have on somatosensory amplification? It would seem reasonable to predict that patients who worry about or are preoccupied with their health or who fear illness may be more likely to amplify somatic sensations in comparison to those who do not have these tendencies. It is of note that there were no differences in hypochondriasis scores (measured by the IBQ) among the fibromyalgia, TMD, and rheumatoid arthritis patients. It would be interesting to determine if differences exist among these groups on a measure of less pathological attitudes toward health and illness.

Another factor that should be considered is the gender of the sample studied. As discussed in the Method section, the fibromyalgia patients were selected randomly but all of the subjects were female. The remaining groups of subjects (i.e., rheumatoid arthritis, TMD, and normal control) were then matched in terms of gender. Fibromyalgia and TMD are disorders which affect females predominantly (Goldenberg, 1999; Wolfe et al., 1997) but males also receive these diagnoses. Of the three chronic pain conditions that were studied, the ratio of males to females tends to be the greatest for rheumatoid arthritis (Parker et al., 1990; Wolfe et al.,1997). Studying only female subjects with these chronic pain disorders may restrict the generalizability of these results.

As well, studying female samples raises other questions. For example, do females with chronic pain disorders differ from males on perceptual and personality measures? Experimental studies have shown that females have demonstrated consistently that they are more pain sensitive (when pressure pain stimuli is used) than are men (Goolkasian, 1985; Otto & Dougher, 1985; Dubreuil & Kohn, 1986). It seems plausible to suggest that the increased sensitivity reported by females may extend to other somatosensory domains. Perhaps, the pattern of generalized hypervigilance which has been observed in conditions such as fibromyalgia and temporomandibular joint dysfunction, conditions that are reported mostly by females, can be accounted for better by gender than by other factors. The exploration of this issue is essential in furthering our understanding of this concept. It would be interesting to repeat this study, using both male and female subjects, and to examine what differences, if any, exist in generalized hypervigilance scores.

In summary, the lack of group differences in generalized hypervigilance among the chronic pain patients in this study conflicts with prior experimental results which have demonstrated that fibromyalgia patients exhibit an increased perceptual sensitivity to a variety of aversive stimuli compared to rheumatoid arthritis patients and control subjects. The current results might suggest that the basis of the chronic pain disorder (determined versus undetermined) does not affect somatosensory amplification. The results may also suggest that it is difficult to measure generalized hypervigilance by using only a questionnaire. Clearly, it is premature to draw any firm conclusions from these findings at

this point. The SSAS needs to be administered to larger and more geographically and socio-economically diverse groups of fibromyalgia, TMD, rheumatoid arthritis patients, as well as control subjects, to determine if the present study findings can be replicated.

2. Deconstructing generalized hypervigilance: Group differences and predictive ability.

As indicated earlier in this paper, the concept of generalized hypervigilance is understood poorly at the present time. This is the first study which has attempted to identify the underlying variables which may be responsible for its presentation, thus helping to clarify the nature of generalized hypervigilance.

a) Do group differences exist on the anxiety, monitoring, attribution, and pain coping style variables?

It was predicted that there would be group differences on measures of anxiety (trait and somatic), monitoring (bodily and threat), somatic attribution, and catastrophizing pain coping style. The results and their implications are discussed below.

Anxiety- Trait and Somatic

It was predicted that the fibromyalgia and the TMD patients would have significantly higher trait anxiety and somatic anxiety scores compared to patients with rheumatoid arthritis. All patient groups were predicted to have higher anxiety scores compared to the normal control group.

The results revealed that the fibromyalgia patients had significantly higher trait anxiety scores (measured by the STAI) compared to the rheumatoid arthritis patients and the normal control subjects, suggesting that the fibromyalgia patients feel more anxious *generally* than do the rheumatoid arthritis and the control subjects. Contrary to predictions, the TMD patients did not report significantly higher trait anxiety scores compared to the rheumatoid arthritis patients or the control subjects, nor did the scores of the rheumatoid arthritis patients differ from the scores of the control subjects. As predicted, the trait anxiety scores of the fibromyalgia and the TMD patients did not differ

from each other, providing partial support for the hypothesis that the patients with conditions of unknown etiology would report similar levels of trait anxiety.

What factors might explain the differences in trait anxiety scores between the fibromyalgia and the rheumatoid arthritis patients? There is the possibility that patients with fibromyalgia may have higher premorbid levels of anxiety compared to patients who have a disorder with a known etiological basis. Previous research has noted differences in levels of psychological distress between fibromyalgia and arthritis patients (Krag et al., 1995; Walker et al., 1997). Some suggest that psychological distress may be a predisposing factor in the development of pain disorders that lack a medical explanation (Barsky & Borus, 1999; Walker et al., 1990; Van Houdenhove, 2001).

Conversely, it is possible that being diagnosed with a disorder which lacks a clearly defined organic cause may be associated with an increase in patients' anxiety regarding the certainty of their diagnosis (Robbins et al., 1990). Robbins et al. has suggested that this uncertainty may, in turn, lead to the amplification of physical sensations. Schwarz et al. (1993) found that patients diagnosed with gastrointestinal (GI) problems that lacked a clear organic basis reported higher levels of anxiety compared to GI patients diagnosed with a condition with demonstrable organic pathology. Those authors suggested that the lack of support and validation from the medical community, which often accompanies diagnoses of unknown origin, may serve to increase patients' anxiety levels. The hypothesis proposed by Schwarz et al. (1993) might explain why the fibromyalgia patients reported higher levels of trait anxiety compared to the rheumatoid arthritis patients. Rheumatoid arthritis patients are told that they have a disease with a known pathophysiological basis. Laboratory and radiographic tests are performed which confirm the diagnosis. Physicians making a diagnosis of fibromyalgia cannot provide patients with any objective evidence of positive findings, with the exception of the tender point examination. Often, fibromyalgia is a diagnosis of exclusion which is made only after other organically based disorders have been eliminated.

Anecdotally, many fibromyalgia patients have reported that they are uncertain about the accuracy of their diagnosis and fear that their symptoms may have been

misdiagnosed (i.e., believe that their symptoms may be indicative of multiple sclerosis or bone cancer). It appears that receiving a diagnosis which lacks a known organic basis may be associated with an increase in anxiety; clearly it is difficult to make this type of statement without knowing patients' premorbid anxiety levels. Goldenberg (1999) has proposed that the opposite may hold true; he believes that receiving a label of fibromyalgia tends to reassure patients that a degenerative disease is not present and consequently will allow patients to focus on "getting better" rather than searching for a "cause and cure" (p. 178).

The consequences of being given a label for a set of symptoms for which the underlying cause is unknown were not examined directly in this study but would be an interesting and informative avenue for future research. For example, are individuals relieved when they are provided with a label to explain their symptoms or does receiving this label, one which cannot be explained in organic or pathophysiological terms, increase patients' concerns about the possibility of misdiagnosis? If patients indicate that the label is distressing or anxiety-provoking, then it would be important for health care practitioners to educate patients about the nature and the course of their disorders. Education has been to shown to decrease disability and distress in chronic pain patients (Kellner, 1985).

The results showed that the TMD group did not report higher SSAS scores compared to the rheumatoid arthritis group. This finding does not support the hypothesis proposed by Schwarz et al. (1993) that would predict that the TMD patients who have a condition of undetermined etiology would have higher anxiety levels compared to arthritis patients who have a disorder with an organic cause. Perhaps, the "lack of validation" issue (Schwarz et al., 1993) may not be as important for a regional pain disorder, such as TMD, compared to fibromyalgia which involves diffuse pain combined with persistent fatigue and greater levels of disability.

The present study has shown that the fibromyalgia patients had significantly higher trait anxiety scores compared to the rheumatoid arthritis patients. Although this finding is interesting and is consistent with previous research findings, it does not provide

information about the direction of this relationship. This issue needs to be tested in future studies. More specifically, it will be important to determine if fibromyalgia patients have high levels of trait anxiety prior to their diagnosis or whether anxiety develops following the onset of their chronic pain disorder. This question could be addressed using longitudinal studies where the anxiety levels of family physician patients are followed for a number of years; this would allow researchers to determine if those patients who were eventually diagnosed with fibromyalgia reported previously high anxiety levels. If anxiety is shown to be a risk factor in the development of fibromyalgia or other pain disorders with undetermined etiologies, then appropriate treatments aimed at targeting anxiety could be designed and implemented at an early stage. Conversely, if anxiety is shown to be the result of being diagnosed with a pain disorder which lacks a determined cause, treatments designed to help patients reduce levels of anxiety and to cope more effectively with their disorder can be developed.

In addition to trait anxiety, group differences were noted on the measure of somatic anxiety, defined as the tendency to experience somatic distress when feeling anxious (e.g., "My heart beats fast", "I perspire", "I feel jittery in my body") (Schwartz et al., 1978). It was predicted that the fibromyalgia and the TMD patients would report similarly high levels of somatic anxiety and that both of these groups would report higher scores on this measure compared to the rheumatoid arthritis group. All patient groups were expected to have elevated somatic anxiety scores compared to the normal control group.

The results provided partial support for these hypotheses; the fibromyalgia patients had significantly higher somatic anxiety scores compared to the rheumatoid arthritis patients, suggesting that the fibromyalgia patients experience physical symptoms of distress when they are feeling anxious whereas the rheumatoid arthritis patients were less likely to express anxiety in a physical manner. It should be noted that the CSAQ also measures the degree to which subjects experience cognitive distress when they are anxious (e.g., "I find it difficult to concentrate because of uncontrollable thoughts", "I worry too much over something that doesn't really matter"). There were no group

differences on the cognitive anxiety subscale but when the somatic anxiety and cognitive anxiety responses were compared, the fibromyalgia patients were the only group which had significantly higher somatic, versus cognitive, anxiety scores.

It has been well documented that fibromyalgia patients report multiple somatic symptoms outside of the musculoskeletal domain (McDermid et al., 1996; Smythe, 1986, Yunus et al., 1989, Yunus et al., 1991, Block, 1993). Perhaps, the tendency of fibromyalgia patients to express anxiety as primarily somatic distress may account, to some degree, for the varied nature of their physical complaints but it is important to note that research has shown that fibromyalgia patients do not typically fulfill the diagnostic criteria for somatization disorder (Dunne, 1995; Kirmayer et al., 1988). One must be careful not to exclude the possibility that fibromyalgia patients may report multiple physical symptoms because of possible deficiencies in mechanisms responsible for the modulation of aversive stimuli (Yunus, 1992; Lautenbacher & Rollman, 1996).

There were no other reported group differences for the somatic anxiety scale. These results were not in keeping with previous research which has shown that chronic pain patients tend to report higher levels of somatic anxiety compared to healthy control subjects (Schwartz et al., 1978). It should be noted that the normal control subjects in the present study had elevated somatic anxiety scores compared to the published scores of other control samples (Schwartz et al.). This could minimize the between-group variability and may help to account for the lack of significant differences between the control and the patient groups.

As with trait anxiety, future research needs to address the question of whether an elevated level of somatic anxiety is an antecedent or a consequence of being diagnosed with fibromyalgia. That is, are individuals who tend to experience anxiety primarily as somatic distress at increased risk of developing fibromyalgia? Conversely, does somatic anxiety develop following the diagnosis of fibromyalgia? Again, longitudinal studies are needed to answer this important question. The information obtained from such studies would allow for the development and implementation of appropriate treatments.

Monitoring of Bodily Sensations and of Threatening Events

In keeping with previous studies, it was expected that the fibromyalgia and the TMD patients would be more vigilant about their bodily sensations and would be more likely to engage in bodily monitoring (i.e., report higher scores on the PILL) compared to the rheumatoid arthritis patients. As well, it was hypothesized that the fibromyalgia and the TMD patients would be more likely to respond to threatening environmental events with a monitoring (information-seeking) versus blunting (cognitive avoidance) style. Miller's Behavioral Style Scale (MBSS) was used as the monitoring of threat measure. All patient groups were predicted to report higher scores on measures of bodily monitoring and monitoring of threat compared to the normal control subjects.

With respect to bodily monitoring, the results showed that the fibromyalgia patients had significantly higher PILL scores (greater frequency of symptom occurrence) compared to the TMD, rheumatoid arthritis, and normal control groups. As well, the TMD patients had higher bodily monitoring scores than did the normal control group. These results are consistent with previous research which has shown increased symptom reporting in fibromyalgia patients (Block, 1993; McDermid et al., 1996). Interestingly, the fibromyalgia patients reported significantly higher bodily monitoring scores compared to the TMD patients, indicating that monitoring of physical sensations is not comparable in both disorders of undetermined etiology. Perhaps, fibromyalgia patients, who experience diffuse pain, are more likely to engage in bodily monitoring compared to the TMD patients whose pain is typically localized to the face and jaw.

In addition to the PILL frequency of symptom occurrence score, the total number of symptoms which subjects endorsed, regardless of frequency, was calculated. The results showed that the fibromyalgia patients reported significantly more symptoms (35 symptoms out of a possible 46 symptoms) compared to the rheumatoid arthritis patients (26 symptoms) and the normal control group (26 symptoms). No differences were reported between the fibromyalgia and the TMD patients (31 symptoms). Admittedly, the PILL could be considered an indirect measure of bodily monitoring, but it has been used in other studies to measure bodily preoccupation and bodily monitoring (van Vliet et al.,

1997; Woods et al., 1996). It is used in the same vein in the present study. The current results showed that the fibromyalgia patients differed from the other patient groups in terms of bodily monitoring. With respect to treatment implications, future research needs to address whether monitoring is a predisposing factor or whether monitoring develops following the diagnosis of fibromyalgia. When this information is determined, then appropriate treatment strategies can be developed and implemented.

Contrary to predictions, there were no statistically significant between-group differences for the MBSS monitoring of threat variable. These results do not support the hypothesis that the fibromyalgia and the TMD patients would be more likely to adopt a monitoring style when faced with environmental threat compared to the rheumatoid arthritis patients and the normal control subjects. One explanation for the lack of group differences on the MBSS, in addition to small sample size, may be the nature of the questions. As described earlier, when subjects completed the MBSS, they read four scenarios and were asked to indicate how they would respond in these situations. They were given 8 response options (4 monitoring and 4 blunting) and were asked to endorse all that applied. The four scenarios were: 1) being afraid of the dentist and having to go for dental work, 2) being held hostage by a group of armed terrorists, 3) a stressful work-related situation regarding a job evaluation, and 4) being on an airplane that develops serious mechanical difficulties during the flight. It is unlikely that most people would have encountered two of these situations (#2 and #4) and consequently may have difficulty imagining how they would react in these scenarios or perhaps subjects did not view these scenarios as being particularly realistic. These factors may have affected their attitudes when completing the questionnaire.

The correlations between the two primary monitoring measures (i.e., the PILL frequency of symptom occurrence score and the MBSS monitoring scale score) were calculated. It was expected that there would be a significant positive correlation between these two measures for each of the four groups of subjects; individuals who monitor their bodily sensations were expected to be more likely to adopt a monitoring approach when faced with threat in the environment. The only significant results showed that,

paradoxically, there was a statistically significant negative correlation between these measures for the TMD group whereas a positive correlation existed for the normal control group. For the fibromyalgia group, the lack of correlation between the PILL and the MBSS scores is likely caused by a restricted range of values; fibromyalgia patients who had elevated scores on the PILL also had elevations on the MBSS measure.

Contrary to predictions, the results of the present study failed to show any group differences in monitoring of threat scores. The current results do not provide compelling evidence to use this measure in future studies involving generalized hypervigilance, but clearly, replication with a larger sample size is required before this conclusion can be drawn.

Attribution

The Symptom Interpretation Questionnaire (SIQ) was used to measure the number of somatic, psychological, and environmental attributions that subjects made for a number of common physical symptoms. Previous research has shown that patients with an acute or chronic physical illness make more somatic attributions for common physical sensations compared to individuals without illness (Robbins & Kirmayer, 1991). Robbins et al. have suggested that having a chronic illness may increase patients' vigilance toward future illness and that pain patients tend to interpret sensations within an illness schemata or framework.

It was predicted that the fibromyalgia and the TMD patients would make more somatic attributions for common bodily sensations compared to the rheumatoid arthritis patients. As well, it was predicted that all patients groups would make more somatic attributions for common bodily symptoms compared to the control subjects.

Contrary to predictions, the results of the SIQ revealed significant group differences only for the environmental attribution scale: the fibromyalgia patients made significantly fewer environmental/normalizing attributions for common physical symptoms compared to the normal control subjects. This result was expected, but the prediction that the TMD and the rheumatoid arthritis patients would also make fewer

environmental attributions compared to the control group was not confirmed. Surprisingly, there were no group differences on either of the physical attribution or the psychological attribution scales. The fibromyalgia and the TMD patients did not make more somatic attributions compared to the rheumatoid arthritis patients, nor did the chronic pain patients differ in the number of physical or psychological attributions made compared to the control subjects.

The results of the present study conflict with previous findings which have shown that patients with acute or chronic illnesses made significantly more somatic attributions compared to control subjects (Robbins & Kirmayer,1991). Perhaps, the type of illness which patients have affects the attributional causes which are endorsed. For example, the subjects in Robbins and Kirmayer's study consisted of family medicine outpatients who had acute (i.e., pneumonia, acute myocardial infarction) and chronic (i.e., asthma, arthritis, schizophrenia) illnesses. The authors aggregated the scores of patients with acute and chronic illnesses, making a comparison to the chronic pain patients in this study impossible.

The findings from the present study suggest that the chronic pain patients are no more likely than the control subjects to attribute bodily sensations to physical causes. Replication of this study with larger samples will help to determine if these findings are representative of these populations.

Coping

The PRSS "catastrophizing" subscale was used as the measure of maladaptive pain coping style. It assesses situation-specific cognitions that either promote or hinder attempts to cope with pain (Flor et al., 1993). The scores on the "catastrophizing" scale of the PRSS, which consists of statements which focus on the negative aspects of the pain experience (i.e., "This pain is driving me crazy", "I cannot stand this pain any longer", and "I am a hopeless case"), were compared.

It was expected that the fibromyalgia and the TMD patients would have higher scores on this measure compared to the rheumatoid arthritis patients. All groups with

pain disorders were predicted to have higher scores on the catastrophizing scale compared to the control group. These predictions were partially supported: the fibromyalgia patients and the TMD patients had significantly higher scores on the catastrophizing scale compared to the control group. Interestingly, there were no significant differences among the pain patients on this scale; the hypothesis that the fibromyalgia and the TMD patients would endorse significantly more catastrophizing responses than would the rheumatoid arthritis patients was not supported. The means were in the predicted direction, with the fibromyalgia and the TMD patients having larger means compared to the rheumatoid arthritis patients, but the differences did not reach statistical significance.

Surprisingly, there were no significant differences in catastrophizing scores between the rheumatoid arthritis patients and the normal control subjects. This may, in part, be the result of the normal control subjects' elevated catastrophizing scores ($\underline{M}$ = 1.45, $\underline{SD}$ = .93) compared to the published results for other groups of control subjects ($\underline{M}$ = .85, $\underline{SD}$ = .80, Flor et al.).

Previous research has shown that catastrophizing responses are associated with higher pain intensity ratings (Flor et al., 1993; Sullivan et al., 1998). This finding was partially confirmed; there was a positive association between present and past month pain intensity ratings with catastrophizing responses for the fibromyalgia and the TMD patients, but these correlations were not statistically significant for the rheumatoid arthritis patients.

Summary of Group Differences for Generalized Hypervigilance Variables

Group differences were predicted for measures of anxiety, monitoring, somatic attribution, and catastrophizing pain coping style, the variables believed to underlie generalized hypervigilance. Although many of the hypotheses were not fully confirmed, the results nevertheless showed that the groups differed on a number of these variables. These differences were primarily between the pain patients and the control group, illustrating that patients with chronic pain conditions differ on a number of psychological

and perceptual measures, compared to healthy individuals who experience occasional episodes of acute pain.

Group differences among the chronic pain patients were more limited; they were observed only on measures of anxiety and monitoring. More specifically, the fibromyalgia patients reported higher levels of trait anxiety and somatic anxiety compared to the rheumatoid arthritis patients. As well, the fibromyalgia patients reported higher bodily monitoring scores compared to the TMD and the rheumatoid arthritis patients.

Generally, the results suggest that there tend to be more similarities than differences among the fibromyalgia, TMD, and rheumatoid arthritis patients in terms of anxiety, monitoring, symptom attribution, and catastrophizing pain coping style. On a number of these measures where one would have expected sizeable differences, they did not occur. Replication with larger samples is required to determine if these findings are reflective of these populations or if the lack of significant findings is primarily caused by a small sample size.

Group Differences on Pain Perception Measures

In addition to studying group differences on the variables underlying generalized hypervigilance, differences were examined on a number of pain perception measures. The three measures of pain perception included visual analogue scale ratings, the body map, and the McGill Pain Questionnaire. As with many of the variables discussed in the previous section, the chronic pain patients differed from the control subjects but often did not differ from each other. As predicted, the fibromyalgia, TMD, and rheumatoid arthritis patients had significantly higher VAS present pain intensity ratings compared to the control subjects but there were no differences on this measure among the chronic pain patients. With respect to typical pain intensity ratings over the past month, all patients reported higher ratings than did the control group and the fibromyalgia patients had higher ratings compared to the rheumatoid arthritis patients.

As expected, the body map data revealed that all patient groups reported more painful sites than did the control subjects. As well, there were differences among the

chronic pain patient groups; the fibromyalgia patients reported significantly more painful sites (an average of 22 sites) compared to the TMD (12 sites) and the rheumatoid arthritis patients (13 sites). This result was anticipated because fibromyalgia is a musculoskeletal disorder involving diffuse pain. Interestingly, the TMD patients reported widespread pain; the painful sites that they marked on the body maps were not limited to the face, head, and neck regions. The TMD results lend support to the generalized hypervigilance hypothesis, suggesting that patients with conditions that lack a known etiology may have an increased sensitivity to internal noxious sensations. The MPQ results showed that the fibromyalgia patients used more words to describe their pain and had higher scores on the sensory pain rating index compared to the rheumatoid arthritis patients. Also, the fibromyalgia patients rated their pain as being quite intense when compared to the published scores of a number of other chronic pain patients (Melzack, 1975).

b) How accurately can group members be classified according to their scores on measures of anxiety, monitoring, somatic attribution, and pain coping style?

Discriminant function analyses were performed to determine how accurately the anxiety, monitoring, attribution, and coping style variables believed to underlie generalized hypervigilance could discriminate among the subjects in this study.

First, a discriminant function analysis, using six variables (trait anxiety, somatic anxiety, bodily monitoring, environmental monitoring, somatic attribution, and catastrophizing) was performed for the fibromyalgia, TMD, rheumatoid arthritis, and normal control groups. The overall rate of classification was 45.1%. The results of the discriminant function analysis indicated that the normal control subjects (67.6%) and the fibromyalgia patients (60.6%) had the highest rates of classification, followed by the rheumatoid arthritis patients (37.9%). Classification rates were based upon their scores on a discriminant function where the following variables loaded: bodily monitoring, catastrophizing pain coping style, trait anxiety, and somatic anxiety. Interestingly, over one third of the arthritis patients were classified as belonging to the normal control group, suggesting that the arthritis patients may share more characteristics with pain-free

individuals than they do with the groups of chronic pain patients. Another surprising finding was the low percentage of TMD cases which was identified correctly (only 3.8%). Most of the TMD patients were classified as belonging to either the fibromyalgia group (46.2%) or the normal control group (34.6%).

Next, a discriminant function analysis, including only the three patient groups, was performed. The same six variables were used; the results indicated that bodily monitoring, somatic anxiety, trait anxiety, and catastrophizing pain coping style loaded on the discriminant function. The overall rate of classification was 52.3%. The fibromyalgia patients were classified with 66.7% accuracy, the rheumatoid arthritis patients were classified with 65.5% accuracy, and the TMD patients with 19.2% accuracy. Again, the TMD patients were the most difficult group of subjects to classify correctly, with 42.3% and 38.5% of these patients being inaccurately classified as belonging to the fibromyalgia and the rheumatoid arthritis groups, respectively.

Before the results of the discriminant function analyses can be generalized, these analyses should be repeated with larger sample sizes and should be cross-validated (Tabachnick & Fidell, 1989). Despite this, it is important to note that the psychological measures suggest that most of these patient groups are distinguishable. Interestingly, the results demonstrated that the TMD patients are consistently the most difficult to identify, suggesting that they do not have a distinct pattern of responses on the discriminating variables that allows them to be classified easily.

c) How well do anxiety, monitoring, somatic attribution, and pain coping style predict generalized hypervigilance, measured by the Somatosensory Amplification Scale?

Separate standard multiple regression analyses, using six independent variables, were performed for each group of chronic pain patients. As well, stepwise multiple regression analyses were conducted to determine the best predictor(s) of generalized hypervigilance. The results for each group of chronic pain patients will be examined first, followed by a general discussion of the implications of these findings.

Fibromyalgia Group

First, it is important to note the pattern of correlations between the dependent variable, the SSAS scores, and the independent variables. Trait anxiety was the only variable which had a statistically significant correlation with SSAS scores, the measure of generalized hypervigilance. Surprisingly, the variables measuring somatic anxiety, bodily monitoring, monitoring of threat, somatic attribution, and catastrophizing pain coping style likely did not correlate significantly with SSAS scores for the fibromyalgia group. Further examination revealed that bodily monitoring, monitoring of threat, and catastrophizing did not correlate significantly with SSAS scores because of problems with a restricted range of values.

A stepwise regression analysis was used to determine the best predictor(s) of generalized hypervigilance. The results of this analysis revealed that trait anxiety was the best predictor of generalized hypervigilance for the fibromyalgia patients, accounting for approximately 17% of the variance in SSAS scores. Further analyses revealed that trait anxiety remained a statistically significant predictor of SSAS scores after the effects of the other independent variables that correlated with trait anxiety (i.e., somatic anxiety, bodily monitoring, somatic attribution, and catastrophizing pain coping style) were removed. As well, hypochondriasis, depression, and present pain intensity were assessed to determine if they affected the relationship between trait anxiety and SSAS scores; the results indicated that trait anxiety remained a significant predictor after the effects of hypochondriasis and present pain intensity were controlled for statistically but trait anxiety no longer contributed to the prediction of SSAS scores after the effects of depression were eliminated. This finding is not surprising given the high degree of association between the trait anxiety and depression variables.

Temporomandibular Joint Dysfunction (TMD) Group

An examination of the zero-order correlations for the TMD patients revealed that the variables measuring trait anxiety, somatic anxiety, bodily monitoring, somatic attributional style, and catastrophizing pain coping style each correlated significantly with

SSAS scores. Monitoring of threat is the only variable which did not have a statistically significant correlation with the SSAS scores for this group. Although five independent variables correlated with SSAS scores, the results of the standard multiple regression analysis showed that bodily monitoring was the only variable which emerged with a statistically significant regression coefficient. This likely occurred because of the considerable degree of shared variance among the independent variables. The results of this analysis are misleading; they suggest that bodily monitoring is the only variable involved in prediction of SSAS scores for the TMD group where in reality, trait anxiety, somatic anxiety, catastrophizing pain coping style, and somatic attribution are each associated with SSAS scores.

The main interest was in determining the best predictor of generalized hypervigilance. The results of the stepwise regression analysis revealed that bodily monitoring is the best predictor of generalized hypervigilance, accounting for 32% of the variance in SSAS scores. Further analyses revealed that bodily monitoring remained a significant predictor of SSAS scores after the effects of the other independent variables that were correlated with bodily monitoring (i.e., monitoring of threat, trait anxiety, somatic anxiety, somatic attributional style, and catastrophizing pain coping style) were removed. The effects of depression, pain intensity, and hypochondriasis were examined to determine what effect they might have upon the relationship between bodily monitoring and SSAS scores. Depression and pain intensity were significantly correlated with bodily monitoring whereas hypochondriasis did not correlate with this variable. Further analyses showed that bodily monitoring continued to be a significant predictor of SSAS scores after the effects of depression and pain intensity were controlled for statistically.

Rheumatoid Arthritis Group

An examination of the correlations between the independent variables and the SSAS scores shows that the variable measuring bodily monitoring correlated significantly with the SSAS scores for the rheumatoid arthritis group. Contrary to the hypotheses, the

trait anxiety, somatic anxiety, monitoring of threat, somatic attribution, and catastrophizing pain coping style variables did not correlate significantly with SSAS scores for this group. The standard multiple regression results indicated that the overall regression equation was not statistically significant.

The stepwise regression analysis revealed that the best predictor of generalized hypervigilance is bodily monitoring, accounting for 20% of the variance in SSAS scores. Further analyses showed that bodily monitoring remained a significant predictor of SSAS scores after the effects of the other independent variables which correlated with it (i.e., somatic anxiety, somatic attribution, and catastrophizing pain coping style) were removed. The effects of depression, hypochondriasis, and present pain intensity, variables which could potentially affect the relationship between the independent and the dependent variable, were assessed. None of these variables was shown to correlate significantly with bodily monitoring for the RA group so no further analyses were conducted.

Summary of Regression Analyses for Chronic Pain Patients and Resulting Implications

While any interpretation of these findings is speculative at this point, the results of the stepwise multiple regression analyses appear to suggest that, of the several components hypothesized to be involved with generalized hypervigilance, trait anxiety is the most salient for the fibromyalgia group whereas bodily monitoring is the overriding component for the rheumatoid arthritis patients and for the TMD patients. The findings illustrate that different variables are involved in the prediction of generalized hypervigilance, depending on the group of chronic pain patients.

The effects of depression, hypochondriasis, and pain intensity, variables that were not included in the model but which were assessed to determine if they may affect the relationship between the independent and dependent variables, were shown to correlate significantly with SSAS scores. More specifically, depression and hypochondriasis were found to correlate significantly with SSAS scores for the fibromyalgia group whereas depression and present pain intensity were shown to be significant correlates of the SSAS for the TMD group. Interestingly, none of these variables correlated with SSAS scores

for the arthritis patients. The finding that depression, hypochondriasis, and pain intensity are associated with SSAS scores causes one to rethink what variables may contribute to generalized hypervigilance. Future models of generalized hypervigilance should include these variables. As well, researchers may want to focus upon developing a model of generalized hypervigilance which would test the causal direction among the contributing variables (i.e., does anxiety predict monitoring, which in turn predicts somatic attribution which then predicts catastrophizing).

Before any firm conclusions can be drawn from the results of the present study, it is necessary to replicate this study with broader and more diverse populations of chronic pain patients. As well, larger sample sizes, which would afford more stable statistical solutions, are needed. If the findings of this study are confirmed, they could have significant clinical implications. If predictors of generalized hypervigilance can be identified for various groups, then treatment strategies which target these predictor variables can be developed. This study has shown that it is important to identify predictors of generalized hypervigilance because of its demonstrated relationship with a number of variables. The results indicated that generalized hypervigilance, as measured by the SSAS, is associated with measures of health care utilization and pain perception. For example, for the TMD patients, generalized hypervigilance correlated positively with the past and present pain intensity ratings, the number of doctor visits per year, the number of physician visits for pain, the number of painful body sites, and the number of words chosen to describe pain. For the rheumatoid arthritis patients, generalized hypervigilance scores correlated with the number of physician visits per year and the number of physician visits per year for pain. An examination of scatterplots for the arthritis group revealed that the association between SSAS scores and present pain intensity ratings was not significant because of a restricted range of values (i.e., the scores of the rheumatoid arthritis patients tended to be elevated on both measures, resulting in decreased variability). For the fibromyalgia patients, there were no significant correlations between generalized hypervigilance and measures of health care utilization or

pain intensity. Further analyses revealed that a restricted range of values likely contributed to the nonsignificant correlation findings for the fibromyalgia group.

Recent studies have examined the costs associated with treating fibromyalgia. An American study which examined service utilization and costs in over 500 fibromyalgia patients (Wolfe et al., 1997) showed that the mean yearly cost per patient is $2274.00. The major contributors to this cost were hospital admission and drugs, many of which have been demonstrated to be ineffective in the treatment of fibromyalgia (i.e., non-steroidal anti-inflammatory drugs). Given that the estimated prevalence of fibromyalgia in the general community is 3.4% for women and 0.5% for men and that fibromyalgia is the second most common diagnosis in rheumatology clinics (Wolfe et al., 1997), considerable stresses are being placed on an already financially strapped health care system. A recent Canadian study drew the same conclusion; fibromyalgia patients in London, Ontario used significantly more health services and medications compared to a group of subjects who had widespread pain but who were not diagnosed with fibromyalgia (White et al., 1999).

Cognitive behavioural treatment would appear to provide a readily accessible and more cost-effective way to help patients manage their symptoms effectively. Research has shown that cognitive-behavioural treatments are effective in reducing somatic symptoms, generalized distress, and disability (Nielson, Walker, & McCain, 1991). These interventions assist patients in coping with their symptoms by helping them to reexamine their health beliefs and expectations and to explore the effects of the sick role and of stress and distress upon their symptoms (Barsky & Borus, 1999). As well, cognitive behavioural therapy can assist patients in finding alternative explanations for their symptoms, restructuring faulty disease beliefs, altering expectations, and learning techniques of focussed attention and distraction (Keefe & Caldwell, 1997). A cognitive behavioural approach to treatment is also beneficial because it allows patients to assume a more active role in coping and rehabilitation, and it counters the assumption that positive change results only from the application of technological interventions to passive patients (Bennett, 1996).

It is important to note that the outcome of fibromyalgia and other related conditions is often adversely affected by inappropriate coping strategies and by catastrophic beliefs (Petrie, Moss-Morris, & Weinman, 1995; Wessely, Chalder, Hirsch, Wallace, & Wright, 1996). Cognitive behavioural programs, that focus on changing such beliefs, have been shown to be an effective treatment tool and have been associated with a decrease in pain ratings and improved quality of life in fibromyalgia patients (Singh, Berman, Hadhazy & Creamer, 1998; White & Nielson, 1995). Education appears to be a critical component of treatment. There is increasing evidence that systematic education and reassurance can diminish the significant disability associated with conditions that lack a known etiology (Kellner, 1985). It should be noted that although there have been encouraging results reported for cognitive behavioural treatments, few studies have examined the long-term benefits of this approach in a controlled manner (Goldenberg, 1999). This is an area of research which needs to be pursued.

The results of the present study showed that trait anxiety is the best predictor of generalized hypervigilance for the fibromyalgia group whereas bodily monitoring is the best predictor of generalized hypervigilance for the rheumatoid arthritis and the TMD groups. Cognitive behavioural therapy could be used to decrease the levels of trait anxiety in the fibromyalgia patients and to decrease the amount of bodily monitoring in the rheumatoid arthritis patients and the TMD patients. Intervention studies could be conducted to determine if cognitive behavioural treatment is effective in reducing levels of generalized hypervigilance, measured by the SSAS. This could be achieved by randomly assigning patients to a treatment group, where they would receive cognitive behavioural therapy, or to a control group where no treatment would be provided. The groups could then be compared in terms of their scores on the measure of generalized hypervigilance. One would expect a reduction of generalized hypervigilance scores for the patients who received cognitive behavioural treatment.

General Summary

What has been learned about generalized hypervigilance as a result of this study? Contrary to predictions, the results suggest that the chronic pain patients in this study were more similar than anticipated in terms of their scores on the measure of generalized hypervigilance. The results do not support the hypothesis that the fibromyalgia and the TMD patients who have conditions with an undetermined etiology would report higher generalized hypervigilance scores compared to the rheumatoid arthritis patients who have a pain disorder with a known origin. The findings may suggest that the etiological nature of the pain disorder may not be an influential factor in generalized hypervigilance.

The results also raise questions about the measure of generalized hypervigilance which was used. In the present study, generalized hypervigilance was measured with the Somatosensory Amplification Scale. The SSAS findings conflict with previous experimental studies which have reported a pattern of hypervigilance for fibromyalgia patients, compared to rheumatoid arthritis patients, for a variety of noxious stimuli (i.e., the fibromyalgia patients reported significantly lower threshold and tolerance ratings in response to aversive stimuli; Lautenbacher et al., 1994; McDermid et al., 1996; Scudds et al.). The results of the present study may suggest that generalized hypervigilance is a difficult construct to tap when measured by questionnaire alone; it is premature to draw any conclusions until further testing with the SSAS is conducted. Clearly, it would be more practical to administer a questionnaire to assess generalized hypervigilance in clinical settings than it would be to perform psychophysical tests on patients.

One important area of investigation that should be examined is the relationship between somatosensory amplification and negative affectivity or neuroticism (Costa & McCrae, 1987; Watson& Pennebaker, 1989). Previous research has demonstrated that individuals with high levels of neuroticism tend to experience higher levels of anxiety and depression and to be more vulnerable to stress (Costa & McCrae, 1992; Watson & Clark, 1992). Neuroticism has been shown to be related to symptom reporting and health care utilization. Several studies have demonstrated that neuroticism is correlated consistently with physical symptom reporting but is not related consistently to objective

markers of health status (Costa & McCrae, 1987). For example, it has been shown that neuroticism was significantly related to increased somatic complaints including chest pain, but it was not related to objective pathology such as coronary artery disease (Costa, 1987). Neuroticism has also been associated with the somatic complaints in patients diagnosed with functional syndromes (Drossman, Whitehead, & Camiller, 1998; Kirmayer and Robbins, 1991; Schwartz et al., 1998). Future researchers should investigate the relationship between the SSAS and a measure of negative affectivity such as the Positive and Negative Affect Scale (PANAS) by Watson and Clark (1998) to determine the degree of overlap between these constructs.

As discussed previously, future research should examine more diverse populations of chronic pain patients. As well, it would be beneficial to include control groups who do not suffer from chronic pain (i.e., patients with endocrine disorders or patients with diagnosed psychiatric conditions). The results of such a study would show if generalized hypervigilance scores differ depending on the nature of the chronic illness.

As well, it will be important to compare chronic pain patients diagnosed by family physicians with those diagnosed by specialists in tertiary care centres. Research has indicated that patients treated in tertiary facilities often have poorer outcomes compared to those treated in the community (Crook, Weir, & Tunks, 1989; Granges et al., 1994) but surprisingly, little research has been conducted which examines what factors may account for these differences. In addition to the inclusion of family physician samples, attention should be focussed on community samples. There are numerous individuals in the community who fulfill diagnostic criteria for fibromyalgia but who do not seek medical treatment (White, Harth, Speechley, & Ostbye, 1999).

What characteristics distinguish those who seek treatment from those who do not? Barsky (1992) has suggested that the amplification of bodily sensations may play an important role in the variability of symptom reporting among different individuals who have been diagnosed with the same medical condition (Barsky, 1992). Research has suggested that substantial differences exist in the intensity, number, and nature of the somatic symptoms reported by different patients with the same medical illness. For

example, the presence of peptic ulcer disease (documented by radiographic or endoscopic procedures) is weakly related to the presence of symptoms (Peterson, Sturdevant, & Frankl, 1977; Bodemar & Walan, 1978). As well, it has been shown that arthritic joint pain cannot be predicted solely on the basis of x-ray findings but is closely associated with patients' attitudes and beliefs about disease rather than with the severity of tissue pathology (Lichtenberg, Swensen, and Skehan ,1986). Dyspnea reported by asthmatics has been found to correspond poorly with measures of airway obstruction (Burdon, Juniper, & Killan, 1982; Rubinfield, 1976). It has been suggested that some of this variability could be related to individual differences in perceptual style, or more specifically, in the tendency to amplify somatic sensations (i.e., generalized hypervigilance).

Barsky (1992) stated that "amplification may be salient in the pathogenesis of several ambiguous conditions that are of unclear clinical status, such as irritable bowel syndrome, fibromyalgia, and chronic fatigue syndrome"(p. 32). These conditions are interesting because studies have shown that there are many people in the community who fulfill the diagnostic criteria for these conditions who have never sought medical attention for their symptoms (Barsky, 1987; White, Speechley, Harth, & Ostbye, 1999). It is possible that it is the perceived intensity of their symptoms that distinguishes those who seek medical attention from those who do not.

The results of the present study suggest that there are no differences in generalized hypervigilance among chronic pain patients, all of whom were drawn from tertiary care facilities. In keeping with Barsky's hypothesis, perhaps the role of generalized hypervigilance is of greater importance in accounting for differences between those patients in tertiary centres and those individuals in the community who fulfill diagnostic criteria for fibromyalgia but who do not seek medical treatment. This is an important area of research that needs to be examined in future studies.

With respect to other study findings, there were fewer differences among chronic pain patients on measures of anxiety, monitoring, attribution, and pain coping style than anticipated. Again, these results suggest that the groups of chronic pain patients that

were studied are more similar than dissimilar; again, the etiological nature of the condition may not be an influential factor. As predicted, significant differences existed between the chronic pain patients and the control subjects on most of these variables, confirming the hypothesis that individuals with chronic pain respond differently on a number of personality and coping measures compared to control subjects. While the results illustrate the there are differences between patient and control groups, the question of causality remains. Can variables, such as anxiety, monitoring, attribution, and coping, be considered risk factors for developing chronic pain disorders or are elevations on some of these variables the result of living with a chronic pain condition? Longitudinal studies are needed to determine the direction of this relationship. If, for example, these variables are shown to be risk factors, then cognitive behavioural treatment could be used in a preventative manner. Conversely, if these variables are shown to be the result of living with a disorder of unknown origin, cognitive behavioural therapy would also be an appropriate treatment strategy to help patients cope more effectively with their disorder.

A related issue is whether generalized hypervigilance is a predisposing or factor or if it is the result of having a disorder of undetermined etiology. Rollman and Lautenbacher (1993) view generalized hypervigilance as a predisposing factor in the development of fibromyalgia. If individuals demonstrate a pattern of generalized hypervigilance, are they more likely to develop a chronic pain disorder of undetermined origin, such as fibromyalgia or temporomandibular joint dysfunction? Conversely, does having chronic pain that lacks an organic explanation result in generalized hypervigilance? This is a necessary area of investigation, the results of which will further our understanding of this concept. If, for example, future studies identify generalized hypervigilance as a risk factor in the development of pain disorders with undetermined etiologies, then it could be detected by a paper-and-pencil measure such as the SSAS and treated at an early stage through cognitive-behavioural treatment. As well, if generalized hypervigilance is the result of living with pain for which the cause is unknown, cognitive behavioural therapy would be beneficial at this stage, as well.

This primary purpose of this study was to further our understanding of generalized hypervigilance. The focus was on examining the role of psychological factors in generalized hypervigilance but it is important to note that generalized hypervigilance is likely influenced by a complex interaction of psychological and physiological variables.

Is generalized hypervigilance worthy of future investigation? The results of this study have advanced our understanding of generalized hypervigilance and have also raised a number of important issues which warrant further study. It seems premature to dismiss the concept of generalized hypervigilance until studies addressing such issues have been conducted.

Appendix A

Appendix A.1

LETTER OF INFORMATION

INVESTIGATORS: Ann McDermid, M.A., and Gary Rollman, Ph.D.,
Department of Psychology, University of Western Ontario

Illness Attitudes and Coping Styles: An Examination of Chronic Pain Patients

This is a study in health psychology. It examines several physical and behavioural characteristics related to health, illness, pain, and discomfort. This study will investigate four groups of individuals: (1) fibromyalgia patients, (2) rheumatoid arthritis patients, (3) temporomandibular joint dysfunction patients, and (4) healthy volunteers who will serve as a comparison group.

We are interested in learning more about how medical patients evaluate their symptoms, cope with pain, and deal with day-to-day issues. A number of questionnaires have been developed that provide data regarding these matters. The results of this study may help us to better understand the factors related to pain and treatment approaches that are beneficial in pain management.

If you agree to participate, you will be asked to complete a packet of questionnaires on your own time at your home and to return the packet of completed questionnaires to the Department of Psychology at the University of Western Ontario within three weeks from the time you receive the questionnaires. It is very important that you answer the questions by yourself and do not ask for the opinions of any other family members or friends. You are encouraged to contact the experimenter if you have any questions about the items on the questionnaires or any other part of the study. The total amount of time it will take subjects to complete the questionnaires will vary but it is estimated that it will take between 1 - 1.5 hours of your time.

There are no known physical or psychological risks associated with this study. Also, you will not benefit directly from this study, but the group results may have clinical implications for treatment.

All information provided by you will be confidential. Your answers will not be revealed to your physician or employer. The questionnaires will not become part of your medical file. A coded subject number will be used instead of your name on all of the questionnaires. The only place your name will appear is on the informed consent form attached to this letter. The consent forms will be kept in a separate file from the completed questionnaires so that your name will not be associated with your questionnaire responses. All information will be kept in a locked filing cabinet in the

experimenter's office at the University of Western Ontario. If the results of this study are published, only group results will be included.

Participation in the study is voluntary. You may refuse to participate or withdraw from the study at any time with no effect on your future care. Also, you are free to decline to answer any questions that you find to be objectionable or that make you feel uncomfortable.

If you are already participating in another research project at this time, please inform Ann McDermid promptly to determine if it is appropriate to be participating in this study. If you would like to participate in this study, please complete the attached Consent Form. When you have completed the questionnaires, pleased put them in the enclosed stamped envelope along with the Consent Form.

If you have any questions or concerns about the study, please feel free to contact the researcher, Ann McDermid, at 679-2111, extension # 4682.

Your sincerely,

Ann J. McDermid, M.A.

Co-Investigator: Dr. Gary Rollman, Professor of Psychology,
University of Western Ontario

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AS SUBMITTED BY: Dr. G. Rollman (Ann McDermid), Psychology, Social Science Centre

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AGENCY: MEDICAL RESEARCH COUNCIL OF CANADA (STUDENTSHIP)

TITLE:

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c.c. Hospital Administration

Appendix A.2

CONSENT FORM

Illness Attitudes and Coping Styles: An Examination of Chronic Pain Patients

I _____ (name) have read the accompanying Letter of Information and have had my questions answered to my satisfaction. I agree to participate in this research study.

Signature: _____

Date: _____

Appendix A.3

Dear _____,

Thank you for returning the postcard. Participation in this project is voluntary. If you agree to participate, please complete and sign the attached Consent Form.

You will find several questionnaires enclosed in this packet. Please complete the questionnaires in the order that you find them. The total amount of time it will take participants to complete the questionnaires will vary but it is estimated that it will take between 1 - 1.5 hours. We realize that there are many questionnaires in the packet but we feel that it is necessary to include them in order to accurately examine how people with different pain problems react to their pain.

It is very important that you answer the questions by yourself and do not ask for the opinions of any family members or friends. When you have completed the questionnaires, please return them in the self-addressed return envelope. Be sure to include the Consent Form in this envelope.

All information that you provide is confidential. You are free to decline to answer any questions that you find to be objectionable or that make you feel uncomfortable.

If you do not wish to participate, please return the uncompleted questionnaires in the self-addressed return envelope.

If you have any questions or concerns about the questionnaires, please do not hesitate to contact Ann McDermid at 679-2111, extensions # 4682. I will be happy to answer your questions.

Yours very truly,

Ann McDermid, M.A.

Appendix A.4

FEMALES NEEDED FOR QUESTIONNAIRE STUDY

WHO?

FEMALES BETWEEN 20 AND 65 YEARS OF AGE WHO DO NOT SUFFER FROM CHRONIC PAIN

WHAT?

Participants are needed to complete questionnaires about their views on health and illness. All responses are confidential.

WHERE?

Participants will be asked to complete the questionnaires on their own time. It takes approximately one hour. Participants will be reimbursed for their time and inconvenience.

WHY? to serve as a control group; responses of chronic pain patients will be compared with responses of control group

If you are interested in participating in this study, or know someone who might be, please contact Ann McDermid, Department of Psychology, University of Western Ontario at 679-2111 extension 4682.

Appendix A.5

INFORMATION FOR NORMAL CONTROL SUBJECTS

Dear Participant,

There are three questionnaires which focus specifically on pain. These are labelled the MPQ, PASS, and the PRSS. *When you are answering these questionnaires, please imagine that you are experiencing some type of pain (e.g. headache, sore muscle, toothache, menstrual pain) and respond accordingly.*

You will be reimbursed 10 dollars for your time and inconvenience. When you have returned the questionnaire packet, I will mail a cheque to you. Please complete the attached form which requests your mailing address.

More information about the study is provided in the Letter of Information. Please return the Consent and Mailing Address forms along with the completed questionnaires in the envelope provided.

Thank you for your interest.

Yours very truly,

Ann McDermid, M.A.

REFERENCES

Ahles, T.A., Yunus, M.B., & Masi, A.T. (1987). Is chronic pain a variant of depressive disorders? The case of primary fibromyalgia. Pain, 29, 105-111.

Ahles, T.A., Khan, S.A., Yunus, M..B., Spiegel, D.A., & Masi, A.T. (1991). Psychiatric status of patients with primary fibromyalgia, patients with rheumatoid arthritis, and subjects without pain: a blind comparison of DSM-III diagnoses. American Journal of Psychiatry, 148, 1721-1726.

Arroyo, J.F., & Cohen, M.L.(1993). Abnormal responses to electrocutaneous stimulations in fibromyalgia. Journal of Rheumatology, 20, 1925-1931.

Barsky, A.J. (1987). Investigating the psychological aspects of irritable bowel syndrome. Psychosomatic Medicine, 50, 515-519.

Barsky, A.J. (1992). Amplification, somatization, and the somatoform disorders. Psychosomatics,33, 28-34.

Barsky, A.J., & Borus, J.F. (1999). Functional somatic syndromes. Annals of Internal Medicine, 130, 910-921.

Barsky, A.J. & Klerman, G. (1983). Hypochondriasis, bodily complaints, and somatic styles. American Journal of Psychiatry, 140, 273-283.

Barsky, A.J., Brener, J., Coeytaux, R.R., & Cleary, P.D. (1995). Accurate awareness of heartbeat in hypochondriacal and non-hypochondriacal patients. Journal of Psychosomatic Research, 39, 489-497.

Barsky, A.J., Orav, J.E., Delamater, B.A., Clancy, S.A., & Hartley, L.H. (1998). Cardiorespiratory symptoms in response to physiological arousal. Psychosomatic Medicine, 60, 604-609.

Barsky, A.J., Wyshak, G., & Klerman, G. (1990). The somatosensory amplification scale and its relation to hypochondriasis. Journal of Psychiatric Research, 24, 328-334.

Bassett, D.L., Gerke, D.C., & Goss, A.N.(1990). Psychological factors in temporomandibular joint dysfunction: depression. Australian Prosthodontic Journal, 4, 42-45.

Bennett, R.M. (1996). Multidisciplinary group programs to treat fibromyalgia patients. Rheumatic Diseases Clinics of North America, 22, 351-367.

Biederman, H.J., McGhie, A., Monga, T.N., & Shanks, G.L. (1987). Perceived and actual control in EMG treatment of back pain. Behavior Research and Therapy, 25, 137-147.

Bishop, G.D. (1987). Lay conceptions of physical symptoms. Journal of Applied Social Psychology, 17, 127-146.

Bishop, G.D., & Converse, S.A. (1986). Illness representations: A prototype approach. Health Psychology, 5, 95-114.

Block, S.R. (1993). Fibromyalgia and the rheumatisms: Common sense and sensibility. Rheumatic Disease Clinics of North America, 19, 61 -79.

Bodemar, G., & Walan, A. (1978). Maintenance treatment of recurrent peptic ulcer by cimetidine. Lancet, 1, 403-407.

Boissevain, M., & McCain, G. (1991). Toward an integrated understanding of fibromyalgia syndrome: II. Psychological and phenomenological aspects. Pain, 45, 239-248.

Brown, G.K., & Nicassio, P.M.(1987). Development of a questionnaire for the assessment of active and passive coping strategies in chronic pain patients. Pain, 31, 53-64.

Burdon, J.G.W., Juniper, E.F., & Killan, K.J. (1982). The perception of breathlessness in asthma. American Review of Respiratory Disease, 162, 825-828.

Campbell, S.M., Clark, S., Tindall, E.A., Forehand, M.E., & Bennett, R.M. (1983). Clinical characteristics of fibrositis: A "blinded", controlled study of symptoms and tender points. Arthritis and Rheumatism, 26 , 817-824.

Chapman, C.R. (1978). Pain: The perception of noxious events. In R.A. Sternbach (Ed.), The psychology of pain (pp. 169-202). New York: Raven Press.

Costa, P.T., & McCrae, R.R. (1987). Neuroticism, somatic complaints, and disease: Is the bark worse than the bite? Journal of Personality,55, 299-316.

Crook J, Weir R, & Tunks E. (1989). An epidemiological follow-up survey of persistent pain sufferers in a group family practice and specialty pain clinic. Pain, 36, 49-61.

Curran, S.L., Carlson, C.R., & Okenson, J.P. (1996). Emotional and physiologic responses to laboratory challenges: Patients with temporomandibular disorders versus matched control subjects. Journal of Orofacial Pain, 10, 141-150.

DeGood, D.E., Buckelew, S.P., & Tiat, R.C. (1985). Cognitive-somatic anxiety response patterning in chronic pain patients and nonpatients. Journal of Consulting and Clinical Psychology, 53, 137-138.

Derogatis, L.R. (1977). Administration, scoring, & procedures manual for the SCL90-R. Towson, MD: Clinical Psychometric Research

Drossman, D.A., & Lowman, B.C. (1985). Irritable bowel syndrome: Epidemiology, diagnosis, and treatment. Clinical Gastroenterology, 14, 559-573.

Dubreuil, D.L., & Kohn, P.M. (1983). Reactivity and response to pain. Personality and Individual Differences, 7, 907-09.

Dunne, F.J. (1995). Fibromyalgia syndrome and psychiatric disorder. British Journal of Hospital Medicine, 54, 194-197.

Dworkin, S.F., Chen, A.C., LeResche, L., & Truelove, E. (1983). Perception of acute pain and changing levels of orofacial pain: Pain assessment and preliminary EEG findings. Pain, (Suppl.2), 604.

Dworkin S.F., & LeResche, L. (1992). Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. Journal of Craniomandibular Disorders, 6, 301-355.

Egbert, L.D., Battit, G.E., & Welch, C.E. (1964). Reduction of postoperative pain by encouragement and instruction of patients: a study of doctor-patient rapport. New England, Journal of Medicine, 270, 825-827.

Ekselius, L., Bengtsson,A., & von Knorring, L. (1998). Personality traits as determined by means of the Karolinska Scales of Personality in patients with fibromyalgia.. Journal of Musculoskeletal Pain, 6, 35-49.

English, T.L. (2000, February). Functional somatic syndromes [Letter to the editor]. Annals of Internal Medicine, p. 329.

Epstein, S.A., Gray, K., Clauw, D., Heaton, R., Klein, D., Krupp, L., Kuck, J., Leslie, V., Masur, D., Wagner, M., Waid, R., & Zisook, S. Psychiatric disorders in patients with fibromyalgia: A multicentre Investigation (1999). Psychosomatics, 40, 57-63.

Eysenck, M.W., MacLeod, C., & Mathews, A. (1987). Cognitive functioning and anxiety. Psychological Research, 49, 189-195.

Ferguson, R.J., & Ahles, T.A. (1998). Private body consciousness, anxiety and pain symptom reports of chronic pain patients. Behaviour Research and Therapy, 36, 527-535.

Fernandez, E. (1986). A classification system of cognitive coping strategies for pain. Pain, 26, 141-151.

Fillingim, R., Maixner, W., Kincaid, S., Sigurdsson, A., & Harris, M.B. (1996). Pain sensitivity in patients with temporomandibular disorders; relationship to clinical and psychosocial factors. Clinical Journal of Pain, 12, 260-269.

Flor, H., Behle, D., & Birbaumer, N. (1993). Assessment of pain-related cognitions in chronic pain patients. Psychological Assessment: A Journal of Consulting and Clinical Psychology, 1-22.

Flor, H., & Turk, D. (1989). Psychophysiology of chronic pain : Do chronic pain patients exhibit symptom-specific psychophysiological responses? Psychological Bulletin, 105, 215-219.

Gagliese, L., & Katz, J. (2000). Medically unexplained pain is not caused by psychopathology. Pain Research & Management , 5, 251-257.

Gallagher, R.M., Marbach, J.J., Raphael, K., Dohrenwend, B.P., & Cloitre, M. (1991). Is major depression comorbid with temporomandibular pain and dysfunction syndrome? A pilot study. Clinical Journal of Pain, 7, 219-225.

Gard, D., Edwards, P.W., Harris, J., & McCormick, G. (1988). The sensitizing effects of pretreatment measures on cancer chemotherapy nausea and vomiting. Journal of Consulting and Clinical Psychology, 56, 80-84.

Gerster, J.C., & Hadj-Djilani, A. (1984). Hearing and vestibular abnormalities in primary fibrositis syndrome. Journal of Rheumatology, 11 (5), 678-680.

Goldenberg, D. L.(1989). Psychiatric and psychologic aspects of fibromyalgia syndrome. Rheumatic Disease Clinics of North America, 15, 105-114.

Goldenberg, D.L. (1999). Fibromyalgia syndrome a decade later. What have we learned? Archives of Internal Medicine, 159, 777-785.

Goolkasian, P. (1985). Phase and sex effects in pain perception: a critical review. Psychology of Women Quarterly, 9, 15-28.

Gordon, D.A. (1997). Fibromyalgia: out of control? Journal of Rheumatology, 24, 1247.

Goss, A.N., Bassett, D.L., & Gerke, D.C. (1990). Psychological factors in temporomandibular joint dysfunction: anxiety. Australian Prosthodontic Journal, 4, 35-39.

Graber, G. (1991). Epidemiological research on the etiological factors behind dysfunctional diseases of the motor apparatus: The stomatognate system as an example. In W. Muller, (Ed.), Generalisierte Tendomyopathie (Fibromyalgie) (pp.221-229). Darmstamdt: Steinkopff Verlag.

Granges, G., Gibson, S.J., Littlejohn, G., & Helme, R.D. (1993). Cerebral event related potentials and heat pain thresholds in fibromyalgia syndrome. Journal of Musculoskeletal Pain, 1, 177 -184.

Granges, G., & Littlejohn. G. (1993). Pressure pain threshold in pain-free subjects, in patients with chronic regional pain syndromes, and in patients with fibromyalgia syndrome. Arthritis and Rheumatism, 36, 642-646.

Granges G, Zilko P, Littlejohn G.O. (1994). Fibromyalgia syndrome: assessment of the severity of the condition 2 years after diagnosis. Journal of Rheumatolgy, 21, 523-529.

Griep, E.N., Boersma, J.W., & de Kloet, E.R. (1993). Altered reactivity of the hypothalamic-pituitary-adrenal axis in the primary fibromyalgia syndrome. Journal of Rheumatology, 20, 469-474.

Haenen, M.A., Schmidt, A.J., Schoenmakers, M., & van den Hout, M.A.(1997). Tactual sensitivity in hypochondriasis. Psychotherapy and Psychosomatics, 66, 128-132.

Haenen, M.A., Schmidt, A.J., Kroeze, S., & van den Hout, M.A. (1996). Hypochondriasis and symptom reporting - the effect of attention versus distraction. Psychotherapy and Psychosomatics, 65, 43-48.

Hadj-Djilani, A., & Gerster, J.C. (1984). Meniere's disease and fibrositis (psychogenic rheumatism): Relationships in audiometric and nystagmographic results. Acta Otolaryngol, 406, 67-71.

Hedrick, T.E. (2000, February). Functional somatic syndromes [Letter to the editor]. Annals of Internal Medicine, p. 327.

Heimberg, R.G., Gansler, D., Dodge, C.S., & Becker, R.E. (1989). Convergent and discriminant validity of the Cognitive-Somatic Anxiety Questionnaire in a social phobic population. Behavioral Assessment, 9, 379-388.

Helson, H. (1954). Adaptation level theory: An experimental and systematic approach to behavior. New York: Harper and Row.

Hudson, J.I., Hudson, M.S., Pliner, L.F., Goldenberg, D.L., & Pope, H.G. (1985). Fibromyalgia and major affective disorder: A controlled phenomenology and family history study, American Journal of Psychiatry, 142, 441-446.

Hummel, T.J., & Sligo, J.R. (1971). Empirical comparison of univariate and multivariate analysis of variance procedures. Psychological Bulletin, 76, 49-57.

Huyser,B., & Parker, J.C. (1998). Stress and rheumatoid arthritis: an integrative review. Arthritis Care & Research, 11, 135-145.

Johansson, G., Risberg, J., Rosenhall, U., & Orndahl, G. (1995). Cerebral dysfunction in fibromyalgia: Evidence from regional cerebral blood flow measurements, otoneurological tests and cerebrospinal fluid analysis. Acta Psychiatrica Scandinavica, 91, 86-94.

Kallenberg, A., Wenneberg, B., Carlsson, G.E., & Ahlmen, M. (1997). Reported symptoms from the masticatory system and general well-being in rheumatoid arthritis. Journal of Oral Rehabilitation. Journal of Oral Rehabilitation, 24, 342-349.

Keefe, F.J., & Caldwell, D.S. (1997). Cognitive behavioral treatment of arthritis pain. Medical Clinics of North America, 81, 277-290.

Keefe, F.J., Caldwell, D.S., Queen, K.T., Gil, K.M., Martinez, S., Crisson, J.E., Ogden, W., & Nunley, J. (1987). Pain coping strategies in osteoarthritis patients. Journal of Consulting and Clinical Psychology, 55 (2), 208-212.

Kelley, H.H. (1971). Attribution in social interaction. In E.Jones, D. Kanouse, H. Kelley, R. Nisbett, S. Valinis, & B. Weiner (Eds.), Attribution: Perceiving the Causes of Behavior (pp. 1-26). Morristown, NJ: General Learning.

Kellner, R. (1985). Functional somatic symptoms and hypochondriasis: A survey of empirical studies. Archives of General Psychiatry, 42, 821-833.

Kellner, R. (1986). Somatization and hypochondriasis. New York: Praeger.

Kirk, R.E. (1982). Experimental design: Procedures for the behavioral sciences (2nd ed). Pacific Grove: Brooks/Cole.

Kirmayer, L.J. (1986). Somatization and the social construction of illness experience. In S. McHugh & T.M. Vallis (Eds.), Illness behavior: A multidisciplinary model. New York: Plenum, 111-123

Kirmayer, L.J., Robbins, J.M., & Kapusta, M.A. (1988). Somatization and depression in fibromyalgia syndrome. American Journal of Psychiatry, 145(8), 950-954.

Krag, N.J., Norregaard,J., Hindberg, I., & Larsen, J.K. (1995). Psychopathology measured by established self-rating scales and correlated to serotonin measures in patients with fibromyalgia . European Psychiatry, 10, 404-409.

Krag, N.J., Norregaard, J., Larsen, J.K., & Danneskiold-Samsoe, B. (1995). A blinded, controlled evaluation of anxiety and depressive symptoms in patients with fibromyalgia, as measured by standardized psychometric interview scales. Acta Psychiatrica Scandinavica, 89, 370-375.

Kurt, T.L. (2000, February). Functional somatic syndromes [Letter to the editor]. Annals of Internal Medicine, p. 329.

Kurtze, N., Gundersen, K.T., & Svebak, S. (1998). The role of anxiety and depression in fatigue and patterns of pain among subgroups of fibromyalgia patients. British Journal of Medical Psychology, 71, 185-194.

Lattimer, P.R. (1983). Functional Gastrointenstinal Disorders: A Behavioral Medicine Approach. New York: Springer Publishing Co.

Lau, R.R., & Hartman, K.A. (1983). Common sense representations of common illnesses. Health Psychology, 2, 167-186.

Lautenbacher, S., Rollman, G.B., and McCain. G.A.(1994). Multi-method assessment of experimental and clinical pain in patients with fibromyalgia. Pain, 59, 45-53.

Lautenschläger. J., Segalias, J., Brückle, W., & Müller, W. (1991). Comparisons of spontaneous pain and tenderness in patients with primary fibromyalgia. Clinical Rheumatology, 10, 168-174.

Lawson, K., Reesor, K.A., Keefe, F.J., & Turner, J.A. (1990). Dimensions of pain-related cognitive coping: Cross validation of the factor structure of the Coping Strategy Questionnaire. Pain, 43, 195-204.

Leavitt, F., Katz, R.S., Golden, H.E., Glickman, P.B., & Layfer, L.F. (1986). Comparison of pain properties in fibromyalgia patients and rheumatoid arthritis patients. Arthritis and Rheumatism, 29, 775-781.

Lichtenberg, P.A., Swensen, C.H., & Skehan, M.W. (1986). Further investigation of the role of personality, lifestyle, and arthritic severity in predicting pain. Journal of Psychosomatic Research, 30, 327-337.

Lindman, R., Hagberg, M., Bengtsson, A., Henriksson, K.G., & Thornell, L.E. (1995). Capillary structure and mitochondrial volume density in the trapezius muscle of chronic trapezius myalgia, fibromyalgia, and healthy subjects. Journal of Musculoskeletal Pain, 3, 5-22.

Magni, D. (1993). General consideration on psychiatric illness in relation to musculoskeletal pain. In H. Merskey & H. Vaeroy (Eds.), Progress in fibromyalgia and myofascial pain. Amsterdam: Elsevier Press.

Maixner, W., Fillingim, R., Booker, D., & Sigurdsson, A.(1995). Sensitivity of patients with painful temporomandibular disorders to experimentally evoked pain. Pain, 63, 341-351.

Maixner, W., Fillingim, R., Kincaid, S., Sigurdsson, A., & Harris, M.B. (1997). Relationship between pain sensitivity and resting arterial blood pressure in patients with painful temporomandibular disorders. Psychosomatic Medicine, 59, 503-511.

Malow, R.M., Grimm, L., & Olson, R.E. (1980). Differences in pain perception between myofascial pain dysfunction patients and normal subjects: A signal detection analysis. Journal of Psychosomatic Research, 24, 303-309.

McCain, G.A., & Scudds, R.A. (1988). The concept of primary fibromyalgia (fibrositis): Clinical value, relation and significance to other chronic musculoskeletal pain syndromes. Pain, 33, 273-287.

McDermid, A.J., Rollman, G.B., & McCain, G.A. (1996). Generalized hypervigilance in fibromyalgia: Evidence of perceptual amplification. Pain, 66, 133-144.

McHugh, S. & Vallis, M. (1986). Illness behavior: operationalization of the biopsychosocial model. In S. McHugh and T.M. Vallis (Eds.), Illness behavior: A multidisciplinary model (pp. 1-32). New York: Plenum Press.

Mechanic, D. (1983). The experience and expression of distress: The study of illness behavior and medical utilization. In D. Mechanic (Ed.), Handbook of health, health care, and the health professions (pp. 591-607). New York: Free Press.

Mechanic, D. (1986). Illness behaviour: An overview. In S. McHugh and T. M. Vallis (Eds.), Illness behaviour: A multidisciplinary model (pp.101-109). New York: Plenum Press.

Melzack, R. (1975). The McGill Pain Questionnaire: Major properties and scoring methods. Pain, 1, 277-299.

Merskey, H. (1989). Physical and psychological considerations in the classification of fibromyalgia. Journal of Rheumatology,19, 72-79

Merskey, H., & Evans, P.R. (1975). Variations in pain complaint threshold in psychiatric and neurological patients with pain. Pain, 1, 73-79.

Meyer, D., Leventhal, H., & Guttmann, M. (1985). Common-sense models of illness: the example of hypertension. Health Psychology, 4, 115-135.

Miller, L.C., Murphy, R., & Buss, A.H. (1981). Consciousness of body: Private and public. Journal of Personality and Social Psychology, 41, 397-406.

Miller, S.M. (1987). Monitoring and blunting: Validation of a questionnaire to assess styles of information-seeking under threat. Journal of Personality and Social Psychology, 52, 345-353.

Miller, S., Brody, D.S., & Summerton, J. (1988). Styles of coping with threat: Implications for health. Journal of Personality and Social Psychology, 1, 142-148.

Miller, S.M., Leinbach, A., & Brody, D.S. (1989). Coping style in hypertensive patients: Nature and consequences. Journal of Consulting and Clinical Psychology, 57(3), 333-337.

Miller, S.M., & Mangan, C.E. (1983). The interacting effects of information and coping style in adapting to gynecologic stress: Should the doctor tell all? Journal of Personality and Social Psychology, 45, 223-236.

Moldofsky, H. (1986). Sleep and musculoskeletal pain. American Journal of Medicine, 81 (suppl. 3A), 85-89.

Mountz, J.M., Bradley, L.A., Modell, J.G., Alexander, D.W., Triana-Alexander, M., Aaron, L.A, Stewart, K.E., Alarcon, G.S., & Mountz, J.D. (1995). Fibromyalgia in women. Abnormalities of regional cerebral blood flow in the thalamus and the caudate nucleus are associated with low pain threshold levels. Arthritis and Rheumatism, 38, 926-938.

Muris, P., & van Zuuren, F. (1992). Monitoring, medical fears, and physical symptoms. British Journal of Clinical Psychology, 31, 360-362.

Myers, J.L., & Well, A.D. (1991). Research design and statistical analysis. New York: Harper Collins.

Neeck, G., & Riedel, W.(1994). Neuromediator and hormonal perturbations in fibromylagia syndrome: results of chronic stress? Balliere's Clinical Rheumatology, 8, 763-775.

Neitzert, C., Davis, C., & Kennedy, S. (1997). Personality factors related to the prevalence of somatic symptoms and medical complaints in a healthy student population. British Journal of Medical Psychology, 70, 93-101.

Newman, S., Fitzpatrick, R., Lamb, R., & Shipley, M. (1990). Patterns of coping in rheumatoid arthritis. Psychology and Health, 4, 187-200.

Nicassio, P.M., Radojevic, V., Schoenfeld-Smith, K., & Dwyer, K. (1996). The contribution of family cohesion and pain coping processes to depressive symptoms in fibromyalgia. Annals of Behavioral Medicine, 17, 349-356.

Nielson, W.R., Walker, C., & McCain, G. (1991). Cognitive behavioral treatment of fibromyalgia syndrome: preliminary findings. The Journal of Rheumatology, 19, 99-103.

Olson, C.L. (1976). On choosing a test statistic in MANOVA. Psychological Bulletin, 83, 579-586.

Otto, M.W., & Dougher, M.J. (1985). Sex differences and personality factors in responsivity to pain. Perceptual Motor Skills, 61, 383-90.

Paganini-Hill, A., Hsu, G. Chao, A., & Ross. P.K. (1993). Comparison of early and late respondents to a postal health survey questionnaire. Epidemiology, 4, 375-9.

Parker, J.C., Buckelew, S.P., Smarr, K.L., Buescher, K.L., Beck, N.C., Frank, R.G., Anderson, S.K., & Walker, S.E. (1990). Psychological screening in rheumatoid arthritis. Journal of Rheumatology, 17, 1016-21

Pennebaker, J.W. (1982). The psychology of physical symptoms. New York: Springer-Verlag Inc.

Pennebaker, J.W. (1994). Psychological bases of symptom reporting: Perceptual and emotional aspects of chemical sensitivity. Toxicology & Industrial Health, 10, 497-511.

Perry, F., Heller, P.H., & Levine, J.D. (1988). Differing correlations between pain measures in syndromes with or without explicable organic pathology. Pain, 34, 185-189.

Peterson, W.L., Sturdevant, R.A., & Frankl, H.D. (1977). Healing of duodenal ulcer with an antacid regimen. New England Journal of Medicine, 297, 341-345.

Petrie, Kolody., Moss-Morris, R., & Weinman J. (1995). The impact of catastrophic beliefs on functioning in chronic fatigue syndrome. Journal of Psychosomatic Research,39, 31-37.

Phipps, S., & Zinn, A.D. (1986). Psychological response to amniocentesis: Effects of coping style. American Journal of Medical Genetics, 25, 143-148.

Pilowksy, I. & Spence, N.D. (1975). Patterns of illness behaviour in patients with infractible pain. Journal of Psychosomatic Research, 19, 279-287.

Pincus, T., Griffith, J., Pearce, S., & Isenberg, D. (1996). Prevalence of self-reported depression in patients with rheumatoid arthritis. British Journal of Rheumatology, 35, 879-883.

Plesh, O., Wolfe, F., & Lane, N. (1996). The relationship between fibromyalgia and temporomandibular disorders: Prevalence and symptoms severity. Journal of Rheumatology, 23, 1948-1952.

Procacci, P. , Zoppi, M., Padeletti, L., & Maresca, M. (1976). Myocardial infarction without pain: a study of the sensory functions of the upper limbs. Pain, 2, 309-313.

Raymond, B., & Bergland, M.M. (1995). Psychosocial aspects of fibromyalgia syndrome. Journal of Applied Rehabilitation Counselling, 25, 42-46.

Robbins, J.M., & Kirmayer, L.J. (1986). In L.J. Kirmayer and J.M. Robbins (Eds.), Cognitive and social factors in somatization (pp. 107-141). Washington, DC: American Psychiatric Press, Inc.

Robbins, J.M., & Kirmayer, L.J. (1991). Attributions of common somatic symptoms. Psychological Medicine, 21, 1029-1045.

Robbins, J.M., Kirmayer, L.J., & Kapusta, M.A. (1990). Illness worry and disability in fibromyalgia syndrome. International Journal of Medicine, 20, 49-63.

Rodin, J. (1978). Somatophysics and attribution. Personality and Social Psychology Bulletin, 4, 531-540.

Rollman, G.B. (1979). Signal detection theory pain measures: Empirical validation studies and adaptation level effects. Pain, 6, 9-21.

Rollman, G.B. (1989). Measurement of pain in fibromyalgia in the clinic and laboratory. Journal of Rheumatology, 16, 113-119.

Rollman, G.B.& Gillespie, J.M. (2000). The role of psychosocial factors in temporomandibular disorders. Current Review of Pain, 4, 71-81

Rollman, G.B., & Lautenbacher, S. (1993). Hypervigilance effects in fibromyalgia: Pain experience and pain perception. In H. Vaeroy and H. Merskey (Eds.), Progress in fibromyalgia and myofascial pain (Vol. 6, pp. 149-159). Amsterdam: Elsevier.

Rosenstiel, A.K., & Keefe, F.J. (1983). The use of coping strategies in chronic low back pain patients: Relationship to patients characteristics and current adjustment. Pain, 17, 33-44.

Roth, R.S., & Bachman, J.E.(1998). Pain experience, psychological functioning and self-reported disability in chronic myofascial pain and fibromyalgia. Journal of Musculoskeletal Pain, 1, 209-216.

Rubinfield, A.R.(1976). Perception of asthma. Lancet, 1, 822-824.

Russell, I.J., Michalek, J.E., Vipraio, G.A., Fletcher, E.M., Javors, M.A., & Bowden, C.A. (1992). Platelet [^{3}H] imipramine uptake receptor density and serum serotonin levels in patients with fibromyalgia/fibrositis syndrome. Journal of Rheumatology, 19, 104-109.

Salter, M., Brooke, R.I., Merskey, H., Fichter, G.F., & Kapusianyk, D.H. (1983). Is temporomandibular pain and dysfunction a disorder of the mind? Pain, 17, 151-166.

Schnurr, R.F., Brooke, R.I., & Rollman, G.B. (1991). Psychosocial correlates of temporomandibular joint pain and dysfunction. Pain, 42, 153-165.

Schwarz, S.P., Blanchard, E.B., Berreman, C.F., Scharff, L, Taylor, A.E., Greene, B.R., Suls, J.M., & Malamood, H.S. (1993). Psychological aspects of irritable bowel syndrome: Comparisons with inflammatory bowel disease and nonpatient controls. Behaviour Research Therapy, 31, 297-304.

Schwartz, G.E., Davidson, R.J., & Goleman, D.J. (1978). Patterning of cognitive and somatic processes in the self-regulation of anxiety: Effects of mediation versus exercise. Psychosomatic Medicine, 40, 321-328.

Scudds, R.A., Rollman, G.B., Harth, M., & McCain, G.A. (1987). Pain perception and personality measures as discriminators in the classification of fibrositis. Journal of Rheumatology, 14, 563-569.

Scudds, R.A., Rollman, G.B., Harth, M., & McCain, G.A. (1989). Improvements in pain responsiveness in patients with fibrositis after successful treatment with amitriptyline. Journal of Rheumatology, 16, 98-103.

Sensky, T., MacLeod, A.K., & Rigby, M.F. (1996). Causal attributions about common somatic sensations among frequent general practice attenders. Psychological Medicine, 26, 641-646

Shorter, E. (1992). From paralysis to fatigue: A history of psychosomatic illness in the modern era. New York: Free Press.

Singh, BB., Berman, BM, Hadhazy, V.A, & Creamer, P. (1998). A pilot study of cognitive behavioral therapy in fibromyalgia. Alternative Therapies in Health & Medicine, 4, 67-70.

Smedstadt, L.M., Moum, T., Vaglum,, P., & Kvien, T.K. (1996). The impact of early rheumatoid arthritis in psychological distress: A comparison between 238 patients with RA and 116 matched controls. Scandinavian Journal of Rheumatology, 25, 377-382.

Smythe, H.A. (1984). Problems with the MMPI. Journal of Rheumatology, 11, 417-418.

Smythe, H.A. (1986). Tender points: Evolution of concepts of the fibrositis/fibromyalgia syndrome. The American Journal of Rheumatology,11, 417-418.

Solomon, D.H, & Liang, M.H. (1997). Fibromyalgia: scourge of humankind or bane of a rheumatologist's existence? Arthritis and Rheumatism, 40, 1553-1555.

Southwell, J., Deary, I.J., & Geissler, P. (1990). Personality and anxiety in temporomandibular joint syndrome patients. Journal of Oral Rehabilitation, 17, 239-243.

Spanos, N.P., Radtke-Bodorik, L., Ferguson, J.D., & Jones, B. (1979). The effects of hypnotic susceptibility, suggestions for analgesia, and the utilization of cognitive strategies on the reduction of pain. Journal of Abnormal Psychology, 88, 282-292.

Spielberger, C.D., Gorusch, R.L., & Lushene, R.E. (1975). Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologist Press.

Sternbach, R.A. (1978). Pain patients: Traits and treatments. Academic Press: New York.

Sternbach, R.A. (1986). The psychology of pain. Raven Press: New York.

Sullivan, M.J., & Neish, N.R. (1998). Catastrophizing, anxiety and pain during dental hygiene treatment. Community Dental Oral Epidemiology, 26, 344-349.

Sullivan, M.J., Stanish, W., Waite, H., Sullivan, M., & Tripp, D.A. (1998). Catastrophizing, pain, and disability in patients with soft-tissue injures. Pain, 77, 253-260.

Tabachnick, B.G. & Fidell, L.S. (1989). Using Multivariate Statistics (2nd ed.). New York: Harper & Row.

Tamaren, A.J., Carney, R., & Allen, T.W. (1985a). Predictive validity of the cognitive versus somatic anxiety distinction. Pavlovian Journal of Biological Science, 20, 177-180.

Tamaren, A.J., Carney, R., & Allen, T.W. (1985b). Assessment of cognitive and somatic anxiety: A preliminary validation study. Behavioral Assessment, 7, 197-202.

Toomey, D., Finneran, J., & Scarborough, W.B. (1988). Clinical features of health locus of control beliefs in chronic facial pain patients. Clinical Journal of Pain, 3, 213-218.

Tunks, E., Crook, J., Norman, G., & Kalaher, S. (1988). Tender points in fibromyalgia. Pain, 34, 11-19.

Turk, D.C., & Okifuji, A. (1997). Evaluating the role of physical, operant, cognitive, and affective behaviors of chronic pain patients. Behavior Modification, 21, 259-280.

Turk, D.C., Meichenbaum, D.H., & Genest, M. (1983). Pain and Behavioral Medicine: A Cognitive-Behavioral Perspective. New York: Guilford.

Ursin, H., Endresen, I.M., Håland,E.M., & Mjellem, N. (1993). Sensitization: a neurobiological theory for muscle pain. In: H Vaeroy and H. Merskey (Eds.), Progress in fibromyalgia and myofascial pain (pp. 413-417). Amsterdam: Elsevier.

Van Houdenhove, B., Neerinckx, E., Lysens, R., Vertommen,H., Van Houdenhove, L., Onghena, P., Westhovens, R., & D'Hooge, M. (2001). Victimization in chronic fatigue syndrome and fibromyalgia in tertiary care : A controlled study on prevalence and characteristics. Psychosomatics, 42, 21 - 28.

van Vliet, K.P., Willemsen, E.M., Radder, J.K., Lemker, H., & Jacobi, C.E. (1997). Symptom perception and hypoglycemia unawareness in IDDM patients. Gedrag and Gezondheid: Tijdschrift voor Psychologie and Gezondheid, 25, 22-32.

Vassend, O., Krogstad, B.S., & Dahl, B.L. (1995). Negative affectivity, somatic complaints, and symptoms of temporomandibular disorders. Journal of Psychosomatic Research, 39, 889-899.

Wagner , P.J., & Curran, P. (1988). Health beliefs and physician identified "worried well". Health Psychology , 3, 459-74.

Walker, E.A., Keegan, D., Gardner, G., Sullivan, M., Bernstein, D., & Katon, W.J. (1997). Psychosocial factors in fibromyalgia compared with rheumatoid arthritis: Psychiatric diagnoses and functional disability. Psychosomatic Medicine, 59, 572-577.

Walker, E.A., Roy-Byrne, P.P., Katon, W.J., Li, L., Amos, D., & Jiranek, G. Psychiatric illness and irritable bowel syndrome: A comparison with inflammatory bowel disease. American Journal of Psychiatry, 147, 1656-1661.

Watson, D., & Pennebaker, J.W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. Psychological Review, 96, 234-254.

Wessely S, Chalder T, Hirsch S, Wallace P, & Wright D. (1996). Psychological symptoms, somatic symptoms, and psychiatric disorder in chronic fatigue and chronic fatigue syndrome: a prospective study in the primary care setting. American Journal of Psychiatry, 153, 1050-1059.

White, K.P., & Nielson, W. (1995). Cognitive behavioral treatment of fibromyalgia syndrome: A follow-up assessment. The Journal of Rheumatology, 22, 717-721.

White, K.P., Harth, M., Speechley, M., & Ostbye, T. (1999). Testing an instrument to screen for fibromyalgia syndrome in general population studies: The London Fibromyalgia Epidemiology Study Screening Questionnaire. The Journal of Rheumatology, 26, 880-884.

White, K.P., Speechley, M., Harth, M., & Ostbye, T. (1999). The London Fibromyalgia Epidemiology Study: Comparing the demographic and clinical characteristics in 100 random community cases of fibromyalgia versus controls. The Journal of Rheumatology, 27, 1577-1585.

White, K.P., Speechley, M., Harth, M., & Ostbye, T. (1999). The London Fibromyalgia Epidemiology Study: Direct health care costs of fibromyalgia syndrome in London, Canada. Journal of Rheumatology, 26, 885-889.

Whitehead, W.E. & Schuster, M.M. (1983). Gastrointenstinal disorders: Behavioral and physiological basis for treatments. Orlando: Academic Press.

Wilson, H., Olson, W.H., Gascon, G.G., & Brumback, R.A. (1982). Personality characteristics and multiple sclerosis. Psychological Reports, 51, 796-809.

Wise, T.N., & Mann, L.S. (1994). The relationship between somatosensory amplification, alexithymia, and neuroticism. Journal of Psychosomatic Research, 38, 515-521.

Wolfe, F., Smythe, H.A., Yunus, M.B., Bennett, R.M., Bombardier, C., Goldenberg, D., Tugwell, P., Campbell, S.M., Abeles, M., Clark, P., Fam, A.G., Farber, S.J., Fiechtner, J.J., Franklin, C.M., Gatter, R.A., Hamaty, D., Lessard, J., Lichtbroun, A.S., Masi, A.T., McCain, G., Reynolds, W.J., Romano, T.J., Russell, I.J., & Sheon, R.P. (1990). The American College of Rheumatology 1990 criteria for the classification of fibromyalgia. Arthritis and Rheumatism, 33, 160-172.

Wolfe, F., Anderson, J., Harkness, D., Bennett, R.M., Caro, S.J., Goldenberg, D.L., Russell, I.J., & Yunus, M.B. (1997). A prospective, longitudinal, multicenter study of service utilization and costs in fibromyalgia. Arthritis and Rheumatism, 40, 1560-1570.

Woods, D.W., Miltenberger, R.G., & Flach, A.D. (1996). Habits, tics, and stuttering: Prevalence and relation to anxiety and somatic awareness. Behavior Modification, 20, 216-226.

Yunus, M.B. (1992). Fibromyalgia: A dysfunctional syndrome with chronic pain. In F. Sicuteri, L. Terenius, L. Vecchiet, & C.A. Maggi (Eds.), Pain versus Man: Advances in Pain Research and Therapy (vol. 20, pp. 131-140). New York: Raven Press.

Yunus, M.B. (1993). Research in fibromyalgia and myofascial pain syndromes: Current status, problems and future directions. Journal of Musculoskeletal Pain, 1, 23-41.

Yunus, M.B., Ahles, T.A., Aldag, J.C., & Masi, A.T. (1991). Relationship of clinical features with psychological status in primary fibromyalgia. Arthritis and Rheumatism, 34, 15-21.

Yunus, M.B., Masi, A., & Aldag, J.C. (1989). A controlled study of primary fibromyalgia syndrome: Clinical features and associations with other functional syndromes. Journal of Rheumatology, 16 (Suppl.19), 62-71.

Zach, G.A., & Andreasen, K. (1991). Evaluation of the psychological profiles of patients with signs and symptoms of temporomandibular disorders. Journal of Prosthetic Dentistry, 66, 810-812.

Zvaifler, N.J. (1989). Etiology and pathogenesis of rheumatoid arthritis. In D.J. McCart (Ed.), Arthritis and allied conditions: A textbook of rheumatology (11th ed., pp. 659-763). Philadephia: Lea & Febiger.