Understanding the experience of chronic pain: A latent profile analysis of chronic pain in relation to general and mental health

by

Austin Ray Beck

B.S., Brigham Young University, 2012
M.S., Brigham Young University, 2015

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

School of Family Studies and Human Services
College of Human Ecology

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Abstract

Chronic pain is one of the most pervasive healthcare conditions being treated today. The onset of chronic pain can start at any age, and can follow a myriad of trajectories. Health conditions like chronic pain have been shown to be associated with increases in depression, anxiety, and other adverse mental health outcomes. The present study utilized a sample of 10,266 adult individuals with chronic conditions where chronic pain was typically present to identify different profiles of chronic pain sufferers and then examine the associations between general health, chronic pain profile membership, and mental health outcomes. Although previous studies have attempted to identify chronic pain profiles, no study has yet explored how pain frequency and intensity, fatigue, duration of chronic condition, and physical limitations caused by this condition may uniquely identify subgroups within the chronic pain population. Utilizing a latent profile analysis, four distinct profiles of chronic pain were identified, including a Constant Companion profile, an Adjustments Needed profile, an Annoying Companion profile, and a No Limitations profile. Through a path analysis, significant associations were found between both general health and changes in general health, chronic pain profile membership, and frequency of anxious, depressed, and hopeless feelings. Results generally were counterintuitive, with better health linked with higher odds of fitting the more extreme chronic pain profiles compared to the no limitations profile; and those in the more extreme chronic pain profiles had significantly less frequent feelings of depression, anxiety, and hopelessness. Ideas for clinical implications and suggestions for future research are provided.

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Dedication

To Bri – you're one of the strongest people that I know. I don't know where this journey will take us, but my life is infinitely better with you by my side.

Chapter 1 - Introduction

Chronic pain is one of the most pervasive health problems in America today, with over 100 million Americans dealing with chronic pain (Institute of Medicine, 2011). To put this in perspective, chronic pain affects more Americans than diabetes, heart disease, and cancer combined (American Diabetes Association, 2017; American Heart Association, 2011; American Cancer Society, 2017). Chronic pain is one of the most expensive challenges, and the most common reason American adults use healthcare each year (Von Korff, 2013). Chronic pain contributes to over 50 million lost workdays in the United States each year (American Pain Foundation, 2009; NIH, 2010), and is the most common cause of both short- and long-term disability (NIH, 2010). Those with chronic pain have been shown to be more likely to struggle with problems such as depression (Tunks, Crook, & Weir, 2008), anxiety (Breivik et al., 2006), and generally tend to be less healthy (Nahin, 2015). It has been estimated that the annual economic cost of chronic pain in the United States alone, including both direct and indirect costs, is nearly $635 billion (NCHS, 2012; Institute of Medicine, 2011).

Pain is a uniquely individual and subjective experience that can vary greatly depending on biological, psychological, and social factors (Institute of Medicine, 2011). Pain can come from a variety of sources, such as physical injuries (Turner, Cardenas, Warms, & McClellan, 2001) or other health conditions (e.g. arthritis, fibromyalgia, or neuropathy; Aggarwall, 1999; National Fibromyalgia Association, 2016; Sacks, Luo, & Helmick, 2010), as well as from emotional pain stemming from traumatic events, such as witnessing extreme instances of violence or abuse (Roy, 1998). In an effort to better understand and treat chronic pain, researchers have explored medical treatments ranging from less invasive treatments such as stretching and physical therapy, to more invasive treatments such as medications or surgeries

(e.g., Chou et al., 2009). Researchers have also looked at psychological interventions, such as the use of cognitive-behavioral therapy (Turk, 2002) to try to improve the lives of those dealing with chronic pain. Typically, when this type of research is conducted, the inclusion criteria for the sample is based on two different factors: the duration of experiencing chronic pain (e.g., must have experienced pain for longer than 3 months) or a specific type of pain (e.g., those with rheumatoid arthritis or chronic pelvic pain). These factors have important limitations associated with the impact and outcomes of the research. First, although using duration of chronic pain as the inclusion criteria allows for a broader understanding of the pain, it fails to capture the potential differences in individuals with pain from different sources. Second, the focus on a specific type of pain allows for increases in depth of understanding, but lacks generalizability. Regardless of sampling criteria, these specific samples are then used to understand the effects of chronic pain, but these studies are unable to capture the complexity and multifaceted nature of chronic pain. Despite research illustrating the varied etiology and presentation of symptoms that come with chronic pain, minimal research has been conducted examining the link between specific chronic pain characteristic profiles (e.g., source, intensity, frequency, duration) and mental health outcomes. By understanding the similarities and differences between individuals' subjective experiences of chronic pain, we might be able to personalize treatment to the unique needs of those individuals with different presentations and types of pain. This tailored approach could help find answers to what works and what does not in treatment, and better serve a complex problem that affects a wide array of individuals.

In line with the goals above, the purpose of this study is threefold. First, to identify whether there are different profiles of adults with specific chronic conditions where pain is typically present when examined through the lens of pain, fatigue, and physical limitations.

Second, to determine if overall general health, changes in general health, and age are associated with pain profile membership. Third, to investigate whether profile membership probabilities are associated with depression, anxiety, feelings of hopelessness, and reported effort required to perform tasks each day. By exploring the ways in which various pain profiles are associated with different mental health outcomes, we may be better able to identify and develop more specific mental health interventions for this population. These results may ultimately provide new insights into the variability of experience among chronic pain sufferers, how these differences might be associated with various levels of depression and anxiety, and ultimately act as a springboard for developing more nuanced ways to treat the mental health of those suffering from chronic physical conditions where pain is present.

Chapter 2 - Literature Review

Theoretical Foundations

Recognizing the complexity of everything that influences chronic pain, it is necessary to develop working theories that help classify and understand the complexities of physical and mental health symptomology. The gate control theory (Melzack & Casey, 1968; Melzack & Wall, 1965) was the first attempt to develop an integrative model that could account for both the body's physiological responses to pain as well as the potential influence that individual psychology and attitude might have on the way one experiences pain. According to Melzack and Casey (1968), there are three systems that are utilized by the body when processing the pain from a stimulus that is causing damage to body tissue: the sensory-discriminative system (the brain automatically determining which stimuli to recognize and ignore), the motivational-affective system (an individual's attitude and focus influencing which stimuli to recognize), and the cognitive-evaluative system (cognitive process of evaluating the messages received from said stimuli). All three of these systems contribute to the subjective experience of pain in the body. According to gate control theory, whenever the body experiences some sort of peripheral stimuli, such as a gentle touch of the arm or a forceful slap on the back, these three systems interact in such a way that they allow or prevent different types and intensity of pain messages from being sent back to the brain, thus influencing the way pain is perceived. Put another way, the stimuli interact with cortical variables, such as mood or anxiety, in such a way that they are able to influence the mind and body's perception of the painful stimuli.

Although Melzack and Casey's (1968) original intent was to understand how the body and mind interact to processes painful stimuli, they also opened the door to understanding how painful stimuli affect one's brain and mood by highlighting the interplay between physiological

pain and an individual's mental health (Turk & Monarch, 2002). Building on Melzack and Casey's (1968) work, Baliki and Apkarian (2015) provided one potential explanation for how sustained painful stimuli can affect one's mood. In order to understand how pain could influence one's mood, one must first be able to understand different moods from a neurological perspective. Anxiety can be viewed as a sustained state where the sympathetic system is activated in order to promote behaviors that will diminish anticipated dangers in the relatively near future (Baliki & Apkarian, 2015). The sporadic nature of some pain lends itself to increased anxiety, even when there are no painful stimuli present, simply because the anticipation of what is to come is enough to keep the sympathetic nervous system activated. Conversely, Baliki and Apkarian (2015) conceptualized depression as a more global aversion to one's environment (e.g., through social isolation or reduced activity) in order to minimize stimuli and provide some sense of safety from perceived or anticipated pain. This buffering process is more likely to come when painful stimuli are experienced more frequently, since the pain cannot be avoided and therefore must be endured. With that conceptualization, depression and anxiety can be maladaptive processes that are encouraged or maintained by neuropathological mechanisms in order to help the body anticipate sporadic pain and avoid more consistent painful stimuli (Baliki & Apkarian, 2015).

Recognizing the complexity and influence that pain and mental health can have on the experience of pain, it becomes clear that pain and mental health are not considered to be exclusively a somatic or psychogenic experience, but rather a blend of the two (Turk & Monarch, 2002). Melzack and Casey's (1968) gate control theory provides an explanation for the interplay of cognitive and biological factors in pain, and the work of Baliki and Apkarian (2015) and others have provided a framework for understanding pain's influence on one's mental health.

The current study attempts to build on their work by combining the subjective experience of pain, one's view of their general health, and mental health in order to better understand, and ultimately help, those who suffer from chronic pain.

Etiology of Pain

According to the International Association for the Study of Pain (Merskey & Bogduk, 1994), pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (p. 74). Chronic pain becomes more common as people grow older, but this problem can be experienced at any age (NCHS, 2012). Chronic pain can be triggered from a wide variety of events including, but not limited to, health conditions or other genetic sources such as arthritis or fibromyalgia; home, workplace, or automobile accidents; or even through indirect incidents such as witnessing traumatic events (Roy, 2008).

Health conditions. There is a wide variety of medical conditions that can leave a person in pain for an extended period of time. Health conditions can be caused by a person's genetics as well as through a combination of sickness and/or disease. Examples of conditions that could trigger chronic pain include rheumatoid arthritis, fibromyalgia, neuropathy, and other various degenerative diseases. Rheumatoid arthritis is an autoimmune condition that affects the inflammation in the joints and afflicts over 1.5 million people in the United States alone (Sacks, Luo, & Helmick, 2010). Fibromyalgia, a more general umbrella term that can include rheumatoid arthritis, causes pain throughout the body that can manifest as headaches, stiffness, and difficulty sleeping (Wolfe, 2010). Some health conditions, such as rheumatoid arthritis, have greater levels of variability in terms of intensity, but are typically characterized by more frequent episodes of pain as the condition progresses, to the point where the pain can almost become a

constant companion for the person (Walsh & McWilliams, 2014). Other conditions, such as migraines, vary greatly in their frequency, but are typically characterized by intense levels of pain that can be debilitating in an otherwise healthy person (Dalkara & Moskowitz, 2017). Since pain is subjective, the experience of pain can be influenced by previous experience with pain, amount of external stimulation, as well as acute and general mood (Melzack & Casey, 1968). Although there is variability from person to person, medical conditions that include chronic pain have been shown to be associated with higher levels of depression and anxiety (Tunks, Crook, & Weir, 2008),

Accidents. Chronic pain can be triggered by a variety of accidents. Examples of these accidents include traffic accidents, workplace accidents, medical treatments that went poorly, or even accidents around the home. In 2015, there were over 6 million traffic accidents in the United States, and while not all of these led to instances where there was chronic pain, car accidents are a common source of back and neck injuries (Gopinath et al., 2015; National Center for Statistics and Analysis, 2016). Some seemingly minor accidents can leave people with neck and jaw problems that cause episodic or consistent pain for the rest of their lives, whereas other accidents can appear to be catastrophic but ultimately end up leaving no lasting effect on the individual (Haggman-Henrikson, Lampa, Marklund, & Wanman, 2016). In 2015, there were over 2.9 million nonfatal workplace accidents in the United States (Bureau of Labor Statistics, 2016). The most common injury resulting from a workplace accident is a lower back injury, usually as the result of lifting an object or falling at work (Bureau of Labor Statistics, 2016). Accidents and subsequent injuries are especially problematic because they can cause significant limitations at home and at work. Accidents that result in chronic pain can force individuals to miss work, leading to emotional distress and anxiety (NIH, 2010). Low-income and unemployed

populations where the principle wage earner suffers from chronic pain experience a disproportionate amount of stress and anxiety, especially regarding their financial future (D'Arcy & Siddique, 1987; Roy, 2008). Pain that might be debilitating to someone who works as a construction worker, might cause very few limitations for someone who works at a desk job. For that very reason, it is important to understand dimensions of pain may affect the individual rather than simply assuming all pain is the same.

  Indirectly triggered. Chronic pain can be triggered by emotional pain that comes from traumatic events such as abuse or witnessing extreme instances of violence (Roy, 1998). Women with chronic pelvic pain have been found to have experienced significantly higher instances of childhood sexual abuse, especially in cases where doctors have been unable to find a biological reason to explain their pain (Gross et al., 1981; Harrup-Griffiths et al., 1988; Lampe et al., 2003; Walker et al., 1988). Studies have shown a link between stressful life events, depression, and extended chronic lower back pain (e.g., Lampe et al., 2003). As with health conditions and accidents, the intensity, frequency, duration, and limitations that come from indirectly triggered pain can vary greatly. Some chronic pain symptoms can subside with time, allowing a person to eventually lead a life without limitations from pain, but there is no guarantee that this will take place (Green, Flowe-Valencia, Rosenblum, & Tait, 2001). Others, such as those who experience sexual trauma, might experience chronic pain in their pelvic area for the rest of their lives (Lampe et al., 2003). In those cases, some experience a constant pain in their pelvic region, whereas others might only experience such pain when the area in and around their genitals is stimulated (Ayorinde, Macfarlane, Saraswat, & Bhattacharya, 2015).

Ways of Experiencing Pain

Chronic Pain Intensity and Frequency

The most obvious symptom of chronic pain is the pain itself, but there is much more to chronic pain than simply the existence of pain. For some, such as those dealing with chronic migraines, the pain can come intermittently, with periods of relief where the individual does not have the limitations that come when they are dealing with migraine symptoms. For others, such as those dealing with lower back injuries, the pain might be more consistent, but lack the level of pain intensity that the migraine sufferer has to deal with. Pain interferes with one's abilities to perform daily activities (e.g., Putzke, Richards, Hicken, & DeVivo, 2002), and that interference becomes particularly pronounced as the frequency and intensity of the pain increases (Osborn, Jensen, Ehde, Hanley, & Kraft, 2007). As pain intensity increases, it can become more difficult to ignore the pain and carry on with daily tasks (Crombez, Viane, Eccleston, Devulder, & Goubert, 2013). Increases in pain intensity have been shown to be associated with more fearful thinking about the pain, fewer positive emotions, and more pervasive negative emotions (Crombez et al., 2013).

Meredith and colleagues (2006) found that individuals with higher levels of pain self-efficacy, which is their belief in their own ability to handle the pain, reported lower levels of pain intensity for different conditions where pain is typically present. That is to say, those that believe they can handle pain reported experiencing less-intense pain compared to those with lower levels of pain self-efficacy. It should be noted that this association was no longer significant as the duration of pain increased. In fact, they found that as the frequency of pain increased, there was a decrease in an individual's belief in their own abilities to handle the pain (Meredith, Strong, & Feeney). Recognizing the interplay between pain and a person's thoughts and beliefs about their

own abilities, it comes as no surprise that increases in pain frequency, as well as pain intensity, have been associated with increases in a variety of negative mental health outcomes (Turk, Crook, & Weir, 2008). It is important to note that pain frequency and intensity can vary greatly from condition to condition as well as from person to person when considering the same condition. Regardless of the source of pain, the frequency and intensity of pain experienced can vary from individual to individual, and are almost always associated with adverse outcomes in many areas of an individual's life (e.g. Putke, Richards, Hicken, & DiVivo, 2002).

Chronic Pain Duration

Simply put, as chronic pain persists there tends to be an increase in the number of comorbid symptoms that will affect the chronic pain sufferer's life (e.g., Dahan, Shir, Velly, & Allison, 2015). Increases in duration of chronic pain have been shown to be associated with increases in pain catastrophizing and distress as well as decreases in perception of spousal support when dealing with one's pain (Cano, 2004). Interestingly, if pain intensity and duration contribute to comorbid symptoms, and people tend to experience more pain as they age, one could speculate that older adults are destined to have cycles of pain and negative comorbid conditions; however, this is not always the case. According to Boggero and colleagues (2015), older adults seem to be remarkably adept at psychologically coping with pain, especially compared to younger adults. By comparison, older adults report at least as good or better quality of life, marital satisfaction, social satisfaction, and mood, despite experiencing higher levels of chronic pain intensity as well as duration (Cook & Chastain, 2001; Rustøen et al., 2005; Sorkin, Rudy, Hanlon, Turk, & Stieg, 1990; Thomas, Peat, Harris, Wilkie, & Croft, 2004).

Frequency of Fatigue

The discomfort of pain is only one small aspect of the experience of chronic pain. In a study surveying chronic pain sufferers about their experience with chronic pain, Turk and colleagues (2007) found fatigue to be one of the most important aspects of chronic pain that significantly affected their lives. The authors went on to highlight that chronic pain influences quality of sleep, feelings of weakness when awake, as well as increasing overall fatigue experienced by the individual. One difficult part about the fatigue experienced by those with chronic pain is the fact that it can feel overwhelming and uncontrollable (Hewlett et al., 2005). These researchers found that patients reported feeling as if they had no influence over the amount of fatigue that they experienced, regardless of the amount of sleep that they got each night, and became frustrated with the lack of control in their lives. Chronic fatigue has been associated with mental health such as depression (Craig et al., 2013). Pollard, Choy, Gonzalez, Khoshaba, & Scott (2006) found that fatigue and symptoms of depression were indicators of pain in certain populations, and that these symptoms tended to become so intertwined that it can became difficult to distinguish them from one another.

Physical Limitations

Chronic pain can lead to a variety of physical limitations including, but not limited to, difficulty standing up, walking short distances, lifting objects, or reaching overhead (Waddell et al., 1992). A common misconception is that the majority of chronic pain sufferers are found in the elderly population, when in reality, the average chronic pain sufferer is somewhere in their mid-to-upper-forties (Thomas and Roy, 1999). This means the average chronic pain sufferer is an adult who could be in the middle of their career or someone who might have multiple children still living at home. In order to fully understand how chronic pain affects an individual's life, it is

important to understand the context that a chronic pain sufferer is living in, as well as the limitations experienced by the chronic pain sufferer. Chronic pain can delay or eliminate the ability to complete basic household tasks such as cleaning, laundry, or yard work (Turk & Gatchel, 2013; Smith, 1998). These limitations can come from limitations in mobility (e.g., walking, bending, lifting, rotating) as well as from pain that becomes emotionally overwhelming for the person (Björnsdóttir, Jónsson, & Valdimarsdóttir, 2013; Smith, 1998). The number of limitations caused by chronic pain is not contingent on the intensity of pain. Those with less intense chronic pain can still have difficulties leaving home to attend events or spend time with friends, essentially isolating themselves from others due to their inability to engage with others in ways that they could in the past (Smith, 1998). The physical limitations stemming from chronic pain can become some of the most emotionally difficult parts of the chronic pain, forcing an individual to alter their life in such a way that they lose a part of their identity and independence (Boss, 2006).

General Physical Health and Chronic Pain

Previous research examining chronic pain has highlighted the varied and pervasive effects that chronic pain has on general health, and vice versa. Researchers have found that chronic pain is associated with poor sleep quality (Graham & Streitel, 2010), deterioration in physical performance (Bryant et al., 2007), and decreases in self-rated health (Gureje, Von Korff, Simon, & Gater, 1998; Mantyselka, Turunen, Ahonen, & Kumpusalo, 2003). Chronic pain sufferers have an increased rate of deterioration in overall physical functioning when compared with those not dealing with chronic pain. Decreases in overall physical health has been associated with worse chronic pain symptoms in those already experiencing chronic pain (Blyth, Cumming, Brnabic, & Cousins, 2008). Additionally, chronic pain indirectly affects general

health via increases in functional limitations that can keep people from exercising or participating in other health-promoting behaviors (Bryant et al., 2007). Chronic pain sufferers were even found to have an increased risk of death compared to those who do not have chronic pain (Smith, Wilkie, Uthman, Jordan, & McBeth, 2014). The present study seeks to understand associations between general health and the various profiles chronic pain experience.

Types of Chronic Pain and Mental Health Outcomes

Given challenges with physical pain and financial strain, it should come as no surprise that chronic pain has been shown to be associated with adverse mental health outcomes. Those who experience chronic pain are more likely to report an increase in a wide variety of negative mental health outcomes, such as depression and anxiety (Tunks, Crook, & Weir, 2008). Chronic pain has been shown to be associated with increases in both the frequency and intensity of symptoms of anxious and depressive symptoms reported by chronic pain sufferers and their partners (Bair, Robinson, Katon, & Kroenke, 2003). Chronic pain often threatens the way a person sees himself or herself, who they are in the world, and the meaning that they are able to find in their daily life (DeZutter, Luyckx, & Wachholtz, 2015). Experiencing chronic pain can often require a re-evaluation and revision of the goals and expectations that one has for their own life (Pinquart, Silbereisen, & Froehlich, 2009). Indeed, the life of a chronic pain sufferer is one that is a life familiar with loss and adjustments. One of the most painful parts of chronic pain is the seemingly continual disappointment that accompanies losing a sense of oneself and lowered expectations for what life can become (Boss, 2006).

Baliki and Apkarian's (2015) conceptualization of depression and anxiety as the body's maladaptive responses to try and provide a sense of safety from perceived or anticipated pain offers a framework to understand the relationship between chronic pain, depression, and anxiety.

One could speculate that increases in any metric of pain – intensity, frequency, duration, or limitations – would be associated with increases in depression and anxiety, but we are unclear about how these chronic pain components all fluctuate together. It is possible that the anxiety associated with anticipating potential pain will actually increase as frequency decreases since it is the anticipation and not the actual pain itself that might be causing the anxiety. It is also possible that depression increases as limitations increase because new limitations come with a sense of violated expectations for the life initially planned (Boss, 2006). Conversely, evidence has shown that depression and anxiety are more likely to be reported by those who experience chronic pain than those who do not (Tunks, Crook, & Weir, 2008). This is an argument used to support the idea that higher levels of any pain metric should be associated with increases in depression and anxiety, and that decreases in chronic pain would have the opposite effect. Yet, there are some who experience pain at higher levels of intensity, at greater frequency, with relatively more limitations than other pain sufferers, and yet these individuals do not seem to experience the same adverse mental health outcomes. With so many options for variability within an individual, this study seeks to identify unique profiles of subgroups of chronic pain sufferers, thereby providing greater insight into the experience of chronic pain and its association with mental health outcomes.

Person-Centered Approach to Chronic Pain

Variable-centered studies allow researchers to look at how variables are able to predict outcomes "separately and across people" whereas person-centered approaches to studying chronic pain allow variables to operate "conjointly and within people to shape outcomes" (Gabriel, Daniels, Diefendorff, & Greguras, 2014, p. 3). In other words, rather than examining variable correlations within the context of the entire sample, we are now able to look at

correlations within unique subsamples of the population in order to discover potential subgroups that fare better than others in a variety of outcomes. A latent profile analysis is a specific type of a person-centered approach that identifies subgroups of individuals within a population who share similar configurations for a given set of identified continuous and/or categorical variables.

With chronic pain, consider the limitations of looking only at those who have been identified as having chronic pain, but then looking only at correlations between duration of chronic pain with depression and anxiety outcomes. It would be possible that two people have been experiencing chronic pain for nearly identical amounts of time, but vary greatly in terms of intensity of pain experienced, the frequency in which their chronic pain bothers them, and the number of limitations that this chronic pain imposes in their lives. By controlling for these additional variables in the traditional sense, researchers would be able to provide greater richness to their study, but they would still fall short in their ability to account for the interplay between different chronic pain variants to see how they predict various outcomes.

For example, consider a male construction worker who suffered a lower-back injury six months ago. In the weeks immediately following the accident, he was experiencing pain that he rated an eight out of 10, with one being no pain and 10 being the worst pain of his life, almost every hour of the day. He was unable to work for three weeks, but eventually the pain subsided and now he is able to work again with little to no pain at all. He has to be mindful of the way he works because one misstep or ill-advised move causes his pain to spike back up to an eight out of 10 and he is forced to lay in bed for days in order to recover. This worker has been with the company for years and is close to becoming a foreman, which means he will eventually be able to work at a desk and stay with the company until he retires. Now compare that experience of pain to a female concert pianist that has been showing signs of rheumatoid arthritis in her hands

for the past six months. She has been experiencing an increased amount of stiffness and aching in her hands that make it difficult to perform her job. This pianist reports that the intensity of her pain is typically a two or three out of 10 each day and that she has been in pain almost every day for the past six months. The pianist is aware that this condition will eventually force her to give up her occupation and is very worried about her future.

Researchers narrowly focusing on the duration of chronic pain might consider these two cases to be similar, due to both people reporting chronic pain for the past 6 months. However, that assessment would fall short in capturing the context in which this chronic pain is experienced. The construction worker experiences pain with high intensity and low frequency leading to a large number of limitations when the pain is present. Conversely, the pianist experiences low intensity pain at a high frequency and the number of limitations will rise and eventually force a change of career as symptoms increase. It stands to reason that these two individuals, both view and experience their chronic pain differently, and that treating them as if they are the same, limits researchers in their potential for gaining greater insights into how chronic pain affects individuals and their mental health. Those who experience or study chronic pain understand that chronic pain experiences can vary greatly (e.g., Dunn, Jordan, & Croft, 2006). By identifying different subpopulations of chronic pain sufferers based on a variety of elements of their experiences, it is possible to provide more custom interventions and nuanced approaches in our attempts to help chronic pain sufferers manage, and potentially improve their chronic pain conditions.

Profiles of Chronic Pain

Previous studies used a latent class or latent profile analysis of chronic pain, but these studies are not without their shortcomings. Many studies have focused on pain itself, but related

only to on one specific type of chronic pain, lacking generalizability that would allow findings to be applied to other types of chronic pain. One example of this would be Dunn and Colleagues' (2006) study using a latent class analysis to examine the course of pain for those suffering from lower back pain. In their investigation they identified four classes of chronic back pain, namely "persistent mild", "recovering", "severe chronic", and "fluctuating". Both pain frequency and intensity were used when identifying these classes, and the classes were focused specifically on the pain, but the narrow focus on one specific form of chronic pain limits the applicability of the findings. Hartvgsen and colleagues (2013) chose to take a broader approach by focusing specifically on musculoskeletal pain in a mixed sample of those with and without chronic pain. These authors used the location of a participant's pain as their primary indicators for class. Two latent classes emerged from their study: one class consisting of individuals with site-specific pain, and one class consisted of individuals complaining of diffused pain throughout their body. Both the Hartvigsen and colleagues (2013) and the Dunn, Jordan, and Croft (2006) studies provided a strong focus on pain, but lacked consideration for mental health factors.

Others have taken a broader view like Hartvigsen and colleagues (2013) when classifying pain, using samples that included participants experiencing a variety of different types of pain, or a mixed sample with chronic and non-chronic pain participants. Some of these studies have even begun to incorporate mental health indicators, with varying levels of success. Although these studies have provided more generalizable findings, often times they either do not incorporate non-pain related indicators to classify the pain, or they broaden the classes to the point where they are no longer looking only at indicators related to chronic pain. In one such study, Banta-Green and colleagues (2009) examined opioid use, mental health, and pain of chronic pain patents. In order to be included in this study the participant needed to be using opioids

chronically. The following pain classes emerged: a Typical class with persistent, moderate

mental health and pain symptoms; an Addictive group with elevated mental health symptoms

and problems with opioid use, but pain similar to the Typical class; and the Pain Dysfunction

group with significantly higher pain interference along with elevated mental health and opioid

problems. This study included a sample with a variety of sources of chronic pain while capturing

a more complete picture for how pain might influence mental health and potentially drive

addiction, but their sampling was limited to those who were chronically using opioids, which is a

distinct group that typically has higher levels of pain.

Fenton and colleagues (2015) improved on previous studies by incorporating

biopsychosocial factors when identifying classes and profiles of chronic pelvic pain, and by

using these factors as the primary indicators for the different classes. Biopsychosocial domains

used as indicators included pain, negative affect, fatigue, and social functioning. By using

indicators such as negative affect, fatigue, and social functioning, Fenton and colleagues

acknowledged and began to capture the effects of pain that extend beyond the experience of pain

itself. In their study, they identified four distinct classes of chronic pelvic pain: "No

Dysfunction", "Low Dysfunction", "Moderate Dysfunction", and "High Dysfunction". Each

class name references the level of biopsychosocial dysfunction experienced by members of that

specific group. Although Fenton and colleagues (2015) examined pain and other key indicators

highlighting the experience of chronic pain, they did not explore how class membership might be

associated with specific mental health outcomes. Similarly, they did not explore more acute

experiences of distress, such as feelings of hopelessness or depression to the point of apathy.

The Present Study

The present study seeks to extend research by Fenton and colleagues (2015) by answering three research questions. First, are there multiple latent profiles of adults who experience pain in similar ways when viewed through the lens of pain frequency, pain intensity, duration of chronic condition, fatigue, and limitations caused by these chronic conditions? Second, are age, general health status, and recent changes in general health status associated with chronic pain profile membership probabilities? Third, are chronic pain profile membership probabilities associated with frequency of depressive or anxious feelings, feelings of hopelessness, or feelings that everything in their life requires effort? To my knowledge, this will be the first study taking a broad view of chronic conditions where pain is typically present, identifying profiles within this population regarding both the frequency and intensity of pain, frequency of feeling fatigued or exhausted, the duration of the chronic condition, and the limitations caused by one's chronic condition.

Chapter 3 - Method

Sample and Procedure

To accomplish the purposes of this study, participant responses from the 2012 National Health Interview Survey (NHIS), a yearly survey of United States civilians living in the community, as opposed to a care facility, were used (NCHS, CDC, 2012). The 2012 NHIS survey was a part of an ongoing project designed to use a cross-sectional multistage area probability design to gather nationally representative data from U.S. households each year. After dividing the country into geographical units, smaller subsections were made from within each unit and families being randomly selected from within these smaller subsections to be invited to be interviewed. For the 2012 interview sample, 42,366 households, consisting of 108,130 people in 43,345 families across the country were identified and invited to participate. The total household response rate for the survey was 77.6%. The total response rate for the sample adult component was 61.2%. All information in the study was gathered via face-to-face interviews, telephone interviews, and computer-assisted personal interviews (CAPI, filled out by individuals and representatives of the household).

The NHIS survey consists of multiple questionnaires with each questionnaire focusing on a different aspect of health or a different subpopulation within the family. Core NHIS questionnaires were distributed to every participant in the study wherein participants were asked to provide information about their demographics, general overall physical and mental health, and their current and previous health problems. Clustered sample design was used to create geographically, racially, and economically nationally representative sub-groups within the sample. Sub-level surveys were given to various sub-groups in order to gather information about things such as levels of functioning and disability, injuries, and practices involving alternative

medicine. To accomplish the purposes of the current study, we used participants' responses to the Sample Adult (core survey) and the Adult Functioning and Disability (sub-level survey).

Inclusion criteria for this study included being 18 years of age or older and having at least one of the following conditions that has been classified as a chronic pain: arthritis or rheumatism problem; a back or neck problem; a nervous system or sensory organ condition; a musculoskeletal or connective tissue problem; a problem stemming from the after effects of a surgical procedure or medical treatment; an old age, elderly, or aging related problem; or a problem with some other injury. In order for a condition to be considered chronic, the condition must either be incurable, or have lasted at least 3 months (NIH, 2012, Turk, 2010). Of the original 108,130 participants completing the NHIS (80,114 participants ages 18 and over), 10,266 participants met inclusion criteria and were included in the current study.

Among the 10,266 participants in this operational sample, approximately 61% identified as female, and 39% identified as male. The average age of the participants was 50.02 ($SD =$ 17.53) years old, with responses from every age from 18 to 85+. The majority of the sample identified as White (78.4%); with 14.6% identifying as Black/African American; 1.4% as Indian (American), Alaska Native; 0.8% as Asian Indian; 4.2% as either Chinese, Filipino, or other Asian including Korean, Vietnamese, Japanese, and other Asian subgroups; and 0.4% identifying as multiple race with no primary race selected. In terms of marital status, 42.1% of the participants were married, 10.4% were widowed, 15.9% were divorced, 21.4% had never been married, 6.7% were living with their partner, and 3.6% were separated from their partner. Of those that responded to questions about total annual income, 27.2% reported their income being $14,999 or less, 16.9% reported making $15,000 - $24,999, 24.9% reported making $25,000 - $44.999, 15% reported making $45,000 - $64,999, and 16.1% reported making at least $65,000

per year. Regarding general health, 16.7% of the sample reported being in excellent health, with 26.8% indicating they were in very good health, 31.1% in good health, 18.3% in fair health, and 7.1% reporting they were in poor health. With respect to their health compared to twelve months prior, 21% reported they were in better health, 64.2% reported they were about the same, and 14.8% reported they were in worse health.

Measures

Latent Profile Analysis Indicators

Pain frequency. Chronic pain frequency was assessed using self-reported pain measures looking at the previous 3 months. Measures were created and validated by the Washington Group on Disability Statistics, under the direction of the United Nations Statistical Commission, through cognitive testing and pilot surveys in the United States and internationally (Madans & Loeb, 2013; Madans, Loeb, & Altman, 2011). Participants responded to the question "In the past 3 months, how often did you have pain? Would you say never (0), some days (1), most days (2), or every day (3)?" Higher scores indicated that pain was experienced more frequently compared to those with lower scores.

Pain intensity. Chronic pain intensity was assessed using self-reported pain measures looking at the respondents' most recent incident of pain. Participants responded to the question "Thinking about the last time you had pain, how much pain did you have? Would you say a little (1), a lot (3), or somewhere in between (2)?" Again, higher scores indicated greater intensity of pain the last time they were in pain.

Fatigue. Fatigue was assessed using a single self-report item. Participants were asked, "In the past three months, how often did you feel very tired or exhausted?" Participants could

respond using a scale ranging from 0 (*never*) to 3 (*everyday*). Higher scores indicated a greater frequency of experiencing feelings of fatigue or exhaustion.

Duration of chronic condition(s). Sources of chronic conditions where pain is typically present was assessed using an identical question stem was used for each condition. Participants were asked, "How long have you had _____" with each condition being assessed using a separate question. Participants were asked about conditions including "arthritis or rheumatism", "a back or neck problem", "musculoskeletal or connective tissue problems", "nervous system or sensory organ problems", "surgical after effects or medical treatment problems", "old age, elderly, or aging problems", and "other injury conditions". Possible responses included 1 (*less than 3 months*), 2 (*3-5 months*), 3 (*6-12 months*), and 4 (*more than 1 year*), with responses of 2 and above being considered chronic and recoded into a dichotomous variable (0 = *not chronic*, 1 = *chronic*). The dichotomous variable classifying the condition as either chronic or not chronic was used to create the sample for the current study.

Duration was also assessed using the same question, "How long have you had _____" for each condition being assessed, with a new set of potential responses. With this question, responses ranged from 0 (*less than 1 year*) to 85 (*85+ years*). This scale was used to create the duration variable used to the duration of chronic condition variable for the analysis. Since participants could potentially have multiple conditions that contributed to their chronic pain, the condition that had the highest number of reported years was used as their duration indicator. For example, if a participant had been dealing with arthritis for 15 years, and fibromyalgia for 2 years, the 15-year duration would have been used as their score for duration of time with a chronic condition.

Limitations from chronic condition(s). Participants were asked to respond to 12 questions in order to assess the type of limitations that they experienced as well as the source of their limitations. An identical question stem was used for each question ("By yourself, and without using any special equipment, how difficult is it for you to…"), with each question assessing a different potential limitation. Questions assessed for limitations ranging from an individual's ability to "walk a quarter mile – about 3 city blocks?" and "stoop, bend, or kneel?" to "go out to things like shopping, movies, or sporting events?" and "do things to relax at home or for leisure (reading, watching TV, sewing, listening to music)?". Participants responded using a 5-point scale ranging from 0 (*not at all difficult*) to 4 (*can't do at all*). Higher scores indicated greater severity of limitations. Due to the large dataset and the constraints of the analysis software with such a large model, the limitations scores needed to be simplified from 12 unique measures to a single composite score of limitations. Thus, the mean of these responses to limitations was computed, where higher scores represented higher limitations ($\alpha = .93$).

Predictors of Latent Profiles of Pain

Age. Age was accounted for using a single-item asking participants to report their age in years.

Sex. Sex was coded as 1 (*male*) or a 2 (*female*).

General physical health. To evaluate the general physical health of each participant, a single-item evaluating general health was used. Participants were asked "Would you say your health in general is excellent (5), very good (4), good (3), fair (2), or poor (1)?" with higher scores indicating better general health.

Change in general physical health. In order to be able to evaluate a change in an individual's general physical health over the past twelve months, participants were asked,

"Compared with 12 months ago, would you say your health is better, worse, or about the same?" Participants could respond using a 3-point Likert scale, with possible responses being recoded as 1 (*worse*), 2 (*about the same*), or 3 (*better*).

Outcomes

Depression frequency. In order to assess how frequently chronic pain sufferers experienced feelings of depression, participants were asked to respond using a scale to a single-item. Participants were asked the question "How often do you feel depressed? Would you say daily, weekly, monthly a few times a year, or never?" Responses were recoded so that 0 (*never*) indicated an absence of symptoms whereas 4 (*daily*) indicated experiencing depressive feelings more frequently.

Anxiety frequency. Similar to the depression variable, participants were asked to respond to a single-item assessing the frequency in which they experience anxiety. Participants were asked the question "How often do you feel worried, nervous, or anxious? Would you say daily, weekly, monthly a few times a year, or never?" Responses were recoded so that 0 (*never*) indicated an absence of symptoms whereas 4 (*daily*) indicated experiencing worried, nervous, or anxious feelings more frequently.

Feelings of hopelessness. Acute feelings of hopelessness were assessed using a single question, "During the past 30 days, how often did you feel hopeless?" The responses were recoded so that possible answers ranged from 0 (*none of the time*) to 4 (*all of the time*).

Everything requires effort. Perception of effort required for tasks was assessed using a single question "During the past 30 days, how often did you feel everything was an effort?" The

responses were recoded so that possible answers ranged from 0 (*none of the time*) to 4 (*all of the time*).

Analytic Plan

To answer the research questions, two models were run, both using Mplus 8 (Muthén & Muthén, 2012). In the first model, profile membership was determined using a latent profile analysis, with pain frequency, pain intensity, fatigue, duration of chronic condition(s), and limitations from chronic condition(s) being used as indicators of profile. Predictors of profile membership included age, sex, general physical health, and change in general physical health. In the second model, chronic pain profile memberships were assigned to each participant based on estimated posterior probabilities, and then associations between predictors of chronic pain profiles, chronic pain profiles, and mental health outcomes were determined. Predictors of profile membership included age, sex, self-report of general physical health, and change in general physical health. Mental health outcomes included depression, anxiety, feelings of hopelessness, and feelings that everything requires effort (see Figure 7).

Using a person-centered approach, namely a latent profile analysis, allowed for the examination of the way sets of variables cluster together among various individuals (Bauer & Shanahan, 2007). In order to do this, iterative tests were conducted to compare two profile, three profile, four profile, and five profile models. In order to determine which model best fit the data, the Akaike's Information Criterion (AIC), the Bayesian information criterion (BIC; Schwartz, 1978), the adjusted BIC (ABIC; Sclove, 1987), the Lo-Mendell-Rubin Likelihood Ratio Test (LMR; Lo, Mendell, & Rubin, 2001), and entropy scores were all used to evaluate model fit. Lower values for the AIC, BIC, and ABIC indicate better model fit, whereas higher values for entropy will indicate a better fit to the data. Better model fit indicates that the current number of

profiles fits the data better than alternative models with worse model fit. The LMR is a test used to compare the model fit for the current model with a model that has one fewer number of profiles. A significant LMR value ($p < .05$) indicates that the current model fits the data significantly better than a model with one less profile.

As mentioned previously, once the number of profiles has been identified, posterior probabilities were used to assign each participant to a single profile. Dummy codes were created for the profiles within a path analysis, including the health predictor variables and the mental health outcomes variables. All data were analyzed using full-information maximum likelihood (FIML) estimation in order to better handle missing data, rather than using listwise deletion, pairwise deletion, or mean imputation – all of which can lead to losing valuable richness in the data (Peters & Enders, 2002).

Chapter 4 - Results

Bivariate correlations, means, and standard deviations for all variables in the model can be viewed in Table 1. A latent profile analysis and path analysis were used to answer all three research questions in this study.

Latent Profile Analysis

To answer research question 1, a latent profile analysis was run with 2-, 3-, 4-, and 5-profile solutions. The indicators of model fit for each solution can be viewed in Table 3. Examination of the Lo-Mendell-Rubin Likelihood Ratio Test (LMR) revealed that the 4-profile model was significantly better than the 3-profile model ($p < .001$), and that the 5-profile model was significantly better than the 4-profile model ($p < .01$). Entropy for the 4-profile model (.94) was equivalent for the 3-profile model (.94), while the entropy value for the 5-profile model dropped significantly (.79). AIC, BIC, and ABIC were all higher for the 4-profile model when compared to the 3-profile model, but only slightly lower than for the 5-profile model. When viewed in totality, these statistical indicators provided evidence that a 4-profile model was the best fit for the data.

The four profiles that were revealed through the LPA are shown in Figure 1. The four profiles were named in reference to the inferred relationship they have with pain, including the: *Constant Companion* profile, the *Adjustments Needed* profile, the *Annoying Companion* profile, and the *No Limitations* profile. Of the 10,266 participants included in the analysis, 577 (5.6%) were members of the constant companion profile (profile 1), 1,105 (10.7%) were members of the adjustments needed profile (profile 2), 1,425 (15.1%) were members of the annoying companion profile (profile 3), and 7,178 (69.8%) were members of the no limitations profile (profile 4). In the constant companion profile, participants reported the highest average score on every

indicator used to determine profile membership. These were the participants that reported being in pain most days, experienced the greatest amount of pain the last time they were in pain, were very tired to the point of feeling exhausted on most days, had the longest average length of time for being diagnosed with a chronic condition (18.7 years), and reported that, on average, their condition made it very difficult to complete a variety of basic household and social tasks. In other words, the pain and exhaustion experienced by this group was frequent, had been a part of their life for an extensive period of time, and limited their ability to complete common tasks on an almost daily basis.

Participants in the adjustments needed and annoying companion profiles had comparable, but relatively lower scores on every predictor of profile membership, with the adjustments needed profile scoring higher on every indicator, with the exception of pain intensity, compared to the annoying companion profile. Members in both of these profiles reported experiencing pain on some days each week, moderate levels of pain last time they were in pain, and that they both were very tired or exhausted on some days each week. Participants in the adjustments needed profile had been first diagnosed with a chronic condition an average of 17.11 years before taking the survey, whereas the annoying companion profile participants reporting being first diagnosed with a chronic condition an average of 14.76 years before taking the survey. Finally, the adjustments needed profile reported that their chronic condition made it somewhat difficult for the individual to complete basic household and social tasks, whereas the annoying companion profile reported that their condition made it "only a little difficult" to complete these same tasks.

The no limitations profile reported the lowest average score on every indicator of profile, including an average score of nearly zero (not at all difficult) for all of the limitation questions. These participants had a chronic condition for an average of 11.14 years, experienced pain on

some days of the week, and were tired or exhausted on some days over the past 3 months, but these conditions did not seem to limit them in their life.

Mean Comparisons

After using the highest posterior probabilities to assign each participant to a single profile, mean-level difference tests were conducted to compare the four profiles of people with chronic conditions where pain is typically present. The assumption of homogeneity of variance was tested using Levene's statistic and found to have been met for all of the variables with the exception of the variable measuring the intensity of pain the last time the individual experienced pain. In order to compare means for this variable, Welch's test was used to test differences between groups, and the Games-Howell post-hoc test was used to examine the mean comparisons. All of the results of these mean differences between profiles can be viewed in Table 3. All five indicators had at least one significant mean different between the four profiles. The complete results from these mean difference tests between profiles can be viewed in Figures 2 – 6. All means were significantly different with the exception of the pain intensity variable, where the no limitations, annoying companion, and adjustments needed groups did not significantly differ in terms of group means ($p < .01$).

Path Analysis

In order to answer research questions 2 and 3, profiles were assigned to individual participants using posterior probabilities and then dummy coded so that meaningful comparisons could be made. Profiles 1 (constant companion), 2 (adjustments needed) and 3 (annoying companion) were used in the analysis, thereby allowing profile 4 (no limitations) to serve as the reference group. This path analysis was a just-identified model, with no degree of misfit between the raw data and the specified model (Kline, 2011). All but two of the direct paths from

predictors to profile membership were significant (see Figure 7). A one unit increase in overall general health was associated with a 3.24-fold increase in the odds of being in the constant companion profile (b = 1.18, p < .001 OR: 3.24), a 61% reduction in the odds of belonging in the adjustments needed profile (b = -.95, p < .001 OR: .39), and a 32% reduction in the odds of being in the annoying companion profile (b = -.38, p < .001 OR: .68), relative to the no limitations profile.

A one unit increase in improvement of individuals' change in overall health was associated with a 1.56-fold increase in the odds of being in the constant companion profile (b = .44, p < .001 OR: .68), and a 13% reduction in the odds of belonging in the adjustments needed profile (b = -.14, p < .05 OR: .87), relative to the no limitations profile. Change in overall health was not significantly associated with membership in the annoying companion profile.

Compared to being a man, being a woman was associated with a 37% reduction in the odds of being in the constant companion profile (b = -.46, p < .001 OR: .63), and a 46% increase in the odds of belonging in the adjustments needed profile (b = .38, p < .001 OR: 1.46), relative to the no limitations profile. Being a woman was not significantly associated with membership in the annoying companion profile.

A one unit increase in age was associated with a 4% decrease in the odds of being in the constant companion profile (b = -.05, p < .001 OR: .96), a 3% increase in the odds of belonging in the adjustments needed profile (b = .03, p < .001 OR: 1.03), and a 2% increase in the odds of being in the annoying companion profile (b = .02, p < .001, OR: 1.02), relative to the no limitations profile.

Profile Membership and Mental Health Outcomes

Being a member of the constant companion group was significantly associated with all four of the mental health outcomes in the model. Interestingly, being a part of the constant companion profile was associated with less frequent feelings of anxiety ($\beta = -.25$, $p < .01$), depression ($\beta = -.28$, $p < .001$), and hopelessness ($\beta = -.31$, $p < .001$), along with less frequent feelings that everything in one's life requires effort ($\beta = -.41$, $p < .001$). Similarly, being a member of the adjustments needed group was associated with less frequent feelings of hopelessness ($\beta = -.10$, $p < .001$) along with less frequent feelings that everything in one's life requires effort ($\beta = -.09$, $p < .001$). Membership in the annoying companion profile was also associated with less frequent feelings of hopelessness ($\beta = -.15$, $p < .001$) along with less frequent feelings that everything in one's life requires effort ($\beta = -.18$, $p < .001$). Memberships in the adjustments needed profile and the annoying companion profile were not significantly associated with the frequency of feeling anxious or depressed.

It is worth noting that there were significant associations in the model between the predictors of profile membership and the mental health outcomes. Increases in age were associated with decreases in feelings of depression ($\beta = -.15$, $p < .001$), anxiety ($\beta = -.23$, $p < .001$), hopelessness ($\beta = -.19$, $p < .001$), and feelings that everything requires effort ($\beta = -.21$, $p < .001$). Increases in general health scores were associated with decreases in feelings of depression ($\beta = -.24$, $p < .001$), anxiety ($\beta = -.14$, $p < .001$), hopelessness ($\beta = -.22$, $p < .001$), and feelings that everything requires effort ($\beta = -.22$, $p < .001$). Improvements in one's general health over the past 12 months were associated with decreases in feelings of depression ($\beta = -.06$, $p < .01$), anxiety ($\beta = -.05$, $p < .05$), hopelessness ($\beta = -.10$, $p < .001$), and feelings that everything requires effort ($\beta = -.06$, $p < .001$). Finally, being female was associated with increases in

feelings of depression (β = .07, p < .01), anxiety (β = .09, p < .001), hopelessness (β = .03, p <

.01), and feelings that everything requires effort (β = .03, p < .01).

Chapter 5 - Discussion

This study represents the effort to build on the research of Fenton and colleagues (2015), Dunn and colleagues (2006), Hartygsen and colleagues (2013), and others, by furthering the efforts to not only identify traits and profiles of chronic pain sufferers, but also look at potential predictors for profile membership as well as potential mental health outcomes that might be associated with each profile membership. Similar to Fenton and colleagues (2015) and other studies conducted by fellow researchers using different indicators to identify profiles of chronic pain sufferers, four profiles of chronic pain sufferers were identified. This study is unique in that profiles were established based on patterns of pain frequency and intensity, fatigue, limitations, and duration of chronic pain. These profiles of unique ways people experience pain were then predicted by several assessments of general health.

The present study was conducted in an effort to answer three research question. First, are there profiles of adults with specific chronic conditions where pain is typically present when people are viewed through the lens of pain frequency, pain intensity, duration of chronic condition, fatigue, and limitations caused by said chronic conditions? Second are age, general health status, and recent changes in general health status associated with chronic pain profile membership probabilities? Third, are chronic pain profile membership probabilities associated with frequency of depressive or anxious feelings, feelings of hopelessness, or feelings that everything in their life requires effort?

Profiles of Chronic Pain

Previous studies have already established the link between chronic pain and adverse mental health outcomes (e.g. Tunks, Crook, & Weir, 2008), but the current study is the first to use these specific indicators in a person-centered approach to examine these relationships. With

the exception of the adjustments needed and annoying companion profiles pain intensity scores, each profile followed similar trajectories without any overlap. Put another way, those in the constant companion profile (profile 1) had the highest mean scores on all indicators, those in the adjustments needed profile (profile 2) had the second highest mean scores on all indicators, and a similar pattern for those in the annoying companion profile (profile 3) and no limitations profile (profile 4). The only exception to this was those in the annoying companion profile (profile 3) having a higher mean score than the adjustments needed profile (profile 2) for the pain intensity indicator. Names for each profile were assigned based on pain frequency and limitation scores. Those in the constant companion profile reported being in pain most days and had the highest number of limitations, whereas those in the no limitations profile reported only experiencing pain on some days of the week and typically did not having any difficulty performing the tasks in the limitations questions. The adjustments needed and annoying companion profiles were differentiated by the number of limitations, with those fitting the adjustments needed profile reporting a greater number of limitations than those fitting the annoying companion profile.

These classes were identified using a sample of individuals with at least one chronic condition where chronic pain is more likely to occur. In previous studies, researchers typically either identified a specific population, such as chronic pelvic pain (Fenton et al., 2015), or employed a broader set of criteria for inclusion. Although different types of pain from different sources can vary greatly, the present study used a broader approach by including conditions where chronic pain may be present.

As mentioned previously, the present study provides additional support to previous studies (e.g. Fenton et al., 2015) identifying four profiles of chronic pain, despite using different indicators for profile membership. Just as with Fenton and colleagues, pain, fatigue, and social

functioning (a sub-item of the limitations variable) were found to be meaningful indicators for class membership. Interestingly, Fenton and colleagues found a group with more pain who reported lower levels of fatigue and higher levels of social functioning than the group they identified as normal, with no dysfunction. The present study contradicts these findings with profiles showing greater amounts of fatigue as pain increases.

General Health and Profiles of Chronic Pain

In the present study, four distinct profiles of chronic pain were found when pain frequency and intensity, fatigue frequency, duration of condition, and physical limitations were considered. All five indicators – pain intensity, pain frequency, fatigue, duration of chronic condition, and physical limitations – had at least one significant mean difference between the four profiles. Put another way, all five indicators helped differentiate at least 2 groups from one another. Previous research has shown the connection between general health and chronic pain (e.g., Gureje, Von Korff, Simon, & Gater, 1998; Mantyselka, Turunen, Ahonen, & Kumpusalo, 2003). General health was found to be significantly associated with distinct profiles of chronic pain. Unexpectedly, better general health was associated with increased odds of being in the constant companion profile, as well as a reduction in the odds of being in the adjustments needed and annoying companion profile, relative to being in the no limitations profile. Similarly, an individual's self-assessment indicating improvement in their general health over the past 12 months was associated with increased odds of being in the constant companion profile, and a reduction in the odds of being in the adjustments needed and annoying companion profile, relative to being in the no limitations profile. It is unclear as to why seeming improvements in one's general health would make one more likely to be a member of a profile with greater physical limitations than in the no limitations profile, but it may have something to do with the

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intensity of pain experienced. The measure that was used to capture intensity of pain experienced focused on recent pain, thus allowing acute pain to influence results. It is possible that the subjective rating of overall health and the subjective rating of recent pain experienced correlate in such a way that might influence the results. The no limitations profile, which was substantially larger than the other profiles, might have variability in other indicators not used in this analysis that could explain these seemingly counterintuitive associations. If intensity were going to be considered in future studies, researchers should consider using measures that are designed to capture a broader measurement of intensity or a multi-item assessment of intensity.

Profiles of Chronic Pain Experiences and Mental Health Outcomes

Surprisingly, being a part of the adjustments needed profile or the annoying companion profile was not associated with feeling anxious or depressed. Additionally, the constant companion profile was shown to be associated with a decrease in frequency of feeling anxious and/or depressed. These findings are inconsistent with previous research showing a correlation between an increase in the duration of chronic pain and an increase in either anxious or depressed feelings. One possible explanation for these findings might reflect stages of grief or coping ability – there is an element of grief work that has to take place as individuals are coming to terms with their chronic pain and some might have better ability to cope with a longer duration of pain. Individuals who are earlier in the process might experience anxiety and depression at varying levels of frequency, but individuals who have experienced chronic pain for a longer period of time might have been able to grieve the loss of the life that they thought they would have and thereby reduce the frequency in which they experience anxiety and depression (Boss, 2006). The sporadic nature of their pain might also make it more difficult to come to terms with the fact that pain might be a part of their life for an indefinite amount of time, whereas others

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who have experienced pain for a longer period of time and have a greater number of physical limitations as a result of their chronic condition might have come to a place of acceptance, which could result in fewer feelings of anxiety and depression.

Along with acceptance and the passage of time, resilience and resilience mechanisms could potentially account for these findings. Sturgeon and Zautra's (2010) pathway to resilience model identified factors contributing to positive coping responses and outcomes for those with chronic pain. Resources identified, but not included in the current study, include strong social ties, positive social interactions, and positive trait affect. Those with recurrent depression, catastrophizing, negative affect, and negative social interactions tended to cope poorly, which in turn resulted in more negative mental health outcomes.

Regardless of which profile an individual belonged to, each profile was associated with small decreases in feelings of hopeless, and that everything requires a great amount of effort, compared to the no limitations profile. These findings also seem to be counterintuitive. Those in the no limitations profile had little pain and almost no physical limitations from their condition. There is much more than contributes to potential feelings of hopelessness and feeling as if everything requires effort, many of which were not captured in the model, but better explain the variance in these profiles. Melzack and Casey (1968) identified three systems utilized by the body to process pain – the sensory-discriminative system, motivational-affective system, and cognitive-evaluative system. Although affect, social support, catastrophizing, and an individual's cognitive process for evaluating pain were not assessed in this current study, these seemingly counterintuitive findings can still be explained by Gate Control Theory (Melzack & Casey, 1968), and the path to resilience identified by Sturgeon & Zautra (2010). The more extreme profiles, such as the constant companion profile, were associated with more positive mental

health outcomes. One possible explanation for this is that individuals in this profile have been able to develop an attitude and focus that allows the individual to recognize the stimuli of pain (motivational-affective system), and better evaluate said stimuli such that it is no longer threatening, catastrophic, and overwhelming (cognitive-evaluative system). Sturgeon & Zautra's (2010) pathway to resilience provide additional potential explanation through the identification of potential protective factors (e.g., social support) that might be contributing to those fitting a more extreme profile doing better with regards to mental health outcomes.

Clinical Implications

These results provide meaningful information for clinicians and physicians alike. The latent profile analysis revealed pain frequency and pain intensity were not significantly different across all profiles, whereas physical limitations significantly differed from group to group. In terms of pain frequency, the no limitations group experienced significantly less frequent pain compared to the other groups, but the remaining three were not significantly different in terms of pain frequency. Similarly, the no limitations group experienced significantly less intense pain compared to the other groups, but the remaining 3 groups were only partially significantly distinct from one another. Conversely, when looking at the physical limitations variable, all 4 groups were distinct and significantly different from one another. Previous research has shown that the physical limitations caused by chronic pain have a very strong influence on the way an individual sees their pain and the influence pain has on their overall life satisfaction (Smith, Wilkie, Uthman, Jordan, & McBeth, 2014).

These findings support the idea that intensity and frequency of pain, while important, are not exclusively what distinguishes the experience of chronic pain. They may be predictive of depression, anxiety, and other mental health outcomes (Breivik et al., 2006, Tunks, Crook &

Weir, 2008), but the experience of chronic pain goes beyond pain frequency and intensity. Clinically, individuals may come to therapy seeking support as they cope with their chronic pain. These findings suggest the importance of exploring and understanding the physical limitations imposed by chronic pain before developing an individualized treatment plan for clients.

I propose several clinical implications below speculating about potential ways these results could be incorporated into clinical work. Considering the grief and loss that comes with losing physical abilities (Boss, 2006), therapists should focus on the grief experienced as someone comes to terms with the physical limitations brought about by chronic pain. Clinicians may want to consider discussing what a person has tried to do to reinvent him or herself given these new physical limitations. It is possible that individuals unable to see the possibility of developing a new identity and life in the context of chronic pain may struggle with feelings of hopelessness, despair, and depression. Considering that some chronic pain has a slow onset, it is also possible that individuals have yet to accept the fact that they have chronic pain. Acceptance of chronic pain involves focusing on participating in activities that are personally relevant, while managing pain as it arises (McCracken, Vowles, & Eccleston, 2004). An individual's inability to accept that they have chronic pain could be what prevents them from building a new identity that incorporates their chronic pain. Chronic conditions, such as chronic pain, might not seem amenable in talk therapy situations, but providing a space for understanding, grief work, acceptance, and helping to find solutions for perceived physical limitations can help identify possibilities and potentially instill hope within an individual.

As mentioned previously, these findings also provide meaningful information for doctors and physicians. Opioid addiction has recently been identified as an area of keen importance for the National Institute of Health and is becoming a public health crisis (Kolodny et al., 2015).

Doctors and physicians are facing increasing amounts of pressure to reduce the distribution of opioid prescription medication. Just as with clinicians, doctors would be wise to use screeners, such as the Chronic Pain Acceptance Questionnaire (McCracken, Vowles, & Eccleston, 2004), when meeting with chronic pain patients to assess how their patient is doing in terms of accepting the fact that they have chronic pain. Although this was not assessed in the current study, it is possible that those patients that are struggling with accepting their chronic pain might also be struggling with depression and despair and using prescription medications to cope with these feelings. Assessing levels of acceptance might help doctors to better distinguish and identify which patients would be good candidates for antidepressants, talk therapy, and/or opioids/prescription drugs to help with the effects of chronic pain.

Doctors could also benefit from taking some time to screen for physical limitations that have come as a result of an individual's chronic pain. Screeners such as the short form of the McGill Pain Questionnaire (Melzack, 1987), or the Pain Disability Index (Tait, Chibnall, & Krause, 1990), provide physicians with a way to quickly and efficiently assess for pain and physical limitations, which in turn could help them better identify patents that would benefit from medication and which patents might be better served through talk therapy.

Future Directions

Based on the results of this study, one area for future research is in the development of improved measures that are specifically designed to capture the experience of chronic pain. As with many other studies in this area, this study was limited by the questions that were asked of the participants. Rather than asking respondents about general pain, greater specificity could be used to learn about the source of pain, the physical limitations that have come about as a result of the pain, and how that individual experiences and handles that pain. Longitudinal studies

focusing on profile membership and the long-term trajectories on a variety of outcomes could provide meaningful insight into the process of coping with pain along with the factors that differentiate those that are simply trying to survive from those that seem to thrive.

Another area for future research involves the exploration between profiles of chronic pain and other facets of anxiety and depression. This study was limited to asking about frequency of anxious and depressed feelings, but future studies could focus on diagnostic criteria for Generalized Anxiety Disorder, Major Depression, or a variety of other mental health outcomes. Better instrumentation could be used to better identify and describe the experience of chronic pain, learn more about what exactly contributes to symptoms of depression and anxiety, how individuals are coping with these feelings, and what they feel best helps them to cope with the emotional difficulties that come with chronic pain. Longitudinal data would allow for the investigation into intervention work and identifying variables linked with the trajectory of participants' experience of chronic pain. These studies could reveal risk and protective factors that would allow for improved education, prevention, and coping with regards to chronic pain and the adverse mental health outcomes that can follow.

Finally, given the evidence supporting the integration for what we know about resilience and what we know about chronic pain, clinical research focusing on the integration and implementation of theory with specific models of therapy would provide clinicians with the tools that they need to treat this population that needs support. As mentioned previously, theorists have developed models and theories for explaining resilience and chronic pain (e.g. Sturgeon & Zautra, 2010; Yeung, Arewasikporn, & Zautra, 2012), and practical models such as acceptance and commitment therapy (Hayes, Strosahl, & Wilson, 2012) have begun to provide clinicians with instruction for how to work with specific difficulties common in this population, but

researchers and clinicians have not yet explored ways to incorporate more social and relational elements that are also affected by the chronic pain.

Limitations

This study is not without its limitations. First, this study was conducted using cross-sectional data, so it is impossible to establish a temporal ordering to the model. Predictors of profile membership might alternatively be assessed as outcomes of profile membership, whereas the mental health outcomes could conceivably be seen as predictors of profile membership. Second, pain is a subjective experience, and the way pain is measured limits the types of research questions that can be answered. In measuring pain intensity, the wording of the question asks participants to rate the last time they were in pain. There is no way of knowing whether this pain was caused by their chronic condition, or if the pain they are referencing is more of an acute pain that was the result of a fall or some other unique situation.

Finally, there was a disproportionate amount of data missing in the anxiety and depression variables. Only approximately 18% of the individuals included in the sample responded to these questions, with the vast majority either not being asked to respond to that question or failing to respond for unknown reasons. Considering the large sample size in the study, it should be noted that 8,731 were missing responses to just the anxiety and depression questions. In the instance of the question asking participants about the number of years that they have had their chronic condition, not a single participant who responded to that question also responded to the depression or anxiety questions. While the sample size was large, more robust sampling would be helpful in future studies. Given the scattered nature of the data, missing data was a legitimate limitation for the study. There were people that responded to the anxiety questions who did not respond to the depression questions, or pain questions.

Notwithstanding these limitations, the unique aspects of this study advance the research on the experience of pain among individuals with chronic conditions. This is the first study to use a person-centered approach to chronic pain research that includes measures for pain frequency and intensity, along with indicators designed to capture the experience of chronic pain, namely symptoms of fatigue and physical limitations. While sampling and measurement continued to be an issue similar to other studies on chronic pain, attempts to isolate out unique and more acute pain from cancer treatments, and breaking a bone, allowed for a more general, but non-diluted sample and understanding of the chronic pain experience.

Conclusion

An extensive amount of research has been done to show the reciprocal relationship between an individual's physical and mental health (Bair, Robinson, Katon, & Kroenke, 2003; DeZutter, Luyckx, & Wachholtz, 2015). With chronic pain being one of the most pervasive and complicated healthcare issue individuals face today, it is important to develop treatments that recognize and incorporate both mental and physical health factors. Unfortunately, research on chronic pain has led to very few tools for mental health practitioners to use when aiding in the treatment and management of chronic pain. The current investigation was an attempt to incorporate both mental and physical health factors, potentially leading to greater understanding and improved effectiveness of treatments for individuals experiencing chronic pain.

In this study, four distinct profiles of potential chronic pain sufferers were identified (constant companion, adjustments needed, annoying companion, and no limitations), and significant associations were found between physical health, profile membership, and mental health outcomes. While many of the results were counterintuitive, they highlight the need for continued research integrating physical and mental health factors. By recognizing that there are

distinct subgroups within the chronic pain population, this study acts as a building block that

may eventually lead to the development of more specific and individualized treatment

approaches to this complex problem.

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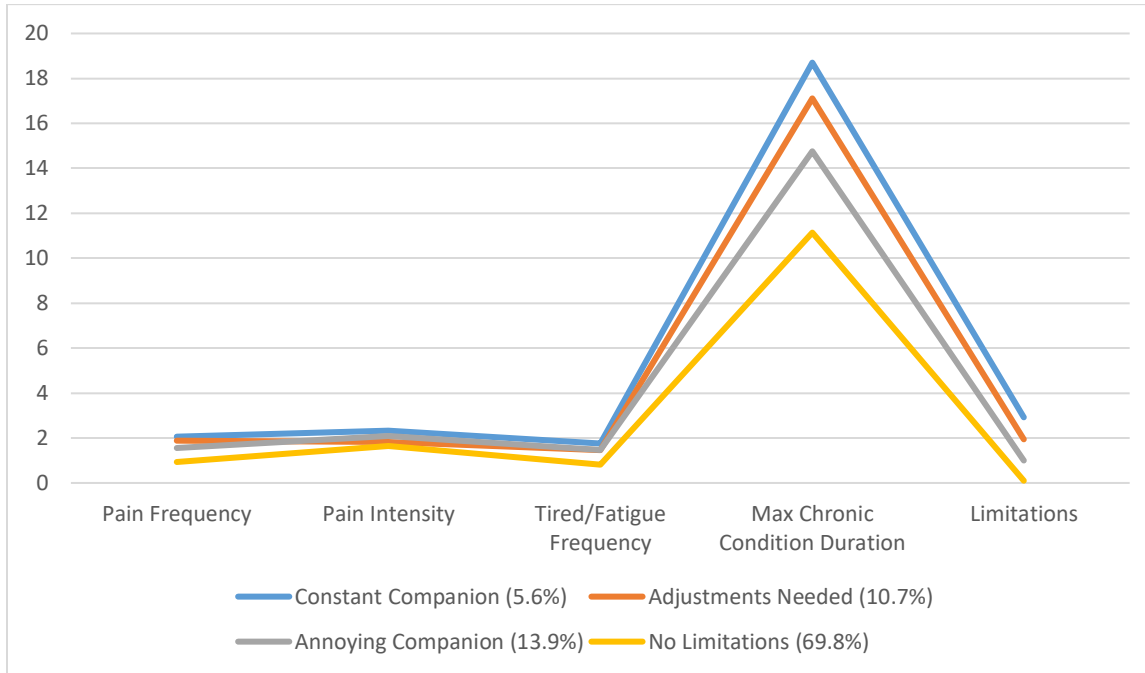   *Social and Clinical Psychology, 31*(6), 593-617.

Appendix A – Figures

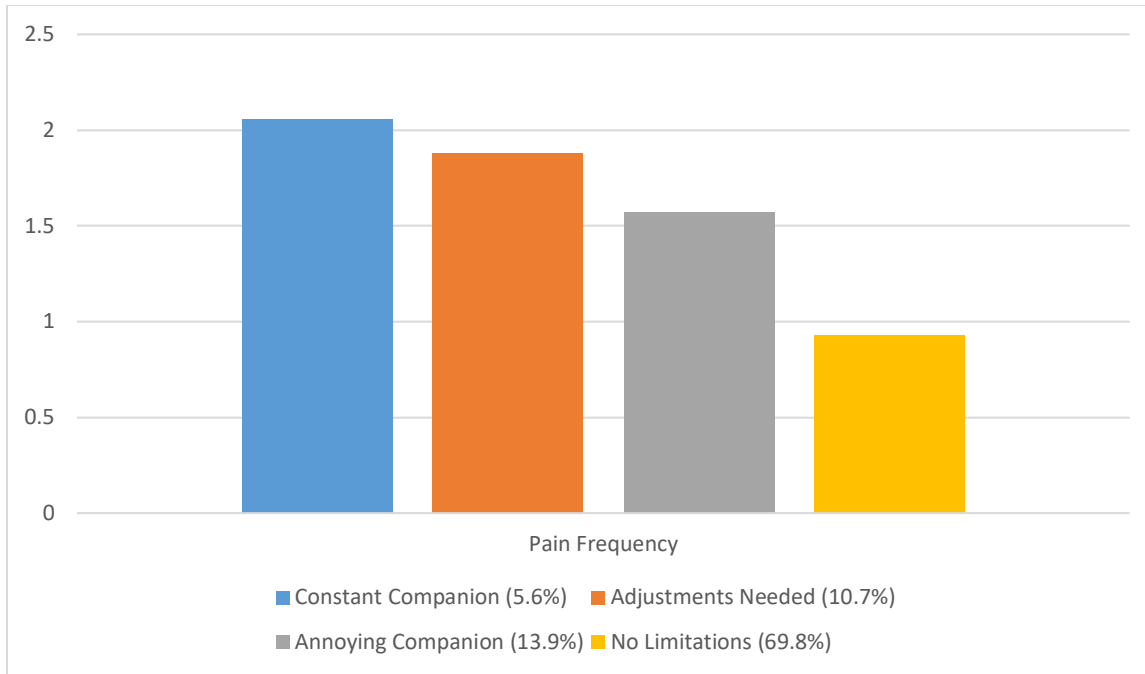Figure 1. Four latent profiles defined by means of the five facets of chronic pain ($N = 10,266$)

Figure 2. Four latent profiles defined by mean scores for pain frequency ($N = 10,266$). Possible scores range from 0 (never) to 3 (everyday)
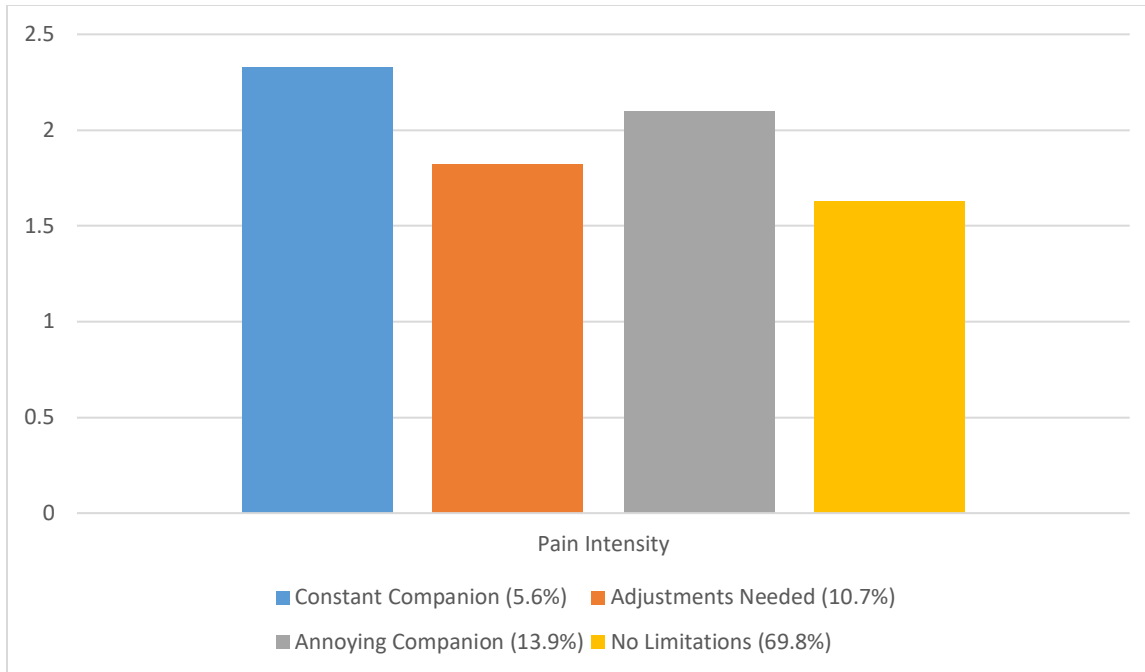
Figure 3. Four latent profiles defined by mean scores for pain intensity ($N = 10,266$). Possible scores range from 1 (a little) to 3 (a lot).
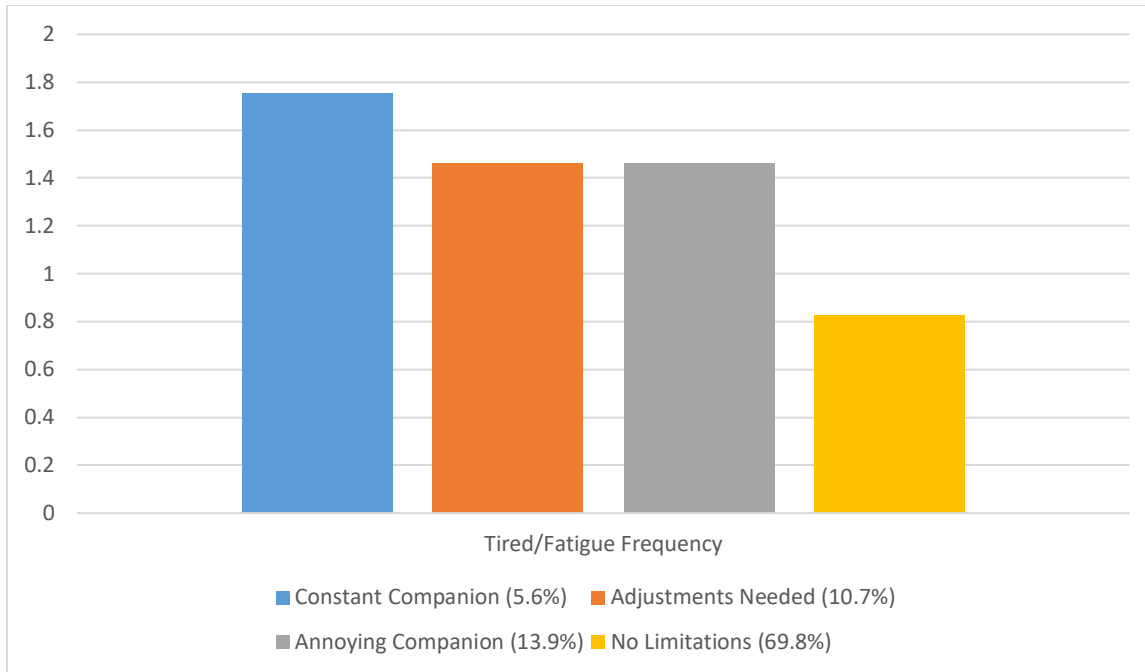
Figure 4. Four latent profiles defined by mean scores for tired/fatigue frequency ($N = 10{,}266$). Possible scores range from 0 (never) to 3 (every day).
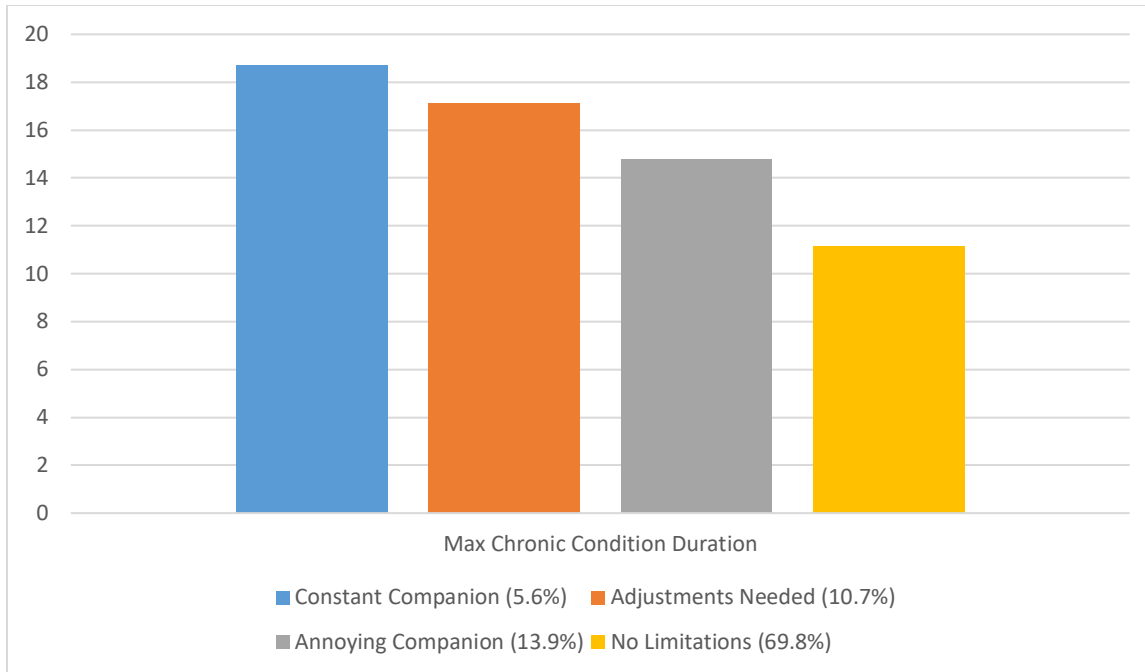
Figure 5. Four latent profiles defined by mean scores for maximum duration of chronic condition ($N = 10{,}266$). Possible scores range from 0 (less than 1 year) to 85 (85+ years).
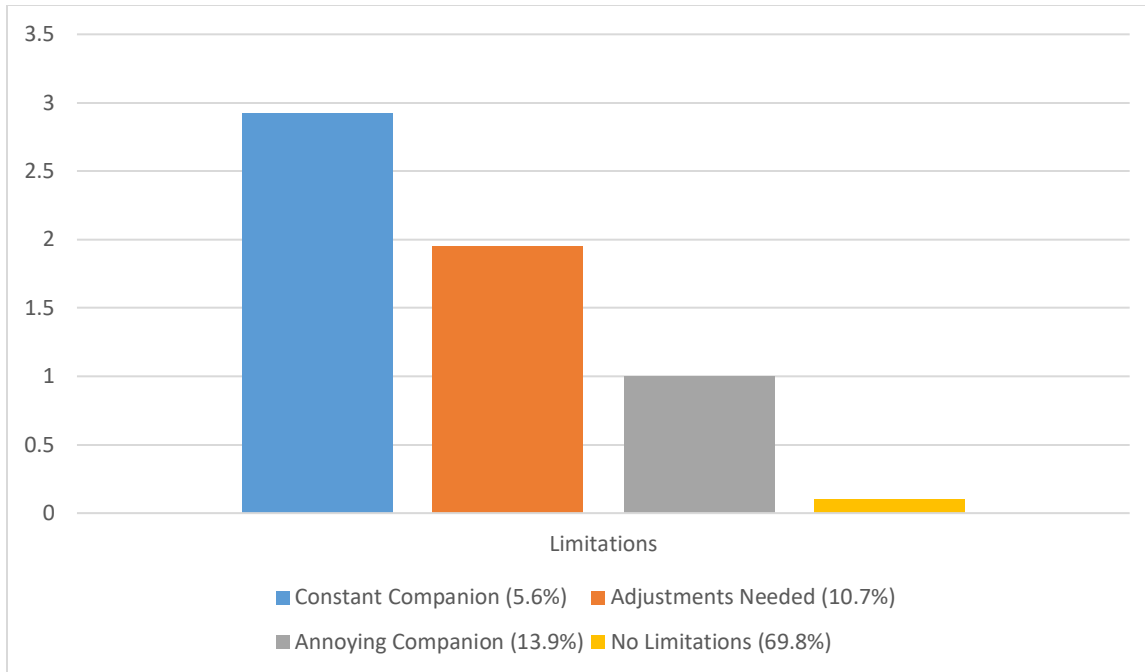
Figure 6. Four latent profiles defined by mean scores for physical limitations caused by chronic condition ($N = 10{,}266$). Possible scores for each item range from 0 (not at all difficult) to 4 (can't do at all).
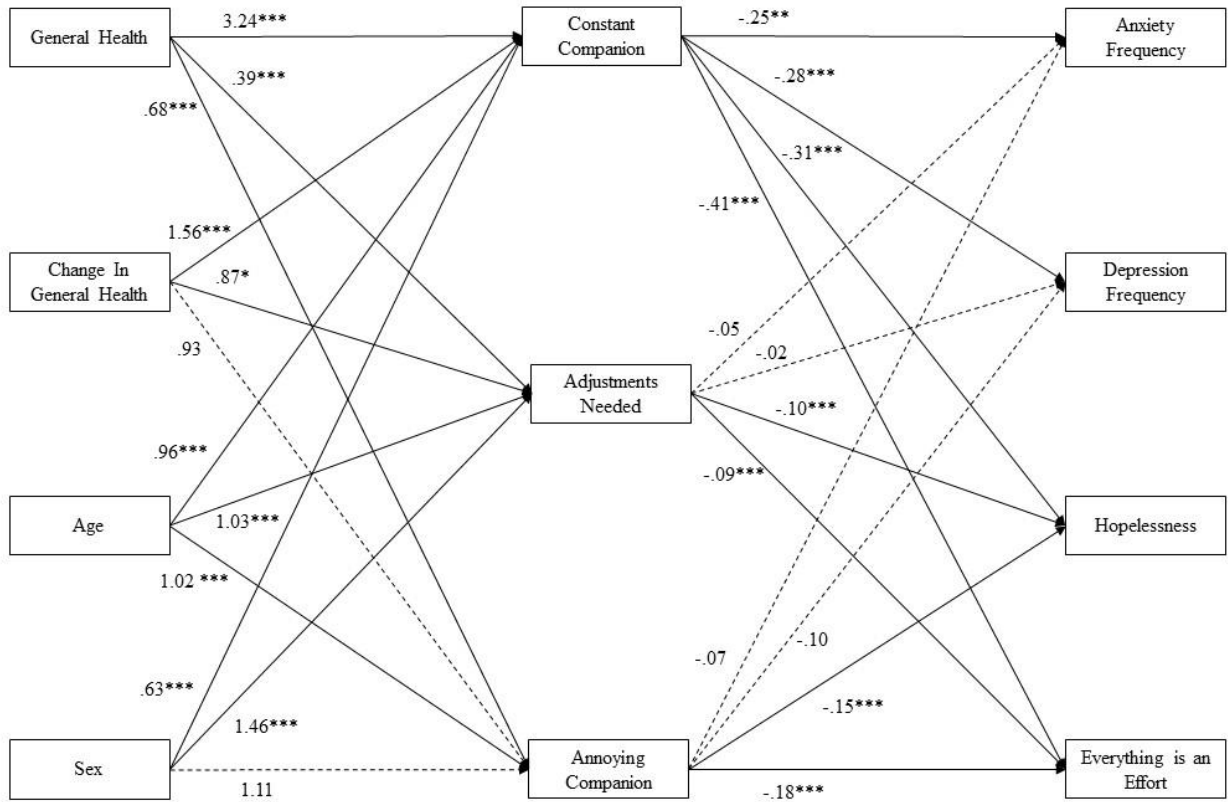
Figure 7. Model of associations among general health, profiles of chronic pain, and mental health outcomes ($N = 10,266$).

Odds ratios of predictors and profile membership with No Limitations profile as reference group. Standardized solutions of group membership and mental health outcomes. All variables included in the model are shown. Model was just identified. Solid arrow represents a significant pathway, whereas a dotted arrow represents a non-significant pathway. *$p < .05$. **$p < .01$. ***$p < .001$(two-tailed).

Appendix B – Tables

Table 1. Bivariate Correlations among Model Variables ($N = 10,266$)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Pain Frequency	–												
2. Pain Intensity	.28**	–											
3. Very Tired Frequency	.35**	.14**	–										
4. Max Duration	.40**	-	.04	–									
5. Limitation Mean Score	.29**	.17**	.26**	.20**	–								
6. Age	.11**	-.04	-.06*	.26**	.38**	–							
7. Sex[a]	-.01	.06	.11**	-.05**	.09**	.02	–						
8. Change in Health	-.10**	-.09**	-.04	-.03*	-.27**	-.11**	.00	–					
9. General Health	-.23**	-.18**	-.22**	-.11**	-.56**	-.27**	-.02	.25**	–				
10. Anxiety Frequency	.19**	.10**	.35**	.11	.16**	-.13**	.10**	-.07**	-.14**	–			
11. Depression Frequency	.19**	.13**	.36**	.17	.24**	-.02	.07**	-.12**	-.26**	.65**	–		
12. Hopelessness	.11**	.12**	.27**	.01	.28**	-.05**	.04**	-.18**	-.30**	.44**	.58**	–	
13. Effort	.16**	.13**	.36**	.04**	.34**	-.05**	.05**	-.15**	-.32**	.49**	.53**	.58**	–

Note. Sex[a]: 1 = *male*, 2 = *female*.

p < .05. **p* < .01 (two-tailed).

Table 2. Criteria for Assessing Fit for Different Number of Classes ($N = 10,266$)

	2-Class	3-Class	4-Class	5-Class
AIC	94095.67	90939.42	88860.71	88376.68
BIC	94213.64	91101.64	89067.17	88627.38
Adjusted BIC	94162.79	91031.72	88978.19	88519.33
Entropy	.94	.94	.94	.79
Lo-Mendendell-Rubin Likelihood Ratio Test	-51049.09***	-47031.83***	-45447.71***	-44402.35***
N for Each Class	C1=9459	C1=1984	C1=7178	C1=1788
	C2=2312	C2=8525	C2=1105	C2=7560
		C3=1262	C3=1425	C3=354
			C4=577	C4=1329
				C5=740

***$p < .001$ (two-tailed).

Table 3. Mean Comparisons between Latent Profiles on Chronic Pain Indicators and Chronic
Pain Profile Indicators (N = 10,266)

Variables	Constant Companion	Adjustments Needed	Annoying Companion	No Limitations
Pain Frequency	2.06$_D$	1.88$_D$	1.57$_D$	.93$_{ABC}$
Pain Intensity	2.33$_D$	1.82	2.10$_D$	1.63$_{AC}$
Fatigue Frequency	1.76$_D$	1.46$_D$	1.46$_D$	.83$_{ABC}$
Duration	18.70$_{CD}$	17.11$_{CD}$	14.76$_{ABD}$	11.14$_{ABC}$
Physical Limitations	2.92$_{BCD}$	1.95$_{ACD}$	1.00$_{ABD}$	.10$_{ABC}$

Note. A=Constant Companion, B=Adjustments needed, C=Annoying Companion, D=No
Limitations. Subscripts indicate which profile that mean is significantly different from. $p < .01$
(two-tailed).