AN EPIDEMIOLOGICAL CROSS-SECTIONAL STUDY OF LEISURE-TIME PHYSICAL ACTIVITY IN INDIVIDUALS WITH AN ANXIETY DISORDER: RELATIONSHIP TO 30-DAY FUNCTIONING MEASURED BY THE WORLD HEALTH ORGANIZATION DISABILITY ASSESSMENT SCALE (WHO-DAS II)

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ABSTRACT

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Objectives: To see how leisure-time physical activity impacts previous 30-day functioning for those with an anxiety disorder.

Methods: Individuals who participated in the National Survey of American Life meeting criteria for an anxiety disorder (n = 548) were included in this analysis. The dependent variables were the WHO-DAS II categories, which measured previous 30-day functioning in six different categories. The independent variable was leisure-time physical activity.

Results: As the level of leisure-time physical activity increased, the odds of having at least some impairment did not decrease. Rarely participating in leisure-time physical activity had a significant protective effect against at least some impairment in the cognition, role impairment, and social interaction categories. Additionally, there was no protective effect for those who often or sometimes participated in leisure-time physical activity in the cognition, mobility, or role functioning categories.

Discussion: Based on this study, public health officials should note that promoting leisure-time physical activity may not be the best strategy to improve daily functioning for those with an anxiety disorder. Consequently, public health experts should continue to explore other constructive ways to improve daily functioning and quality of life for those who suffer from anxiety disorders of one type or another.

Keywords: Anxiety disorders, leisure-time physical activity, impairment

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KEY TO ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
BMI	Body Mass Index
DALYs	Disability-Adjusted Life Years
DSM-V	Diagnostic and Statistical Manual of Mental Disorders
GAD	Generalized Anxiety Disorder
LTPA	Leisure-Time Physical Activity
MDD	Major Depressive Disorder
NSAL	National Survey of American Life
PTSD	Post-Traumatic Stress Disorder
WHO	World Health Organization
WHO-DAS II	World Health Organization Disability Assessment Scale II
WMH-CIDI	World Mental Health Composite International Diagnostic Interview
YLD	Years of Life Lived with Disability

INTRODUCTION

Anxiety disorders are chronic and disabling illnesses that interfere with daily functioning, and cause great burden not only in the US, but on a global scale. In 2010, epidemiologic research classified anxiety disorders as the sixth leading cause of disability in terms of years of life lived with disability (YLD) in high-, middle-, and low-income countries.[1] On an international scale, anxiety disorders account for 390 disability-adjusted life years (DALYs) per 100,000 persons. These disorders include, but are not restricted to, Generalized Anxiety Disorder (GAD), Social Anxiety Disorder, Agoraphobia, Separation Anxiety, and Specific Phobias. The highest burden of these disorders is seen in males and females between the ages of 15 and 34 years, with 65% of the DALYS accounted for by females. In 2010, global costs of mental illnesses were estimated to be $2.5 trillion; (two-thirds of which are indirect costs), and are projected to increase to at least $6 trillion by 2030.[2] According to the World Economic Forum, mental health costs are estimated to be the largest source of global economic burden among non-communicable diseases, higher than cardiovascular disease, cancer, and diabetes.[2]

According to The Centers for Disease Control and Prevention (CDC), anxiety disorders are the most common types of mental disorders in the United States.[3] In the 1990s, the estimated annual cost of anxiety disorders was $42.3 billion in the United States.[4] In 2006, The Agency of Healthcare Research and Quality estimated mental health care costs to be $57.5 billion.[5] The majority of these costs are not due to cost of care, but are a result of unemployment and a variety of indirect costs related to chronic disability. Anxiety disorders have an estimated lifetime prevalence of greater than 15%, while the 12-month prevalence for any anxiety disorder is greater than 10%. In any given year in the United States, anxiety disorders affect approximately 40 million individuals who are 18 years or older; this accounts for 18% of the United States population.[6]

According to the WHO, "mental illnesses are the leading causes of disability adjusted life years (DALYs) worldwide".[7] Additionally, according to The Anxiety and Depression Association of America, approximately only one-third of those with an anxiety disorder receive treatment, even though anxiety disorders are very treatable. Therefore, it is important to understand anxiety disorders and to pursue strategies that address their clinical and public health ramifications.

In the context of these challenges, the purpose of this study is to examine the effects of leisure-time physical activity on previous 30-day functioning for individuals who have a clinically diagnosed anxiety disorder. Specifically, this study examines how various levels of leisure-time physical activity affect previous 30-day functioning, and also examines those aspects of functioning that are affected by leisure-time physical activity, while controlling for demographic and environmental factors.

Anxiety disorders are different from normal, everyday fear and anxiety.[8] While fear is a response to an observable threat, anxiety is the anticipation of future threat. According to the DSM-5, "anxiety disorders include disorders that share features of excessive fear and anxiety and related behavioral disturbances".[8] Anxiety disorders differ from these normative responses of fear and anxiety by being excessive and persistent, usually lasting six months or longer. There are different types of anxiety disorders, which can be differentiated from one another relative to different situations and/or the object(s) that provoke: fear, anxiety, and avoidance behavior. What follows is a review and epidemiology of multiple anxiety disorders (Generalized Anxiety Disorder, Social Anxiety Disorder, Agoraphobia, Panic Disorder, Adult Separation Disorder, and Post-Traumatic Stress Disorder), how they impact day-to-day functioning, and current research that examines the affect of physical activity on anxiety disorders.

Generalized Anxiety Disorder (GAD)

The fundamental feature of GAD is that anxiety and worry are excessive concerning a multitude of life activities and events.[8] Additionally, there are three characteristics that distinguish GAD from everyday anxiety. First, individuals with GAD have worries that are excessive and also significantly interfere with daily functioning. Second, worries in individuals with GAD are distressing, invasive, persistent, and have a longer duration than normal anxiety. Third, unlike with everyday worries, individuals with GAD often report physical symptoms, such as restlessness or muscle tension, in response to constant worrying. Those with GAD often report social and occupational impairment, along with other important areas of functioning. The lifetime morbid risk of GAD is 9.0%.[9] In the United States, the 12-month prevalence of GAD is 2.9% among adults. In other countries, the 12-month prevalence ranges from 0.4% to 3.6%.[10] Additionally, women are twice as likely to be diagnosed with GAD, with prevalence of GAD diagnosis peaking in the middle ages of life.[9,11] It has also been reported that individuals of European descent experience GAD more often than non-Europeans.[10]

Social Anxiety Disorder (Social Phobia)

Social anxiety disorder is distinguished by intense fear or anxiety of social situations, where the individual fears they will be negatively assessed by others.[8] Social situations nearly always cause fear or anxiety, which often leads to avoiding these social situations altogether, or tolerating them with intense fear and anxiety. Fear of social situations can also lead to anticipatory anxiety, which occurs far in advance of the upcoming social situation. The fear and anxiety in social anxiety disorder is excessive compared to the actual risk, and has to last for at least six months to be diagnosed with Social Anxiety Disorder. In the United States, the 12-month prevalence is estimated to be 7%.[6,9] In older adults, the 12-month prevalence ranges from 2-5%.[9,12] The prevalence is higher in American Indians, with lower prevalence rates in Asian, Latino, African American, and Afro-Caribbean individuals when compared to

non-Hispanic whites.[10] In the general population, rates of social anxiety disorder are higher in women compared to men (OR ranging from 1.5-2.2).[13]

Agoraphobia

Agoraphobia is defined by striking, or extreme fear and anxiety brought on by anticipated or actual exposure to a variety of feared situations.[8] These situations can include, but are not limited to, using public transportation, being in open spaces or enclosed spaces, being in a crowd, or being away from the home alone. When in these situations, individuals with agoraphobia experience fear and anxiety almost every time, along with thoughts that something horrible might happen. Individuals with agoraphobia may also experience a full or limited panic attack as a result of the fear and anxiety. The feared situations also cause the individual to actively avoid the situation, or endure it with severe fear or anxiety. Avoidance at the most severe state can result in the agoraphobic individual being completely homebound. Additionally, to be diagnosed with agoraphobia, the anxiety, fear, or avoidance, must be excessive in relation to the true danger of the situation. Agoraphobia must also be persistent, and cause significant social, occupational or other functional impairment. Approximately 1.7% of adolescents and adults every year are diagnosed with agoraphobia.[9,14] Incidence of agoraphobia peaks in late adolescence and early adulthood, with females twice as likely to experience agoraphobia compared to males.[14] Lastly, prevalence rates of agoraphobia do not seem to differ between cultural and racial groups.[10]

Panic Disorder

Panic disorder is defined as "recurrent unexpected panic attacks".[8] Panic attacks consist of a sudden rush of powerful fear or discomfort, and crest within minutes. During a panic attack, four or more physical or cognitive symptoms must transpire out of 13 possible symptoms found in the DSM-V. Symptoms include: pounding or accelerated heart rate, sweating, shaking, chest pain, shortness of

breath, feelings of choking, nausea, chills or heat sensations, light-headedness or dizziness, paresthesias, fear of losing control, derealization, and fear of dying. Panic attacks can be unexpected, when there is no clear trigger, or expected, if there is an obvious trigger for the attack. Attacks can also vary greatly in frequency and severity. The severity and number of symptoms also vary from one panic attack to the next.[15] Having an expected panic attack does not eliminate a panic disorder diagnosis. However, for diagnosis, more than one unexpected panic attack is required. Individuals with panic disorder may change their behavior to avoid panic attacks, such as limiting daily activities and avoiding agoraphobic situations. A separate diagnosis of agoraphobia is given if agoraphobia is present.

In the United States, the 12-month prevalence of panic disorder varies between 2-3% in adolescents and adults.[6,9,16] Rates of panic disorder seem to gradually increase during adolescence, and crest during adulthood.[15] Lower rates of panic disorder are reported in Latinos, Caribbean blacks, African Americans, and Asian Americans, when compared with non-Latino whites.[10] Whereas, American Indians report significantly higher rates of panic disorder. Additionally, females are affected more than men with a rate of 2:1.[6]

Adult Separation Anxiety Disorder

Separation anxiety disorder can occur at any age, but the focus will be on adult separation anxiety disorder. The fundamental feature of separation anxiety disorder is excessive anxiety or fear as a result of anticipated or present separation from an attachment figure or the home.[8] The anxiety expressed by the individual will be excessive, and may exceed expectations based on the developmental level of the individual. Adults with separation anxiety disorder may worry about the safety of their attachment figures, usually their children and spouses. These individuals, especially when separated, experience marked distress and need to know their attachment figures' current location, and need to stay in touch with them. This may cause significant disruption in work or social life, due to constantly

contacting their significant other. They also fear being alone, and leaving the house by themselves due to separation fears. To be diagnosed, this disorder must cause significant social, academic, occupational, or other functional distress or impairment. In the United States, the 12-month prevalence of adult separation anxiety disorder ranges from 0.9-1.9%.[6,9,17]

Post-Traumatic Stress Disorder

Post-Traumatic Stress Disorder (PTSD) is defined as exposure to one or more traumatic events, such as exposure to war, physical assault, or sexual assault, resulting in the development of characteristic symptoms.[8] Symptoms include intrusive events related to the traumatic event, which can be re-experienced in multiple ways, such as recurring and intrusive memories of the event, flashbacks, or recurring dreams related to the event. Those with PTSD deliberately avoid any stimuli associated with the trauma. Stimuli could be thoughts and memories, talking about the event, objects, activities, certain people, or situations. Heightened sensitivity to possible threats is what helps distinguishes PTSD from other disorders.

The projected lifetime risk for PTSD in the United States is 8.7%, with a twelve-month prevalence of approximately 3.5%.[6,18] After adjusting for traumatic exposure and demographics, compared to non-Latino whites, PTSD is reported at higher rates among Latinos, African Americans, and American Indians, while lower rates are reported among Asian Americans.[19, 20] Additionally, females have higher prevalence rates of PTSD across the lifespan, and also experience it for a longer duration, compared to males.[6, 18] Higher rates of PTSD are also found among veterans, and others with a vocation with increased risk of traumatic exposure. PTSD has been seen to impair functioning in social, educational, physical health, and occupational areas. Lastly, lower estimates of approximately 0.5%-1.0% are found in Europe, and most Asian, Latin American, and African countries.[20]

Anxiety Disorders, Daily Function, Physical Activity and Mental Illness

Approximately 29% of individuals in the United States will experience some type of anxiety disorder in their lifetime.[6] In addition, anxiety disorders have an immense impact on daily-functioning, affecting social and family relationships, educational and occupational success, and overall quality of life.[21] These disorders are also associated with indirect costs, such as lost work days or productivity, and direct costs due to increased use of health care.[22] These costs can create a huge economic burden for individuals suffering from an anxiety disorder. Anxiety disorders are also exceedingly prevalent in our population, cause chronic disease, and cause a tremendous decrease in daily-function. Therefore, it is important to understand the epidemiology of these disorders, how they relate to each other, and what can be done from a public health perspective to help prevent and treat them.

Physical activity is known to protect against diseases such as coronary heart disease, hypertension, diabetes, obesity, certain cancers, and all-cause mortality.[23] However, the relationship between physical activity and mental illness has been less well studied.[24] Previous studies have suggested that physical activity may have beneficial effects and reduce symptoms of numerous mental disorders. However, very few large scale, population-based studies have been conducted examining the relationship between physical activity and mental health.[25] The cross-sectional studies that have been done have established a negative association between regular physical activity and symptoms of anxiety and depression. The main limitation to the majority of the cross-sectional and longitudinal studies that have been completed is that they used anxiety and depression symptoms instead of a clinical diagnosis.

Clinical trials have also examined a dose-response relationship between physical activity and mental disorders.[26] Results suggest that the amount, more than the frequency of physical activity, appears to be strongly associated with its therapeutic effects.[27] Additionally, once an adequate level of physical activity is reached, the remission and response rates can be equivalent to other treatments for depression, such as cognitive behavioral therapy or medication.

There is a growing body of literature suggesting that physical activity can be of importance to mental health in addition to physical health. A recent longitudinal study suggests high levels of leisure-time physical activity could decrease the risk of developing mental illness problems.[24] Leisure-time physical activity can be defined as exercise not related to household chores, occupation, or transportation.[28] The relationship between physical activity and mental health, however, is more complicated than the relationship between physical activity and physical health. The physical activity and mental health relationship varies greatly by activity type, individual demographics, and psychological condition. Therefore, more research needs to be done to help define this relationship.

Previous research on this topic has mainly focused on the association between physical activity and mental disorders, with a focus on depression, or depression and anxiety.[29] There are no studies that specifically examine the association between anxiety disorders and physical activity without depression or other mental disorders. This study includes all available subtypes of anxiety in the National Survey of American Life (NSAL) to examine how leisure-time physical activity affects previous 30-day functioning in those with a clinically diagnosed anxiety disorder. It examines those aspects of functioning that are affected by various levels of leisure-time physical activity in terms of previous 30-day functioning using to the World Health Organization Disability Assessment Scale (WHO-DAS II).

H1: I hypothesize that as the level of leisure-time physical activity increases, the odds of having at least some impairment will decrease.

H2: I hypothesize that those who partake in leisure-time physical activity rarely or never will be more likely to have at least some impairment in each functioning category compared to those who partake in leisure-time physical activity often or sometimes.

H3: I hypothesize that there will be a protective effect for those who partake in leisure-time physical activity often or sometimes, especially in the cognition, mobility, and role functioning categories.

METHODS

Description of the Sample (NSAL)

An analysis of existing data will be completed using the National Survey of American Life (NSAL). The NSAL is an integrated national household probability sample survey with a sample size of 6,082 adults, 18 years and older.[30] This survey includes 3,570 African-Americans, 891 non-Hispanic whites, and 1,621 blacks of Caribbean descent. Data were collected in 48 states between January 2001 and November 2002, with an overall response rate of 71.5%. The NSAL was designed to collect data from African-American and Afro-Caribbean populations of the US, and compare them to white participants from the same neighborhoods. Data was collected on mental disorders, emotional, mental, and physical states, as well as potential risk and protective factors to examine racial and ethnic differences.

Anxiety Diagnosis

A modified version of the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) was used to make diagnoses based on the Diagnostic and Statistical Manual (DSM-IV-TR) criteria for mental disorders.[31] Participants who endorsed a DSM-IV, 12-month diagnosis of the following anxiety disorders were included in this study: Generalized Anxiety Disorder (n=102), Social Anxiety Disorder (n=231), Agoraphobia without panic disorder (n=72), Agoraphobia with panic disorder (n=47), Panic Disorder (n=113), Adult Separation Anxiety Disorder (n=84), and PTSD (n=138). Specific phobias were not included because no information was available in the NSAL on specific phobias. Anxiety disorders in this study are reported as "met criteria" or "did not meet criteria" so they are not stratified by severity.

Dependent Variable (WHO-DAS II Categories)

The World Health Organization Disability Assessment Schedule II (WHO-DAS II) is an instrument that was designed to measure previous 30-day functioning and disability among diverse cultures and populations.[32,33] This assessment is based on the International Classification of Functioning, Disability,

and Health framework.[34] The WHO-DAS II assessment is comprised of 32 items, which examine six functional domains of daily life. The six domains include: self-care, cognition, physical mobility, role impairment, social interaction, and time out of role. As a result, this assessment generates six individual domain scores.[35] During the assessment, participants are asked to state the intensity of difficulty when performing the domain activity. Additionally, for every item, participants have to approximate the level of disability for the previous 30 days using a five-point scale.[36] All scores are calculated and can range from 0-100, with higher scores representing more disability. The WHO-DAS II will allow for an analysis of specific functioning domains across levels of leisure-time physical activity. Previous research evaluating the WHO-DAS II categories suggests acceptable internal consistency and test-retest reliability.[34]

Independent Variable (Leisure-Time Physical Activity)

Leisure-time physical activity will be measured using the question: "how often do you engage in active sports or exercise?" Possible responses to this question are: often, sometimes, rarely, or never. Scores for leisure-time physical activity will be coded: 1 = never, 2 = rarely, 3 = sometimes, and 4 = often. Therefore, a higher number will represent more physical activity. The reference category used for analyses was the "often" category. The "often" category was used as the reference group because it is an extreme value, and also because it represents the most normative group.

Covariates

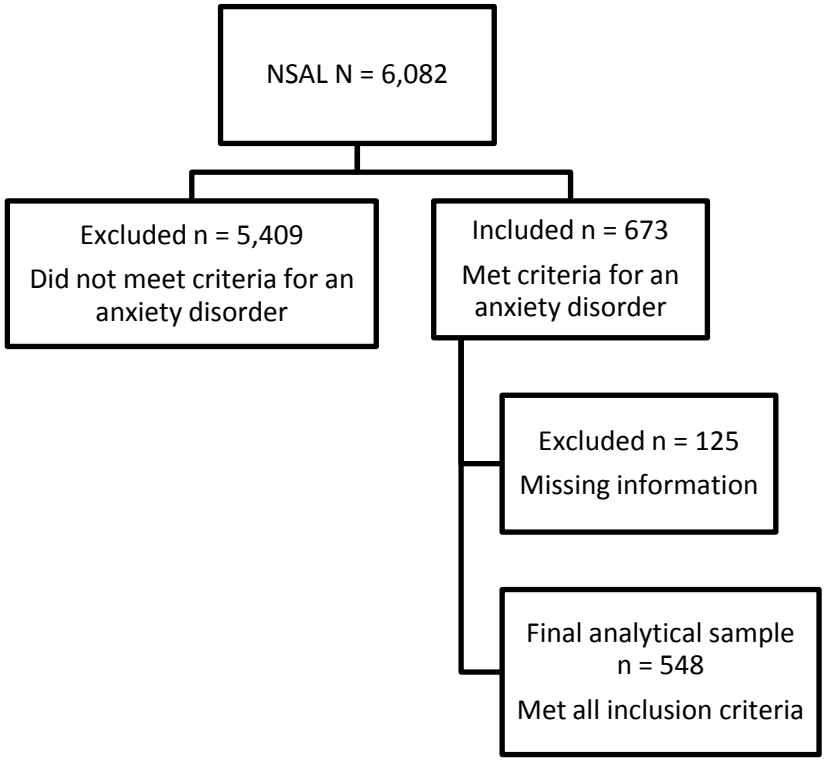
The covariates that will be included in the analysis are: self-reported BMI, household income, education level, self-report of physical health, city type, and DSM-IV Major Depressive Disorder.

Inclusion and Exclusion Criteria

To be included in this study, individuals must be 18-years of age or older, and meet criteria for a 12-month diagnosis of one of the following anxiety disorders: generalized anxiety disorder, social phobia, agoraphobia with or without panic disorder, panic disorder, adult separation anxiety disorder, or

PTSD. Individuals were excluded from this study if they did not meet the inclusion criteria. Additionally, those with missing information on covariates, or the dependent or independent variables, were excluded from all analyses (Figure 1.).

Figure 1. Inclusion and Exclusion Flow Chart



Analyses

Analyses will be performed in STATA 13.1. Weights were designed specifically for the NSAL to account for the complex sampling procedure, and will be used for this analysis. The dependent variable is the WHO-DAS II score, which was coded as a dummy variable, 0=no impairment, and 1=at least some impairment. If the WHO-DAS II score was recorded as a 0 it was recoded to 0. If the WHO-DAS II score was recorded as greater than 0, then it was recoded

as a 1. The independent variable is a categorical variable: Leisure-time physical activity, which can be answered as: often, sometimes, rarely, or never. Multivariable models will be built for each WHO-DAS II category of impairment using the seven step purposeful selection procedure described by Hosmer, Lemeshow, and Sturdivant.[37] Significant variables will be noted and added in as interaction terms with leisure-time physical activity to examine effects of effect modification. Logistic regression will be used to compute odds ratios as well as 95% confidence intervals for each WHO-DAS II category. T-tests and Pearson Chi-square tests will also be computed to look for statistically significant differences.

RESULTS

Demographics

The demographics of the sample are described in Table 1a. There were 548 participants from the NSAL who met the inclusion criteria. Race/ethnic groups were divided into African American (n=336), Non-Latino Whites (n=74), and Afro-Caribbean and Hispanic (n=138). The statistics used for Table 1a. and 1b. tested each variable to see if there were differences between any of the three racial/ethnic groups. This table only tests for differences between the three groups, it does not test for race to race differences. Differences between the three racial/ethnic groups were found for BMI ($p = 0.006$), Education ($p = 0.01$), and City Type ($p = 0.008$). This sample consisted of 402 women (73.36%), and 146 men (26.64%). Thus, in this sample women were 2.75 times more likely to meet criteria for an anxiety disorder. The majority of the sample was between the ages of 25 and 44.

Table 1a. Descriptive Statistics by Race/Ethnicity Group (n = 548). unweighted n (weighted %)

	African-American n = 336	Non-Latino Whites n = 74	All Other Hisp/ Afro-Caribbean n = 138	P-Value
SEX				0.20
Male	39 (53.28)	80 (29.72)	27 (39.20)	
Female	99 (46.72)	256 (70.28)	47 (60.80)	
AGE				0.20
≤ 24	72 (24.10)	3 (8.99)	36 (29.59)	
25-44	155 (43.75)	36 (50.87)	69 (53.37)	
45-54	66 (19.73)	19 (18.07)	20 (7.57)	
≥ 55	43 (12.42)	16 (22.07)	13 (9.46)	
BMI				0.006*
< 18.5	7 (2.48)	0 (0)	1 (0.88)	
18.5-24.9	89 (25.57)	29 (47.49)	53 (21.94)	
25.0-29.9	94 (27.24)	18 (22.09)	43 (42.16)	
30.0-34.9	82 (25.60)	15 (20.33)	20 (6.86)	
≥ 35	64 (19.12)	12 (10.09)	21 (28.17)	
EDUCATION				0.01*
0-11 Years	112 (31.05)	13 (13.63)	25 (24.96)	
12 Years	116 (34.16)	22 (37.65)	41 (25.14)	
13-15 Years	66 (22.17)	17 (17.27)	40 (26.50)	
≥ 16 Years	42 (12.62)	22 (31.45)	32 (23.40)	
Physical Health Rating				0.82
Very Good	117 (31.57)	26 (38.30)	60 (42.02)	
Good	105 (34.06)	23 (29.32)	43 (34.41)	
Fair	86 (26.39)	19 (23.40)	27 (20.44)	
Poor	28 (7.99)	6 (8.97)	8 (3.13)	
MDD12				0.54
Met Criteria	66 (19.99)	20 (24.90)	26 (17.86)	
Did Not Meet Criteria	270 (80.01)	54 (75.10)	112 (82.14)	
City Type				0.008*
Rural Area	62 (16.64)	25 (38.43)	17 (8.18)	
Small Town	62 (17.73)	16 (17.29)	18 (18.20)	
Small City	53 (14.24)	11 (11.16)	12 (9.75)	
Suburb of City	24 (8.32)	8 (16.57)	17 (14.48)	
Large City	129 (41.31)	12 (14.92)	71 (47.55)	
Other	6 (1.76)	2 (1.63)	3 (1.84)	
Household Income				0.45
≤ 17,999	161 (39.41)	23 (33.31)	40 (23.87)	
18,000-31,999	80 (25.22)	18 (21.30)	41 (28.08)	
32,000-54,999	65 (22.03)	16 (20.80)	31 (24.23)	
≥ 55,000	30 (13.34)	17 (24.60)	26 (23.82)	
LTPA				0.48
Often	89 (26.61)	20 (26.79)	37 (21.71)	
Sometimes	89 (27.14)	26 (30.38)	42 (31.50)	
Rarely	66 (20.47)	11 (14.15)	36 (35.34)	
Never	92 (25.78)	17 (28.67)	23 (11.46)	

*indicates $p < 0.05$

Anxiety Disorder Diagnoses

Table 1b. summarizes counts and weighted percentages for all anxiety disorder diagnosis categories. Differences between racial/ethnic groups were only seen for social anxiety (p = 0.002), and agoraphobia without panic disorder (p = 0.046). Data was not available on Adult Separation Anxiety Disorder and PTSD for Non-Latino Whites. The most common diagnoses were Social Anxiety Disorder, PTSD, and Generalized Anxiety Disorder.

Table 1b. Descriptive Statistics for Anxiety Disorders by Race/Ethnicity Group.
unweighted n (weighted %)

	African-American	Non-Latino Whites	All Other Hisp/ Afro-Caribbean	P-Value
Generalized Anxiety				0.13
Met Criteria	57 (16.79)	23 (29.37)	22 (14.98)	
Social Anxiety				0.002*
Met Criteria	123 (37.02)	51 (66.80)	57 (34.96)	
Agoraphobia w/o Panic				0.046*
Met Criteria	52 (15.20)	5 (5.71)	15 (12.93)	
Agoraphobia w/ Panic				0.14
Met Criteria	34 (9.19)	3 (2.99)	10 (5.04)	
Panic Disorder				0.19
Met Criteria	66 (17.41)	20 (25.76)	27 (17.57)	
Adult Separation Anxiety				0.23
Met Criteria	58 (17.99)	NA	26 (12.30)	
PTSD				0.82
Met Criteria	102 (30.52)	NA	36 (33.16)	

*indicates $p < 0.05$

Impairment

Table 2. illustrates the unweighted number and weighted percent with at least some impairment among those meeting criteria for a 12-month anxiety disorder. The out of role category has the largest number of participants for each racial group with at least some impairment. There is no significant difference between racial groups for all WHO-DAS II categories.

Table 2. World Health Organization Disability Assessment Scales-II number and percent (unweighted n, weighted %) with at least some impairment among those meeting criteria for a 12-month anxiety disorder.

		n	%	p-value
SELF CARE				0.28
	All Other Hisp/Afro-C	10	3.73	
	African American	28	7.98	
	Non-Latino Whites	10	12.93	
COGNITION				0.28
	All Other Hisp/Afro-C	45	31.06	
	African American	107	32.99	
	Non-Latino Whites	30	43.4	
PHYSICAL MOBILITY				0.59
	All Other Hisp/Afro-C	44	30.37	
	African American	121	36.91	
	Non-Latino Whites	28	31.11	
ROLE IMPAIRMENT				0.63
	All Other Hisp/Afro-C	68	44.66	
	African American	194	57.63	
	Non-Latino Whites	46	52.53	
SOCIAL INTERACTION				0.06
	All Other Hisp/Afro-C	31	20.93	
	African American	86	24.98	
	Non-Latino Whites	28	40.13	
OUT OF ROLE				0.61
	All Other Hisp/Afro-C	77	50.66	
	African American	209	62.48	
	Non-Latino Whites	49	56.85	

*indicates $p < 0.05$

WHO-DAS II Self Care

The odds of having at least some impairment in the self-care category for those who sometimes partake in LTPA are 7.63 (1.17-49.87) times larger (p=0.03) than that of those who partake in often LTPA (Table 3.). Additionally, the odds of having at least some impairment in the self-care category for those who self reported fair physical health are 5.74 (1.97-16.76) times larger than that of those who self reported very good physical health (p=0.002).

Table 3. WHO-DAS II Self Care Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes*	7.63	7.18	0.03	1.17	49.87
Rarely	3.73	3.31	0.14	0.63	21.96
Never	6.39	6.47	0.07	0.85	48.19
Physical Health Rate					
Very Good	REF				
Good	1.20	0.80	0.79	0.32	4.51
Fair*	5.74	3.08	0.002	1.97	16.76
Poor	3.14	2.35	0.13	0.70	14.01

*Indicates $p < 0.05$

WHO-DAS II Cognition

After adjusting for age, self-rated physical health, Major Depressive Disorder, and city type, the odds of having at least some impairment in the cognitive category for those who rarely partake in LTPA are 90% times smaller (p=0.006) than that of those who partake in often LTPA (Table 4.). Additionally, there was a significant interaction between self-rated physical health and LTPA that was included in the model.

Table 4. WHO-DAS II Cognition Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes	2.15	1.19	0.17	0.72	6.49
Rarely*	0.1	0.08	0.006	0.02	0.51
Never	1.48	1.69	0.73	0.15	14.4
Age					
18-24	REF				
25-44	0.82	0.32	0.61	0.37	1.79
45-54	1.08	0.45	0.85	0.47	2.5
55+	0.36	0.23	0.11	0.11	1.26
Physical Health Rate					
Very Good	REF				
Good	1.38	0.76	0.55	0.46	4.13
Fair	2.95	1.76	0.07	0.9	9.68
Poor	2.58	3.69	0.51	0.15	44.53
Major Depressive Disorder					
Met Criteria	REF				
Did not meet criteria*	0.46	0.16	0.03	0.23	0.91
City Type					
Rural Area	REF				
Small Town	0.68	0.28	0.35	0.3	1.54
Small City	1.8	0.72	0.15	0.81	4.01
Suburb of City*	3.65	1.82	0.01	1.35	9.88
Large City	1.07	0.33	0.83	0.58	1.97
Other	0.57	0.53	0.55	0.09	3.72

*indicates $p < 0.05$

WHO-DAS II Physical Mobility

After controlling for confounders there is no significant association between LTPA and physical mobility impairment (Table 5). However, as the self report of physical health gets worse, the odds of having at least some impairment in the physical mobility category increase. The odds of having at least some impairment in the physical mobility category for those who self rated their physical health as good are 3.21 times larger than that of those who self rated their physical health as very good (p=0.02). The odds of having at least some impairment for those who self rated their physical health as fair are 4.67 times greater compared to those who self rated their physical health as very good (p=0.004). The odds of having at least some impairment for those who self rated their physical health as poor are 60.48 times larger than that of those who self rated their physical health as very good (p<0.001).

Table 5. WHO-DAS II Physical Mobility Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes	1.6	0.6	0.22	0.76	3.38
Rarely	0.85	0.45	0.76	0.29	2.46
Never	1.5	0.65	0.35	0.63	3.56
Physical Health Rate					
Very Good	REF				
Good*	3.21	1.56	0.02	1.22	8.45
Fair*	4.67	2.41	0.004	1.67	13.08
Poor*	60.48	44.88	<0.001	13.76	265.86
City Type					
Rural Area	REF				
Small Town	1.96	1.12	0.25	0.62	6.13
Small City*	2.75	1.25	0.03	1.12	6.79
Suburb of City	1.38	0.92	0.63	0.36	5.2
Large City	1.27	0.6	0.62	0.5	3.23
Other	2.47	2.44	0.36	0.34	17.69

*indicates p < 0.05

WHO-DAS II Role Impairment

After adjusting for age, self rated physical health, Major Depressive Disorder, and income, the odds of having at least some impairment in the role impairment category for those who rarely partake in LTPA are 93% times smaller (p=0.02) compared to those who often partake in LTPA (Table 6a.). Additionally, there were interactions between LTPA and income, self rated physical health, and sex that were accounted for in the model. Thus, the effect of LTPA on role impairment is different for different values of income, self rated physical health, and sex. There was a significant interaction between LTPA and Gender (Table 6b.). Shown in Table 6b, females have a protective advantage for the role impairment category, and the odds of having at least some impairment are significantly smaller for the women who participate in LTPA less.

Table 6a. WHO-DAS II Role Impairment Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes	0.77	0.93	0.83	0.07	8.61
Rarely*	0.07	0.08	0.02	0.01	0.69
Never	2.71	2.81	0.34	0.34	21.48
Age					
18-24	REF				
25-44	1.6	0.66	0.26	0.71	3.65
45-54*	3.21	1.48	0.01	1.27	8.07
55+	0.65	0.36	0.44	0.22	1.96
Physical Health Rate					
Very Good	REF				
Good	1.81	0.96	0.27	0.63	5.2
Fair*	3.51	2	0.03	1.12	10.97
Poor	2.67	3.16	0.41	0.25	28.4
Major Depressive Disorder					
Met Criteria	REF				
Did not meet criteria*	0.47	0.13	0.009	0.27	0.82
Income					
≤ 17,999	REF				
18,000-31,999	2.11	1.15	0.18	0.71	6.24
32,000-54,999*	11.1	8	0.001	2.64	46.74
55,000+	1.06	0.6	0.92	0.34	3.3
Sex					
Male	REF				
Female	2.06	0.97	0.13	0.81	5.25

*indicates $p < 0.05$

Table 6b. Role Impairment Interaction between LTPA and Sex.

	Male		Female	
LTPA	**Adjusted OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Often	REF			
Sometimes	0.74 (-0.32, 1.80)	0.17	0.98 (0.21, 1.76)	0.01*
Rarely	0.20 (-0.11, 0.52)	0.21	0.78 (0.23, 1.33)	0.005*
Never	1.42 (-0.37, 3.21)	0.12	0.55 (0.13, 0.98)	0.01*

*indicates $p < 0.05$

WHO-DAS II Social Interaction

After adjusting for age, education, self rated physical health, and Major Depressive Disorder, the odds of having at least some impairment in the social interaction category for those who sometimes partake in LTPA are 83% times smaller (p=0.04) compared to those who often partake in LTPA (Table 7a.). While, the odds of having at least some impairment in the social interaction category for those who rarely partake in LTPA are 94% times smaller (p=0.01) compared to those who often partake in LTPA. There was also a significant interaction between LTPA and MDD that was added to the model (Table 7b.). The odds of having at least some impairment are 4.29 times larger (p = 0.03) for those who partake in LTPA sometimes, and did not meet criteria for MDD.

Additionally, for social interaction impairment, increasing in age is a protective factor. As participants aged the odds of having at least some impairment decreases. The odds of having at least some impairment for those ages 25-44 are 60% times smaller (p=0.03) compared to that of those aged 18-24. The odds of having at least some impairment for those ages 45-54 are 77% times smaller (p=0.004) compared to that of those aged 18-24. While the odds of having at least some impairment for those ages 55 and older are 84% times smaller (p<0.001) compared to that of those aged 18-24.

Table 7a. WHO-DAS II Social Interaction Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes*	0.17	0.15	0.04	0.03	0.95
Rarely*	0.06	0.06	0.01	0.01	0.50
Never	0.23	0.22	0.12	0.04	1.49
Age					
18-24	REF				
25-44*	0.4	0.17	0.03	0.18	0.92
45-54*	0.23	0.11	0.004	0.08	0.61
55+*	0.16	0.08	<0.001	0.06	0.42
Education					
0-11 Years	REF				
12 Years	1.23	0.7	0.72	0.39	3.84
13-15 Years	1.85	0.82	0.17	0.76	4.49
>=16 Years*	4.81	2.56	0.004	1.67	13.89
Physical Health Rate					
Very Good	REF				
Good	0.83	0.37	0.68	0.35	2.00
Fair	2.74	1.63	0.10	0.83	9.00
Poor	1.98	1.65	0.42	0.37	10.45
Major Depressive Disorder					
Met Criteria	REF				
Did not meet criteria*	0.02	0.01	<0.001	0.005	0.09

*indicates $p < 0.05$

Table 7b. Social Interaction Impairment Interaction between LTPA and MDD.

	Met Criteria for MDD		Did Not Meet Criteria for MDD	
LTPA	**Adjusted OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Often	REF			
Sometimes	0.17 (-0.12, 0.46)	0.24	4.29 (0.37, 8.21)	0.03*
Rarely	0.06 (-0.07, 0.19)	0.34	1.53 (-0.04, 3.10)	0.06
Never	0.23 (-0.19, 0.65)	0.29	9.66 (-2.43, 21.75)	0.12

*indicates $p < 0.05$

WHO-DAS II Out of Role

After adjusting for age, self rated physical health, Major Depressive Disorder, income, and sex, there were still no significant associations between LTPA and out of role impairment (Table 8a.). However, never partaking in LTPA compared to often LTPA is trending toward significance (p=0.06). There were also significant interactions between LTPA and income, and LTPA and sex added to the multivariable model. On the other hand, each self reported level of physical health increases the odds of impairment when compared to very good reported health. In addition, the odds of having at least some impairment in the out of role category for those ages 45-54 are 2.75 times larger (p=0.03) compared to that of those aged 18-24.

The odds of having at least some impairment in this category for those who partake in LTPA sometimes and are female are 1.06 times larger than that of those who partake in often LTPA (Table 8b.). However, the odds of having at least some impairment are 31% times, and 45% times smaller for the women who participate in LTPA rarely or never, respectively.

Table 8a. WHO-DAS II Out of Role Model.

	OR	Linearized SE	p-value	95% CI LL	95% CI UL
LTPA					
Often	REF				
Sometimes	0.74	0.75	0.77	0.1	5.54
Rarely	0.34	0.34	0.29	0.05	2.5
Never	5.3	4.74	0.06	0.89	31.55
Age					
18-24	REF				
25-44	1.63	0.66	0.23	0.73	3.65
45-54*	2.75	1.26	0.03	1.1	6.87
55+	0.52	0.27	0.22	0.18	1.48
Physical Health Rate					
Very Good	REF				
Good*	2.83	1.17	0.01	1.24	6.45
Fair*	8.71	3.64	<0.001	3.79	20.04
Poor*	4.04	2.6	0.03	1.12	14.62
Major Depressive Disorder					
Met Criteria	REF				
Did not meet criteria*	0.49	0.16	0.03	0.25	0.94
Income					
≤ 17,999	REF				
18,000-31,999	2.37	1.93	0.29	0.47	12.05
32,000-54,999*	6.43	4.54	0.01	1.57	26.31
55,000+	0.92	0.61	0.9	0.25	3.45
Sex					
Male	REF				
Female	1.32	0.85	0.66	0.37	4.75

*indicates $p < 0.05$

Table 8b. Out of Role Impairment Interaction between LTPA and Sex.

	Male		Female	
LTPA	**Adjusted OR (95% CI)**	**p-value**	**Adjusted OR (95% CI)**	**p-value**
Often	REF			
Sometimes	0.62 (-0.41, 1.65)	0.24	1.06 (0.14, 1.99)	0.025*
Rarely	0.28 (-0.16, 0.71)	0.22	0.69 (0.16, 1.22)	0.01*
Never	1.01 (-0.49, 2.51)	0.19	0.55 (0.05, 1.04)	0.03*

*indicates $p < 0.05$

DISCUSSION

H1: I hypothesized that as the level of leisure-time physical activity increases, the odds of having at least some impairment will decrease.

As the level of leisure-time physical activity increased, the odds of having at least some impairment did not decrease. Thus, this hypothesis is rejected. In the self-care category, the odds of impairment were highest for the sometimes category when compared to the often category.

H2: I hypothesized that those who partake in leisure-time physical activity rarely or never will be more likely to have at least some impairment in each functioning category compared to those who partake in leisure-time physical activity often or sometimes.

Rarely participating in leisure-time physical activity had a significant protective effect against at least some impairment in the cognition, role impairment, and social interaction categories. In the social interaction category, sometimes partaking in leisure-time physical activity also had a significant protective effect against at least some impairment. Thus, this hypothesis is rejected. However, in the self care and the out of role categories, never participating in leisure-time physical activity was trending towards significance for increasing the odds of impairment in those categories.

H3: I hypothesized that there will be a protective effect for those who partake in leisure-time physical activity often or sometimes, especially in the cognition, mobility, and role functioning categories.

There was not a protective effect for those who participated in leisure-time physical activity often or sometimes in the cognition, mobility, or role functioning categories. Thus, this hypothesis is rejected. However, there was a protective effect for those who participated in leisure-time physical activity sometimes in the social interaction category.

Results of this study suggest that among those with an anxiety disorder, LTPA is associated with the self-care, cognition, role impairment, and social interaction categories of the WHO-DAS II. It is those

who sometimes partake in LTPA who are at an increased risk of self care impairment compared to those who often partake in LTPA. Also, the odds of having at least some cognitive impairment are smaller for those who rarely partake in LTPA than that of those who partake in often LTPA. Additionally, the odds of having role impairment is significantly smaller for those who rarely partake in LTPA compared to those who partake in often LTPA. For the role impairment category, females have a protective advantage compared to males, and the odds of having at least some impairment are smaller for the women who participate in LTPA less. Lastly, the odds of having social interaction impairment among those who rarely or sometimes partake in LTPA are significantly smaller compared to those who often partake in LTPA. For the social interaction category, the odds of having at least some impairment are larger for those who partake in LTPA sometimes, and did not meet criteria for MDD. According to these findings, those who never partake in LTPA are neither protected nor at an increased risk for impairment.

In addition to the self rated physical health measures, other variables such as age, income, and MDD diagnosis also seem to greatly affect the association between LTPA and impairment. Not meeting the criteria for MDD significantly reduces the odds of impairment for the cognition, role impairment, social interaction, and out of role categories. This result is concurrent with previous literature, which states that those with depression or depressive symptoms may not partake in physical activity due to apathy or low levels of energy.[38] For the social interaction category, being greater than ages 18-24 significantly reduces the odds for impairment, and continues to reduces the odds of impairment as age increases. However, those between the ages of 45-54 have an increased odds of at least some impairment for the role impairment and out of role categories.

To my knowledge, this is the first study of physical activity and anxiety disorders, which focuses specifically on anxiety disorders, in addition to examining the relationship between physical activity and previous 30-day functioning. Previous research on physical activity and mental health mainly focus on the prevalence or number of symptoms of anxiety and depressive disorders. This previous research

suggests that leisure-time physical activity is associated with lower prevalence of anxiety and mood disorders.[25] Other research suggests that light physical activity, and moderate to vigorous physical activity is associated with lower rates of reported symptoms of anxiety and depression.[29] These findings are very informative, however, the dependent variable in this study is quite different compared to previous literature.

Rather than addressing the prevalence, or the number of symptoms associated with anxiety disorders, this study looked at impairment in previous 30-day functioning. The results of this study are intriguing. Perhaps individuals with an anxiety disorder do not partake in LTPA because it makes them too anxious. The sample of this study includes those with agoraphobia, panic disorder, and social anxiety. These anxiety disorders can result in avoiding people, places, and certain situations, such as leaving the house. Another possibility is that individuals with an anxiety disorder are sicker than a normal population, and are therefore, not as inclined to participate in physical activity.

The results of this study are curious, which could in part be due to the unique all anxiety sample. Future studies should try using the "never" category as the reference category to see if it clarifies and simplifies the interpretation. Future studies should also try grouping often, sometimes, and rarely together, and compare it to the never category to see if this has an impact on the results. LTPA could also be made binary by combining often and sometimes, as well as rarely and never together. Further research should be done using a cohort design to better assess the impact of physical activity on functioning, and include a larger sample of individuals with anxiety disorders.

Strengths

The strengths of this study should be noted. First, this sample was from the National Survey of American Life (NSAL), which is a national household probability sample survey. Second, a modified version of the World Mental Health Composite International Diagnostic Interview (WMH-CIDI) was used to make diagnoses based on the Diagnostic and Statistical Manual (DSM-IV-TR) criteria for mental

disorders. Thus, clinical diagnoses were assessed rather than anxiety symptoms, which results in more accurate but conservative estimates. Additionally, seven different types of anxiety disorders were included in the analysis. Third, the NSAL was a very detailed survey, thus a wide range of potential confounders could be accounted for. Lastly, this is the first study to use the WHO-DAS II to look at the effect of leisure-time physical activity on previous 30-day functioning for those with a clinically diagnosed anxiety disorder.

Limitations

When interpreting these results it is important to take into account the limitations of this study. First, including only those with an anxiety disorder resulted in a relatively small sample size of 548. Thus, for some of the analyses small cell sizes and statistical power were problematic, which led to large standard errors and confidence intervals. Examining a larger dataset would increase power and reduce small cell sizes. Second, the NSAL sample was designed to assess African Americans and Afro-Caribbeans. It would be interesting to do the same study with a larger sample with a wider range of races. Since the sample size was relatively small the distribution of males to females was also disproportionate. Third, this is a cross-sectional study, so no temporal association can be established. Lastly, only one question, which was self-reported, was used to measure the amount of physical activity. The physical health rating was also self reported. Thus, for future research a better method for measuring physical activity is needed.

Conclusion

In 2010, anxiety disorders were classified as the sixth leading cause of disability, in terms of years of life lived with disability (YLD) in high-, middle-, and low-income countries.[1] Additionally, in any given year in the United States, anxiety disorders affect approximately 40 million Americans who are 18 years or older.[6] Thus, anxiety disorders are highly prevalent, and are chronic conditions that impact quality of life. Therefore, public health efforts need to be taken to find effective ways to help prevent

and treat these disorders. Public health focus should not only include treating symptoms, but should also focus on helping individuals attain greater functionality by reducing impairments that lead to a lower quality of life.

This study focused on the functionality aspect of treatment, by examining the association between physical activity and previous 30-day functioning for those with an anxiety disorder. The results presented here imply that leisure-time physical activity does impact various categories of previous 30-day functioning for those with a clinically diagnosed anxiety disorder. However, compared to those who partake in LTPA often, those who never partake in LTPA are neither protected nor at an increased risk for impairment. Based on this study, public health officials should note that promoting leisure-time physical activity may not be the best approach to improve daily functioning for those with an anxiety disorder. Public health experts should research other possible ways to improve daily functioning and quality of life for those with an anxiety disorder.

REFERENCES

REFERENCES

1. Baxter AJ, Vos T, Scott KM, Ferrari AJ, Whiteford HA. The global burden of anxiety disorders in 2010. Psychol Med. 2014;:1-12.

2. Bloom DE, Cafiero ET, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, Feigl AB, Gaziano T, Mowafi M, Pandya A, Prettner K, Rosenberg L, Seligman B, Stein A, Weinstein, C. (2011). The Global Economic Burden of Non-communicable Diseases. Geneva: World Economic Forum.

3. Kessler RC, Aguilar-Gaxiola S, Alonso J, Chatterji S, Lee S, Ormel J, Ustün TB, Wang PS. The global burden of mental disorders: an update from the WHO World Mental Health (WMH) surveys. *Epidemiol Psichiatr Soc* 2009;18(1):23–33.

4. Greenberg PE, Sisitsky T, Kessler RC, Finkelstein SN, Berndt ER, Davidson JR, Ballenger JC, Fyer AJ. The economic burden of anxiety disorders in the 1990s. *J Clin Psychiatry* 1999;60(7):427–35.

5. Soni, Anita. *The Five Most Costly Conditions, 1996 and 2006: Estimates for the U.S. Civilian Noninstitutionalized Population.* Statistical Brief #248. July 2009. Agency for Healthcare Research and Quality, Rockville, MD.

6. Kessler RC, Chiu WT, Demler O, Walters EE. Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). *Archives of General Psychiatry*, 2005 Jun;62(6):617-27.

7. World Health Organization. (WHO 2011a). *Global status report on non-communicable diseases 2010.* Geneva: WHO.

8. *The Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM–5*; American Psychiatric Association, 2013).

9. Kessler RC, Petukhova M, Sampson NA, et al: Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the US. Int J Methods Psychiatr Res 21(3):169–184, 2012.

10. Lewis-Fernández R, Hinton DE, Laria AJ, et al: Culture and the anxiety disorders: recommendations for DSM-V. Depress Anxiety 27(2):212–229, 2010.

11. Seedat S, Scott KM, Angermeyer MC, et al: Cross-national associations between gender and mental disorders in the World Health Organization World Mental Health Surveys. Arch Gen Psychiatry 66(7):785–795, 2009.

12. Mohlman J, Bryant C, Lenze EJ, et al: Improving recognition of late life anxiety disorders in Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition: observations and recommendations of the Advisory Committee to the Lifespan Disorders Work Group. Int J Geriatr Psychiatry 27(6):549–556, 2012 10.1002/gps.2752.

13. Fehm L, Pelissolo A, Furmark T, Wittchen HU: Size and burden of social phobia in Europe. Eur Neuropsychopharmacol 15(4):453–462, 2005.

14. Wittchen HU, Gloster AT, Beesdo-Baum K, et al: Agoraphobia: a review of the diagnostic classificatory position and criteria. Depress Anxiety 27(2):113–133, 2010.

15. Craske MG, Kircanski K, Epstein A, et al: Panic disorder: a review of DSM-IV panic disorder and proposals for DSM-V. Depress Anxiety 27(2):93–112, 2010.

16. Goodwin RD, Faravelli C, Rosi S, et al: The epidemiology of panic disorder and agoraphobia in Europe. Eur Neuropsychopharmacol 15(4):435–443, 2005.

17. Shear K, Jin R, Ruscio AM, et al: Prevalence and correlates of estimated DSM-IV child and adult separation anxiety disorder in the National Comorbidity Survey Replication. Am J Psychiatry 163(6):1074–1083, 2006.

18. Kessler RC, Berglund P, Demler O, et al: Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry 62(6):593–602, 2005a.

19. Beals J, Manson SM, Shore JH, et al: The prevalence of posttraumatic stress disorder among American Indian Vietnam veterans: disparities and context. J Trauma Stress 15(2):89–97, 2002.

20. Hinton D, Lewis-Fernández R: The cross-cultural validity of posttraumatic stress disorder: implications for DSM-5. Depress Anxiety 28(9):783–801, 2011.

21. Mendlowics MV, Stein MB. Quality of life in individuals with anxiety disorders. *American Journal of Psychiatry* 2000;157:669-682.

22. Stein MB, Roy-Byrne PP, Craske MG, et al. Functional impact and health utility of anxiety disorders in primary care outpatients. *Med Care* 2003;12:34-43.

23. Ströhle A, Höfler M, Pfister H, et al. Physical activity and prevalence and incidence of mental disorders in adolescents and young adults. Psychol Med. 2007;37(11):1657-66.

24.Sanchez-villegas A, Ara I, Guillén-grima F, Bes-rastrollo M, Varo-cenarruzabeitia JJ, Martínez-gonzález MA. Physical activity, sedentary index, and mental disorders in the SUN cohort study. Med Sci Sports Exerc. 2008;40(5):827-34.

25. Ten have M, De graaf R, Monshouwer K. Physical exercise in adults and mental health status findings from the Netherlands mental health survey and incidence study (NEMESIS). J Psychosom Res. 2011;71(5):342-8.

26. Dunn AL, Trivedi MH, O'Neal HA. Physical activity dose response effects on outcomes of depression and anxiety. Med Sci Sports Exerc. 2001;33(6 suppl):S587-97.

27. Dunn AL, Trivedi MH, Kampert JB, et al. Exercise treatment for depression: efficacy and dose response. Am J Prev Med. 2005;28-1-8.

28. Torres ER, Sampselle CM, Ronis DL, Neighbors HW, Gretebeck KA. Leisure-time physical activity in relation to depressive symptoms in African-Americans: results from the National Survey of American Life. Prev Med. 2013;56(6):410-12.

29. Jonsdottir IH, Rödjer L, Hadzibajramovic E, Börjesson M, Ahlborg G. A prospective study of leisure-time physical activity and mental health in Swedish health care workers and social insurance officers. Prev Med. 2010;51(5):373-77.

30. Heeringa, S.G., Wagner, J., Torres, M., Duan, N., Adams, T., Berglund, P., 2004. Sample designs and sampling methods for the Collaborative Psychiatric Epidemiology Studies (CPES). Int. J. Methods Psychiatr. Res. 13, 221-240.

31. http://www.rcgd.isr.umich.edu/prba/nsal

32. World Health Organization (WHO). (2000) *World Health Organization: Disability Assessment Schedule II (WHO-DAS II)*, Geneva, WHO.

33. Galindo-garre F, Hidalgo MD, Guilera G, Pino O, Rojo JE, Gómez-benito J. Modeling the World Health Organization Disability Assessment Schedule II using non-parametric item response models. Int J Methods Psychiatr Res. 2015;24(1):1-10.

34. Von korff M, Crane PK, Alonso J, et al. Modified WHODAS-II provides valid measure of global disability but filter items increased skewness. J Clin Epidemiol. 2008;61(11):1132-43.

35. Chwastiak LA, Von Korff M. Disability in depression and back pain evaluation of the World Health Organization Disability Assessment Schedule (WHO DAS II) in a primary care setting. Journal of Clinical Epidemiology. 2003;56:507-514.

36. Luciano JV, Ayuso-mateos JL, Aguado J, et al. The 12-item World Health Organization Disability Assessment Schedule II (WHO-DAS II): a nonparametric item response analysis. BMC Med Res Methodol. 2010;10:45.

37. Jr. DW, Lemeshow S, Sturdivant RX. Applied Logistic Regression. John Wiley & Sons; 2013.

38. Azevedo da silva M, Singh-manoux A, Brunner EJ, et al. Bidirectional association between physical activity and symptoms of anxiety and depression: the Whitehall II study. Eur J Epidemiol. 2012;27(7):537-46.