Investigating the Relationship Between Anxiety Sensitivity and Chronic Illness: A Replication and Extension

By:

Emily Berdal

Honors Thesis

Appalachian State University

Submitted to The Honors College

in partial fulfillment of the requirements for the degree of

Bachelor of Science in Exercise Science

May 2018

Approved By:

_____

Joshua Broman-Fulks, Ph.D., Thesis Director

_____

Kimberly Fasczewski, Ph.D., Second Reader

_____

Jefford Vahlbusch, Ph.D., Dean, The Honors College

Abstract

In the United States, chronic illness and anxiety disorders are two of the largest burdens on the healthcare system. Almost half the population of the United States has been diagnosed with a chronic illness, and anxiety disorders are the most commonly diagnosed mental illness. The comorbidity between chronic illness and anxiety is fairly common and well-studied. Previous research has shown connections between anxiety and hypertension, heart disease, high cholesterol, and arthritis. One factor that may maintain the comorbidity between anxiety and chronic illness is anxiety sensitivity (AS) and its three subfactors: physical, social, and cognitive. The goal of this study was to investigate the relationship between the subfactors of AS and four chronic illnesses. In addition, the study looked at the role of anxiety sensitivity in those with multiple chronic illnesses and decreased quality of life. Data were gathered from a community sample of 1,002 community individuals. Significant relationships were found between hypertension and physical AS, and high cholesterol and cognitive AS. All subfactors of AS were related to having multiple chronic illnesses, and chronic illness was indicative of decreased quality of life.

Investigating the Relationship Between Anxiety Sensitivity and Chronic Illness: A Replication and Extension

Introduction

Chronic illnesses (or noncommunicable diseases, NCDs) are those that cannot be passed from person to person, but instead slowly progress throughout the lifetime of a single individual. Worldwide, NCDs were responsible for 68% of the world's 56 million deaths in 2012, with more than 40% of the deaths being considered premature (World Health Organization, 2014). In the United States alone, more than 117 million adults, almost half of the population, have been diagnosed with at least one NCD, with one in four adults having two or more NCDs (Ward, 2014). Chronic illnesses account for most of the annual healthcare costs in the U.S., consuming 86% of the country's annual healthcare budget, totaling over 2.3 trillion dollars (Gerteis, 2014).

The overall burden of NCDs can be measured using Disability Adjusted Life Years (DALY). This measure combines years of life lost (YLL) and years lost to disability (YLD). Together DALYs are a measure of how many years of life are lost due to death, illness, or impairment (Murray et al., 2012). In 2015, almost 80,000 years were lost per 100,000 people in the United States due to NCDs. Fifteen percent of the years lost can be attributed to mental diseases, while the other 85 percent are from chronic physical illness (World Health Organization Department of Information, Evidence and Research, 2016). Research has shown that there is a common comorbidity between mental disorder and chronic physical illness (Tsang et al., 2008). Comorbidities can exacerbate the disease condition. Verbrugge, Lepkowski and Imanaka (1989) found that as the numbers of comorbidities increase, disability rises exponentially.

Anxiety disorders are the most common mental illness in the United States (Facts & Statistics, 2017), and comorbidity between chronic illness and anxiety disorders are fairly common. Katon, Lin, and Kroenke (2006) reviewed 31 studies regarding the association between chronic illnesses and anxiety/depression, finding that any person with a diagnosed chronic illness and comorbid anxiety disorder generally perceive more symptoms of the disease than those without anxiety. Chronically ill populations also appear to exhibit heightened awareness to physical symptoms. The burden of comorbid anxiety disorders and chronic illnesses is more likely to increase anxiety symptoms and worsen episodes on top of the taxing symptoms of the disease (Katon et al., 2006)

The American Heart Association (2013) reports that, in the United States, one out of every three persons is hypertensive. Hypertension causes stress to the arteries in the body and a comorbidity with anxiety may increase that stress leading to a higher rate of mortality. In a review conducted by Pan et al. (2015), the researchers found a significant relationship between anxiety and hypertension in cross-sectional studies. In addition, there was a direct association seen in prospective studies that were included in the review. They also concluded that those with anxiety were at an increased risk for hypertension although there are other variables that come into play. In a study conducted with middle aged men, a similar result was seen. Generalized Anxiety Disorder was found to be positively associated with hypertension (Carroll, Phillips, Gale, & Batty, 2009). Their data suggested that the comorbidity of GAD and hypertension was not synergistic, but was acting additively, resulting in an increased disease burden (Carroll et al., 2009).

In the United States alone, over 28 million adults have been diagnosed with heart disease. In addition, it is the number one cause of death among Americans (National Center for Health

Statistics, 2017). The morbidity and mortality of cardiovascular disease makes understanding of associated factors and risks a priority. Vogelzangs et al. (2010) researched the association between the presence of an anxiety or depressive disorder and cardiovascular disease. They found that anxiety and cardiovascular disease are associated. Their study also examined the relationship with coronary heart disease, which is the most common form of cardiovascular disease (Heart Disease, 2017). The study found that the prevalence of coronary heart disease increased over a variety of anxiety diseases. Those who had an anxiety disorder in the past year were up to three times as likely to suffer from coronary heart disease. They further examined the amount of time that persons had been diagnosed with anxiety disorders and found that there was no significant evidence relating length of diagnosis with increased cardiovascular disease (Vogelzangs et al., 2010).

High cholesterol is a strong risk factor for the development of cardiovascular disease. With the relationship of anxiety disorders and cardiovascular disease, it is important to understand if there is a relationship with risk factors as well. Over one third of the adult American population has high cholesterol with less than half of those receiving treatment (Division for Heart Disease, 2015). Rafter (2001) completed a study with the intention of finding biochemical markers for anxiety and depression and found that high total cholesterol is related to anxiety. In another study, Peter et al. (2002) found that cholesterol levels were significantly higher in subjects with an anxiety disorder or OCD than normal control subjects. A more detailed comparison of the population with anxiety disorders showed a significant increase in LDL, and a significant decrease in HDL. Of the patients with anxiety disorders, 68% of them had borderline or high cholesterol compared to 30% of control subjects. This data led to the assumption that elevated cholesterol levels are generally associated to anxiety disorders (Peter et al., 2002).

Arthritis is the leading cause of disability in America, affecting more than 50 million adults, with 30 million of those having osteoarthritis (Arthritis Foundation, 2017). Research suggests that chronic pain and anxiety disorders are highly comorbid. A study investigating the link between anxiety and three chronic pain conditions found that there was a significant association that lasted through adjustments for different confounding variables (McWilliams, Goodwin, Cox, 2004). Similarly, VanDyke et al. (2004) found that trait anxiety was significantly higher in individuals with rheumatoid arthritis than those with osteoarthritis. In addition, as seen in the research on cardiovascular disease, disease duration was not found to be statistically significant in level of anxiety (VanDyke et al., 2004). This indicates that the presence of anxiety was simply related to the presence of disease and was not impacted by the length of time the individual had been diagnosed.

Hypervigilance is one factor that could increase anxiety in those with NCDs. Those with chronic illness tend to be hypervigilant regarding symptoms and sensations (McDermid, Rollman, & McCain, 1996). Chronic illnesses often lead to a variety of sensory experiences that may alert the individual to when something is wrong within the body. While a patient may know to watch for these symptoms, they can be anxious and become hypervigilant, feeling symptoms that are provoked by the anxiety and not related to the illness. Anxiety sensitivity (AS) refers to fears of anxiety-related sensations due to beliefs that the sensations are associated with negative physical, psychological, or social outcomes (Reiss, Peterson, Gursky, & McNally, 1986). Wong et al. (2014) found in chronic pain patients that pain hypervigilance mediates the relationship between AS and catastrophizing pain. For instance, a hypervigilant patient with lung disease may sense shortness of breath after a bout of movement more than a healthy patient would in the same situation. The patient with the illness may perceive this to be a sign that the condition of

their lungs is deteriorating and become anxious. They may catastrophize this feeling into believing their lung collapsed or they are experiencing some other serious medical problem. In this case, hypervigilance can be maintained the patient's AS, which itself has been marked as a risk factor for anxiety disorders (Zvolenskya, Schmidt, Bernsteina, & Keough, 2006).

As mentioned above, AS is a risk factor for the development of various anxiety disorders. AS is the fear of anxiety symptoms that comes from the belief that anxiety may result in physical harm (Reiss, 1991). Furthermore, AS has been broken down into three factors, physical concerns, social concerns, and psychological or cognitive concerns (Zinbarg, Barlow & Brown, 1997). Physical AS includes the belief that physical symptoms may be a sign of illness and the fear that results from that. Social AS is fear that others can observe the anxiety symptoms and it will result in embarrassment or ridicule. Lastly, psychological AS is fear that cognitive anxiety symptoms are proof of mental incapacitation (Stewart, Taylor, & Baker, 1997). The study done by Zinbarg et al. (1997) showed that increased physical AS was associated with greater rates of panic disorder, while higher social AS was associated with social phobia. Increased cognitive AS on the other hand, was not related to a single anxiety disorder, but differentiated diagnosis of an anxiety disorder from that of no anxiety disorder, with the exception of simple phobia (Zinbarg et al., 1997). Reiss and McNally (1985) propose that AS is an individualized personality factor relevant in the development of anxiety disorders. AS has been found to be an identifier for substance abuse (Stewart, Samoluk, & MacDonald, 1999), PTSD (Marshall, Miles, & Stewart, 2010), Panic (Maller & Reiss, 1992), and Agoraphobia (Wardle, Ahmad, & Hayward, 1990). These four associations show importance in their link to chronic illness.

Often times those who have been diagnosed with a chronic illness are prescribed several types of medications and in some cases, may try to self-medicate. Stewart et al. (1999),

investigate the links between various substances being used and abused and their link with AS. Their review suggested a relationship between AS and misuse of substances such as benzodiazepines and analgesics that are commonly prescribed to those with chronic illness. Because of a link between high AS and substance use and the possible link between AS and chronic illness, AS may be a marker predicting substance misuse and abuse among a chronically ill population.

PTSD may also be linked to chronic illness. A patient with chronic illness may experience a spell related to their disease that is later traumatizing to them. This traumatization may cause them to avoid certain situations or places that produce symptoms similar to those that occurred at the time of their spell. That scenario shows the relationship between high AS and PTSD. Furthermore, research has shown that AS can predict future PTSD symptoms. Therefore, patients with high AS are less likely to see a decrease in their PTSD symptoms over time than their counterparts with low AS (Marshall et al., 2010). If research proves a link between AS and chronic illness, it could be seen that the chronically ill population would maintain higher rates of PTSD.

Another demonstrated association with high AS is panic disorder. AS was proven to predict the number, frequency, and intensity of future panic attacks in a study done by Maller and Reiss (1992). It is proposed that the relationship between AS and panic is a result of a misinterpretation of symptoms (Cox, Borger, & Enns, 1999). So, a panic attack arises when an individual interprets what they are feeling as much more perilous than it actually is. This concept relates back to the topic of hypervigilance mentioned above. In the case of a chronically ill person, they may experience a rapid heart rate as a result of a stimulus and believe themselves to be having a heart attack leading themselves to panic. Hypervigilance led this person to have

increased awareness of their symptom, and AS led them to become anxious about the possibility of what an increased heart rate could mean. The increased anxiety led the patient to panic over an otherwise normal stimulus response. Because AS has been found to predict panic (Maller & Reiss, 1992), it serves a salient role in determining the risk of panic disorder in those who are chronically ill.

Similar to panic, agoraphobia has also been found to have a link with AS (Wardle et al., 1990). Agoraphobia is the fear of places and situations that may lead to a feeling of being trapped, embarrassment, or otherwise related to increased anxiety. Wardle et al. (1990), found that agoraphobia is highly linked with AS markers regarding bodily symptoms. Therefore, an individual with agoraphobia would avoid a place if it had the possibility of causing a symptom to arise. In regard to the example given above, a person with chronic illness and high AS may know that their heart rate increases around groups of people, so they will avoid a sporting event, for instance, because they feel an increased heart rate will lead to heart attack. Knowing if AS serves as a link between agoraphobia and chronic illness, can lead to the understanding of why chronic illness causes a stark decrease in quality of life by determining if enjoyable experiences are being avoided for fear of anxiety sensations.

The studies that have been done regarding relationships between anxiety disorders and high AS have a significant role in the research of AS in chronically ill populations. If a relationship between chronic illness and AS holds true, the links made above can identify possible comorbidities increasing impairment and decreasing quality of life. By understanding these relationships, better treatment and care may be provided. In addition, recognition of common comorbid disease could decrease medical spending.

Very few studies have examined the relation between AS and chronic illnesses. Norman and Lang (2005) noted that AS could be a characteristic that was present before an illness was diagnosed, but also that high AS may have developed as a result of the diagnosis. They utilized a sample of 389 participants gathered from VA and university primary care clinic waiting rooms. They had a fairly even split between men and women, about 54% of their sample was Caucasian, and 55% had been diagnosed with at least one chronic illness. In their study they noted limitations that may have played a role in their study that we plan to improve upon. Norman and Lang utilized the original ASI measure for its brevity. They suggested that a more comprehensive measure be used, therefore, we used the ASI-3.

In the previous study, AS was found to have a role in the functioning of patients with hypertension, heart disease and high cholesterol. The current study expected comparable results to the previous research that showed AS is higher in patients diagnosed with one or more chronic illnesses. Because, little research has been done on this topic, this study will serve to reinforce the idea that AS plays a role in the diminished functioning of chronically ill patients. The importance of replication is strengthened by the common comorbidities seen between chronic illness and anxiety disorders (Roy-Byrne et al., 2008). This study aims to determine if the linking factor is, in fact, AS by replicating the results of Norman and Lang (2005), with the exception of functioning and neuroticism. This study evaluated functioning based on the World Health Organization's Quality of Life measure (WHOQOL), and neuroticism were replaced by negative affect, which was measured with the Brief Symptom Inventory 18 as general distress. Based on the results of Norman and Lang (2005), we hypothesized that we would see an association between higher AS and the chronic diseases studied in our research. In addition, we

further hypothesized that in the population with chronic illness physical AS would be higher and quality of life will be decreased.

Methods

The data for this study were previously collected for another study (see Shanely, Knab, Nieman, Jin, McAnulty, & Landram, 2010 for clinical trial details). The data represent a large sample of 1002 residents from a community in western North Carolina. Of the 1002 participants recruited by mass advertising, 941 completed all study requirements, including cognitive testing at base line and post treatment. Additionally, 42 participants were excluded from the calculations for high cholesterol due to insufficient data. 95% of participants were white/Caucasian, 1.8% were African American, and the remaining 3.2% were of other racial and ethnic background. Approximately 60% of the participants sampled were women. The age range of participants was 18 to 85 with a mean of 45.96 (SD = 16.27). During recruitment, ages were stratified to ensure that various age ranges had adequate representation. Forty percent of subjects recruited were between the ages 18-40, 40% were middle aged (41-65), and the remaining 20% were 66-85 and considered older aged adults. In addition to being stratified by age, participants were also stratified by body mass index (BMI). Thirty-three percent were considered normal BMI (18.5-24.9), 33% were considered overweight (25-29.9), and the remaining 33% were obese with BMI over 30. Almost 98% of the participants recruited had completed a high school education and 56% had earned a college degree.

Subjects completed a Brief Symptom Inventory, the ASI-3, WHOQOL, and a health questionnaire. The ASI-3 is an 18 item self-report measure that was designed to measure fear of physiological arousal-related sensations, AS. The ASI-3 improved upon the ASI by focusing on

three subscales each with six items: physical (e.g, “It scares me when my heart beats rapidly”), cognitive (e.g. “It scares me when I am unable to keep my mind on a task”), and social concerns (e.g. “It is important for me to not appear nervous”). Each question is answered on a 0 - 4 point Likert scale (0 = very little, and 4 = very much) (Taylor et al., 2007). The Brief Symptom Inventory included questions regarding how the individual felt in that moment. The Brief Symptom Inventory general distress measure is also being used to predict negative affect. Research shows that the three subscales of the BSI-18 are positively correlated with negative affect (Serafini, Malin-Mayor, Nich, Hunkele & Carroll, 2016). Quality of Life was measured using the WHOQOL. The WHOQOL has 115 questions and gathers information based on each individuals’ perception of their place in life in the context of their values and culture relating to their goals and expectations. Lastly, the health questionnaire included demographic questions, medical history questions, a self-report on chronic disease, risk factors for chronic disease, and questions about lifestyle. Around 38% of participants reported a history including one or more chronic disease. 28% of participants reported having one chronic disease, 8.9% reported two, and 0.8 reported three or more. Chronic diseases to be considered in this study and the respective percentage of persons afflicted include: heart disease (1.9%), hypertension (18.3%), high cholesterol (12.4%), and arthritis (15.5%). The breakdown of diseases and their respective AS and quality of life scores can be seen in Table 1. These four diseases were chosen based on their inclusion in the previously done study done by Norman and Lang (2005).

Table 1: Breakdown of Chronic Illnesses with AS and Quality of Life Scores

		N	Mean age	Sex		Subfactors of AS- mean			Quality of Life- mean
				Male	Female	Physical	Cognitive	Social	
Hypertension		191	57	84	107	5	3	6	71.84
High cholesterol		129	53	35	93	4	3	5	72.02
Heart Disease		20	69	14	6	5	3	5	70.11
Arthritis		162	57	40	121	5	3	6	70.30
Number of diseases	0	609	40	250	359	3	2	6	73.79
	1	292	53	119	173	4	3	6	71.77
	>1	101	62	26	74	5	4	5	70.68

Analysis Plan

Hierarchical logistic regression analyses were performed to determine whether the three subfactors of AS predicted unique variance in each of the chronic illnesses over and above demographic variables and negative affect. Each chronic illness served as a dependent variable in one analysis. At Step 1, age, gender, and the BSI General Distress subscale were entered in to the regression model. Participants' scores on the Physical, Cognitive, and Social Concerns subscales of the ASI-3 were entered at Step 2, consistent with methodology used by Norman and Lang (2005). Age was included because there tends to be a higher prevalence of chronic illness as age increases. Also, chronic illnesses affect each gender at different rates (e.g., more women are diagnosed with arthritis than men [Arthritis Foundation, 2017]). Watson and Pennebaker (1989) found that negative affect was significantly correlated with health complaints. Therefore, we included negative affect in the model. The selected variables were also chosen based on their inclusion in the previous study that is being replicated (Norman & Lang, 2005).

Furthermore, a separate hierarchical regression analysis was conducted to determine if AS scores predicted number of chronic illnesses. In this analysis, number of chronic illnesses was the dependent variable, and the entry of indicator variables was the same as described above.

Lastly, a hierarchical multiple regression analysis was conducted to determine if AS subscale scores predicted quality of life over and above demographic variables and negative affect among individuals who met criteria for one or more chronic disease. Scores on the WHOQOL-BREF served as the independent variable, and the predictor variables were entered into the model as described above.

Results

Correlational analysis was used to examine a general relationship between chronic illness and AS, as well as demographic variables and negative affect. Preliminary results indicated weak relationships between age and chronic illness. Other weak associations were seen between chronic illness and AS and negative affect. The correlational analysis also indicated relationships between number of diseases and AS, demographic variables, and negative affect. Quality of life was seen to have a relationship with the same variables (Table 2).

Table 2: Correlation of Variables

	Age	Gender	BSI General Distress	Physical AS	Cognitive AS	Social AS
Hypertension	.329	-.045	.041	.108	.030	-.012
Heart Disease	.199	-.089	.016	.057	.017	-.025
High Cholesterol	.164	.095	.042	.011	.081	-.020
Arthritis	.301	.131	.105	.101	.111	-.008
Number of Diseases	.464	.072	.102	.132	.119	-.026
Quality of Life	-.019	-.047	-.534	-.283	-.397	-.267

The overall logistic regression analyses for hypertension, high cholesterol, arthritis, and heart disease were significant. In the final models, age was a significant predictor of each chronic illness, and gender significantly predicted all except heart disease ($p = .059$). However, the ASI-3 Physical Concerns subscale was only associated with hypertension after controlling for demographic variables and negative affect ($p < .01$), and the Cognitive Concerns subscale was

only associated with high cholesterol (p = 0.02). The Social Concerns subscale did not predict any of the chronic illnesses, and none of the ASI-3 subscales predicted heart disease or arthritis. The results of the linear regression analyses can be seen in Table 3.

Table 3: Chronic illness and the three subscales of AS with co-variates

Chronic Disease/Variable	Cox and Snell R^2	Chi square	β	Wald	*P*
Hypertension	.122	8.409			
Physical AS			.72	6.355	.012
Social AS			.008	.087	.768
Cognitive AS			-.043	1.827	.176
Age			.060	84.087	.000
Sex			-.453	6.142	.013
BSI General Distress			.012	.967	.326
High Cholesterol	.041	5.431			
Physical AS			-.042	1.581	.209
Social AS			-.012	.152	.696
Cognitive AS			.074	5.322	.021
Age			.031	21.784	.000
Sex			.523	5.779	.016
BSI General Distress			.007	.267	.606
Heart Disease	.048	1.413			
Physical AS			.072	.799	.371
Social AS			.007	.007	.934
Cognitive AS			-.001	.000	.991
Age			.125	23.457	.000
Sex			-1.031	3.552	.059
BSI General Distress			.021	.379	.538
Arthritis	.118	3.853			
Physical AS			.036	1.543	.214
Social AS			-.024	.754	.385
Cognitive AS			.031	.980	.322
Age			.059	68.988	.000
Sex			.743	12.051	.001
BSI General Distress			.027	4.860	.027

Our second aim was to determine if the AS predicted number of chronic illnesses endorsed. The overall regression model was significant, but, in the final model, only age and gender significantly predicted number of chronic diseases (Table 4).

A hierarchical multiple regression analysis was conducted to determine if AS subscale scores predicted quality of life among individuals with chronic illnesses (*n* = 393). The overall

regression model was significant, and, in the final model, age, BSI-General Distress, and ASI-3 Cognitive Concerns were all significant predictors of quality of life (Table 4).

Table 4: Anxiety Sensitivity Predicts Number of Chronic Illness and Quality of Life

	Adjusted R^2	F	β	*t*	*P*
Number of Chronic Diseases	.222	45.838		-5.380	.000
Physical AS			.057	1.443	.149
Social AS			-.026	-.701	.483
Cognitive AS			.049	1.285	.199
Age			.447	15.084	.000
Sex			.024	.830	.407
BSI General Distress			.055	1.696	.090
Quality of Life	.320	30.301		31.821	.000
Physical AS			-.002	-.032	.974
Social AS			-.050	-.860	.003
Cognitive AS			-.175	-2.948	.391
Age			.095	2.170	.031
Sex			.027	.635	.526
BSI General Distress			-.433	-9.179	.000

Discussion

The results from the current study suggest that certain chronic illnesses may be associated with the subfactors of AS. We found that physical AS was predictive of hypertension and cognitive AS was predictive of high cholesterol. However, neither of the other two illnesses that we studied had a significant relationship with any subfactor of AS. This could suggest that certain illnesses present with specific signs and symptoms that could increase AS, instead of the presence of illness in general impacting AS. Symptoms related to hypertension are commonly physical in nature and align closely with physical AS subscale questions. For example, "When I feel pain in my chest, I worry that I am going to have a heart attack," or "When I notice my heart skipping a beat, I worry that there is something seriously wrong with me." While hypertension is mainly asymptomatic, two possible symptoms are chest pain and irregular heartbeat, matching

the ASI-3 questions. While heart disease has similar symptoms, only a small percentage (<2%) of our sample had been diagnosed, which is not representative of the total heart disease population.

While no relationship was found between physical AS and high cholesterol, we did find that cognitive AS was predictor. This could be explained by the relationship high cholesterol has with cognitive decline, dementia, and Alzheimer's Disease. Anstey, Lipnicki, and Low (2008) conducted a systematic review of prospective studies and found that high total cholesterol could be linked to declines in cognitive abilities, such as dementia and Alzheimer's. They found this to be especially true if high cholesterol was reported in middle-aged adults. High cholesterol's role in cognitive decline could explain why there is a significant relationship with cognitive AS.

Arthritis was found to have no relationship with any subfactor of AS. As opposed to the other three chronic illnesses analyzed in this study, no symptom of arthritis is specifically out lined by the ASI-3 questions. This eliminates the possibility of increased AS due to specific symptoms. Norman and Lang (2005) explained that the lack of significant relationship could also be due to the symptomatic nature of the disease. Hypertension, heart disease, and high cholesterol are mainly asymptomatic, so when symptoms do arise they cause increased anxiety and AS. Arthritis patients often live with daily symptoms. Having constant exposure to symptoms may decrease the amount of anxiety and AS attributed to them over time. These are two possible explanations as to why AS cannot predict arthritis, but more research is needed to further investigate possible relationships.

The relationship between the presence of multiple chronic illnesses and AS was also investigated. Both physical and cognitive AS were related to the individual having more than one chronic illness. This could be the result of a common co-morbidity between hypertension and

high cholesterol, where each illness raises their respective subfactor of AS as discussed above. These two illnesses have many of the same risk factors (i.e. sedentary lifestyle, unhealthy diet, smoking) resulting in over half of all individuals with hypertension also being diagnosed with high cholesterol (American Heart Association, 2017). This result also suggests that AS increases as the disease burden increases. In addition, we found that in our chronically ill sample quality of life decreased as all subfactors of AS increased. This implies that as disease burden grows so does functional impairment. A preliminary assumption can be made that the addition of AS to the normal physical burden of chronic illness increases both mental and social impairment as well. More research is needed to further investigate and better understand that relationship.

The relationships that have been identified between AS and chronic illness indicate a need for increased education on the topic. The general public is widely unaware, first, of what AS is and, second, that it has an interaction with a physical chronic illness. Bettering education can help individuals understand aspects of anxiety and the realistic risk of anxiety related sensations, while learning about their disease and its signs and symptoms. This education can help individuals to more easily manage and cope with their illnesses. Education on the topic could also facilitate better interventions. Knowing there is a relationship between AS and chronic illness can lead to an interdisciplinary treatment plan that lowers overall disease burden. An unhealthy lifestyle is one of the main risk factors for chronic illness as a whole. Therefore, recognizing the relationship between AS and chronic illness reinforces not only the physical but mental benefits of a healthy lifestyle.

This study was intended to be a replication of the 2005 study performed by Norman and Lang. While some of our findings corresponded, the majority differed from their results. There are many things that could have attributed to the difference. For one, we utilized different

measures. Where they used the original ASI we chose the ASI-3, which is more comprehensive in measuring the three subscales of AS. We also exchanged their neuroticism measure for general distress as measured by the BSI and substituted the WHO's quality of life measure for functioning. While not likely to cause a dramatic difference in results, these substitutions may account for the discrepancies in results between the two studies. Our sample population also differed from that of the previous study, which could have led to differing results. The sample for this study had very little diversity and was mainly white. Females were also the majority in this sample, so gender differences could be an attributing factor. In addition to the differences in demographics, the samples were collected differently. The previous study pulled individuals from clinics in a larger city while this study took a community sample from a small town.

The limitations to this study somewhat align with the reasons that were given for discrepancy in results between the two studies. A direct measure of neuroticism should be used. This study did not have access to a direct measure so general distress measured with the BSI took its place after research suggested it could be an adequate alternative. The sample for this study was also limited. In further research, a more stratified sample could be of benefit, as different illnesses present in other ethnic and socioeconomic groups. In addition this study did not analyze gender differences, however, gender could play a key factor and its role should be further investigated. Another limitation to our study was small samples. For example, our heart disease sample was too small to confidently extrapolate the data to the entire population with heart disease. Larger sample sizes should be considered if further research should be done. The small R^2 values discovered in our analysis suggest that other factors not examined in this may be contributing to the predictive relationships. Any later research, should further investigate additional influences. Our cross-sectional design was another limitation to this study. We were

not able to determine if chronic illness preceded the AS or vice versa because of the design. If possible, further research on this topic should attempt a longitudinal design. Any other research should also further investigate symptom specific anxiety. As discussed above, certain illnesses have physical symptoms that make them more likely to answer physical AS subscale questions. While this study shows that there is a relationship between elevated AS and decreased functioning in chronically ill populations, additional research is needed to understand the extent of these relationships and the implications they could have for those with chronic illness.

References

American Heart Association (2013). Statistical Fact Sheet. Retrieved from https://www.heart.org/idc/groups/heart-public/@wcm/@sop/@smd/documents/downloadable/ucm_319587.pdf.

American Heart Association (2017). Know Your Risk Factors for High Blood Pressure. Retrieved from http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/UnderstandSymptomsRisks/Know-Your-Risk-Factors-for-High-Blood-Pressure_UCM_002052_Article.jsp#.WqwQOBPwbF1

Anstey, K. J., Lipnicki, D. M., & Low, L. F. (2008). Cholesterol as a Risk Factor for Dementia and Cognitive Decline: A Systematic Review of Prospective Studies With Meta-Analysis. *American Journal of Geriatric Psychiarty, 16* (5), 343-354. http://dx.doi.org/10.1097/01.JGP.0000310778.20870.ae

Arthritis Foundation (2017). *Arthritis by the Numbers: Book of Trusted Facts and Figures.* Retrieved from https://www.arthritis.org/Documents/Sections/About-Arthritis/arthritis-facts-stats-figures.pdf

Carroll, D., Phillips, A. C., Gale, C. R., Batty, D. C. (2010). Generalized anxiety and major depressive disorders, their comorbidity and hypertension in middle-aged men. *Psychosomatic Medicine, 72* (1), 16-19. doi: 10.1097/PSY.0b013e3181c4fca1

Chronic Disease Prevention and Health Promotion. (2017, June 28). Retrieved from https://www.cdc.gov/chronicdisease/overview/index.htm

Cox, B. J., Borger, S. C., & Enns, M. W. (1999). Anxiety sensitivity and emotional disorders: Psychometric studies and their theoretical implications. In S. Taylor (Ed.), *Anxiety sensitivity: Theory, research, and treatment of the fear of anxiety* (pp. 115-148). Mahwah, NJ: Lawrence Erlbaum Associates.

Division for Heart Disease and Stroke Prevention. (2015, April 30). Retrieved from https://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_cholesterol.htm

Facts & Statistics. (2017). Retrieved from https://adaa.org/about-adaa/press-room/facts-statistics#

Gerteis, J., Izrael, D., Deitz, D., LeRoy, L., Ricciardi, R., Miller, T., & Basu, J. (2014). Multiple Chronic Conditions Chartbook. Rockville, MD: Agency for Healthcare Research and Quality. Retrieved from https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/prevention-chronic-care/decision/mcc/mccchartbook.pdf

Heart Disease. (2017, November 28). Retrieved from https://www.cdc.gov/heartdisease/facts.htm

Katon, W., Lin, E. H. B., Kroenke, K. (2006). The association of depression and anxiety with medical symptom burden in patients with chronic medical illness. *Symptom Research, 29* (2), 147-155. doi:10.1016/j.genhosppsych.2006.11.005

Maller, R. G. & Reiss, S. (1992). Anxiety sensitivity in 1984 and panic attacks in 1987. *Journal of Anxiety Disorders, 6,* 241-247. doi: 10.1016/0887-6185(92)90036-7

Marshall, G. N., Miles, J. N. V., & Stewart, S. H. (2010). Anxiety sensitivity and PTSD symptom severity are reciprocally related: Evidence from a longitudinal study of physical trauma survivors. *Journal of Abnormal Psychology, 119* (1), 143-150. doi: 10.1037/a0018009.

McDermid, A. J., Rollman, G. B., & McCain, G. A. (1996). Generalized hypervigilance in fibromyalgia: evidence of perceptual amplification. *Pain, 66,* 133-144. doi:10.1016/0304-3959(96)03059-x

McWilliams, L. A., Goodwin, R. D., Cox, B. J. (2004). Depression and anxiety associated with three pain conditions: results from a nationally representative sample. *Pain, 111* (1-2), 77-83. https://doi.org/10.1016/j.pain.2004.06.002

Murray, C. J. L., Vos, T., Lozano, R., Naghavi, M., Flaxman, A. D., Michaud, C.,... Lopez, A. D. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet, 380.* Retrieved From http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)61689-4/fulltext

National Center for Health Statistics. (2017, May 03). Retrieved from https://www.cdc.gov/nchs/fastats/heart-disease.htm

Norman, S. B. and Lang, A. J. (2005). The functional impact of anxiety sensitivity in the chronically physically ill. *Depression and Anxiety, 21,* 154-160. DOI: 10.1002/da.20076

Pan, Y., Cai, W., Cheng, Q., An, T., & Yan, J. (2015). Association between anxiety and hypertension a systematic review and meta-analysis of epidemiological studies. *Neuropsychiatric Disease and Treatment, 11,* 1121-1130. Doi:https://doi.org/10.2147/NDT.S77710

Peter, H., Hand, I., Hohagen, F., Koenig, A., Mindermann, O, Oeder, F., Wittich, M. (2002). Serum cholesterol level comparison: control subjects, anxiety disorder patients, and obsessive-compulsive disorder patients. *The Canadian Journal of Psychiatry. 47* (6), 557-561. https://doi.org/10.1177/070674370204700608

Rafter, D. (2001). Biochemical markers of anxiety and depression. *Psychiatry Research, 103* (1), 93-96. https://doi.org/10.1016/S0165-1781(01)00251-7

Reiss, S. (1991). Expectancy model of fear, anxiety, and panic. *Clinical Psychology Review, 11* (2), 141-153. https://doi.org/10.1016/0272-7358(91)90092-9

Reiss, S. and McNally, R. J., (1985). Expectancy Model of Fear. In S. Reiss & R. R. Bootzin (Eds.). *Theoretical issues in behavior therapy* (pp. 107-121). San Diego, CA: Academic Press.

Reiss, S., Peterson, A. P., Gursky, D. M., McNally, R. J. (1986). Anxiety sensitivity, anxiety frequency, and the prediction of fearfulness. *Behav. Res. Ther, 24* (1), 1-8. doi: 10.1016/0005-7967(86)90143-9

Roy-Byrne, P. P., Davidson, K.W., Kessler, R. C., Asmundson, G. J. G., Goodwin, R. D., Kubzansky, L.… Stein, M. B. (2008). Anxiety disorders and comorbid medical illness. *General Hospital Psychiarty, 30* (3), 208-225. https://doi.org/10.1016/j.genhosppsych.2007.12.006

Serafini, K., Malin-Mayor, B., Nich, C., Hunkele, K., and Carroll, K. M. (2016). Psychometric properties of the positive and negative affect schedule (PANAS) in a heterogeneous sample of substance users. *Am. J. Drug Alcohol Abuse, 42* (2), 203-212. Doi:10.3109/00952990.2015.1133632

Shanely, R. A., Knab, A. M., Nieman, D. C., Jin, F., McAnulty, S. R., & Landram, M. J. (2010). Quercetin supplementation does not alter antioxidant status in humans. Free Radical Research, 44, 224-231.

Stewart, S. H., Samoluk, S. B., MacDonald, A. B. (1999). Anxiety sensitivity and substance use and abuse. In S. Taylor (Ed.), Anxiety sensitivity: Theory, research, and treatment of the fear of anxiety (pp. 287-319). Mahwah, NJ: Lawrence Erlbaum Associates.

Stewart, S. H., Taylor, S., Baker, J. M. (1997). Gender differences in dimensions of anxiety sensitivity. *Journal of Anxiety Disorders, 11* (2), 179-200. https://doi.org/10.1016/S0887-6185(97)00005-4

Taylor, S., Zvolensky, M. J., Cox B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., Abramowitz, J. S., … Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment, 19* (2), (176-188). Doi: 10.1037/1040-3590.19.2.176

Taylor, S. (Ed.). (2010). *Anxiety Sensitivity Theory, Research, and Treatment of the Fear of Anxiety*. Routledge.

Tsang, A., Von Kroff, M., Lee, S., Alonso, J., Karam, E., Angermayer, M., … Watanabe, M. (2008). *Journal of Pain, 9* (10), 883-891. doi: 10.1016/j.jpain.2008.05.005

VanDyke, M. M., Parker, J. C. Smarr, K. L., Hewett, J. E., Johnson, G. E., Slaughter, J. R., Walker, S. E., (2004). Anxiety in rheumatoid arthritis. *Arthritis Care and Research, 51* (3), 408-412. Doi: 10.1002/art.20474

Verbrugge, L., Lepkowski, J., & Imanaka, Y. (1989). Comorbidity and Its Impact on Disability. *The Milbank Quarterly, 67*(3/4), 450-484. doi:10.2307/3350223

Vogelzangs, N., Seldenrijk, A., Beekman, A. T. F., van Hout H. P. J., de Jonge, P., Penninx, B. W. J. H. (2010). Cardiovascular disease in persons with depressive and anxiety disorders. *Journal of Affective Disorders, 125* (1-3), 241-248. https://doi.org/10.1016/j.jad.2010.02.112

Ward, B. W., Schiller, J. S., & Goodman, R.A. (2014). Multiple Chronic Conditions Among US Adults: A 2012 Update. *Preventing Chronic Disease, 11*. http://dx.doi.org/10.5888/pcd11.130389.

Wardle, J., Ahmad, T., & Hayward, P. (1990). Anxiety Sensitivity in Agoraphobia. *Journal of Anxiety Disorders, 4* (4), 325-333. doi: 10.1016/0887-6185(90)90029-9.

Watson, D. and Pennebaker, J. W. (1989). Health Complaints, Stress, and Distress: Exploring the Central Role of Negative Affectivity. *Psychological Review, 96* (2), 234-254. Doi: 10.1037//0033-295x.96.2.234

Wong, W. S., Lam, H. M. J., Chow, Y. F., Chen, P. P., Lim, H. S., Wong, S., Fielding, R. (2014). The effects of anxiety sensitivity, pain hypervigilance, and pain catastrophizing on quality of life outcomes of patients with chronic pain: a preliminary, cross-sectional analysis. *Qual Life Res, 23*, 2333-2341. doi: 10.1007/s11136-014-0683-y

World Health Organization, Department or Information, Evidence and Research (2016). *Estimated DALYs ('000) by cause, sex and WHO Member State (1), 2015* [Data Set]. Retrieved from http://www.who.int/healthinfo/global_burden_disease/estimates/en/index2.html

World Health Organization (2014). Global Status Report on Noncommunicable Diseases: 2014. Retrieved from http://apps.who.int/iris/bitstream/10665/148114/1/9789241564854_eng.pdf?ua=1

Zinbarg, R. E., Barlow, D. H., Brown, T. A. (1997). Hierarchical structure and general factor saturation of the Anxiety Sensitivity Index: Evidence and implications. *Psychological Assessment, 9* (3), 277-284. http://dx.doi.org/10.1037/1040-3590.9.3.277

Zvolensky, M. J., Schmidt, N. B., Bernstein, A., & Keough, M. E. (2006). Risk-factor research and prevention programs for anxiety disorders: A translational research framework. Behaviour Research and Therapy, 44(9), 1219-1239. doi:10.1016/j.brat.2006.06.001