Examining the Association Between Sociodemographic Factors, Stress and Mindfulness with Migraine Disability and Migraine Frequency in Adults with Migraines

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Abstract

Background: Psychological stress plays a role in migraine, but the role of socioeconomic stress (SES) on migraine is less clear, as well as the impact of how baseline mindfulness may impact these stressors. The purpose of this study is to assess the relationship between SES, perceived stress, migraine frequency, migraine disability, and mindfulness in adults with migraines.

Design: Adults with 4-20 migraines per month completed the following instruments: Perceived Stress Scale (PSS), Migraine Disability Assessment (MIDAS), Headache Impact Test-6 (HIT-6), Five Facet Mindfulness (FFM), and self-reported migraine frequency and sociodemographic factors. Using regression analyses, we assessed the relationships between perceived stress, sociodemographic factors, migraine frequency, disability, and mindfulness. Of 116 participants screened, the data from 106 was analyzed (exclusions: n=4 medication overuse headache; n=2 cluster headache; n=4 daily headaches).

Results: Participants self-reported an average of 7.78 migraines/month, with mean (standard deviation) age of 43.48 years (13.37). Most participants were female (92.45%) and non-Hispanic/Latino (94.34%), with 15.24% black/African American. Participants’ income ranged from $0-49,999 (36.19%), $50-99,999 (34.29%), $100-149,999 (17.14%), to more than $150,000 (12.38%). Participants were moderately stressed, with mean (standard deviation) PSS of 16.66 (6.39), moderately disabled (MIDAS of 15.22 (11.83)), severely impacted by their headaches (HIT-6 of 63.54 (6.05)) and had low levels of mindfulness (FFM of 135.39 (19.19)). Participants who were disabled/employed
part-time/unemployed reported significantly higher PSS versus those employed full time/homemakers/students/retired (p=0.0003). While higher levels of FFM were associated with decreased PSS (p<0.0001), PSS scores were not associated with migraine frequency (p=0.68). There was not a significant association between sociodemographic factors and migraine frequency, MIDAS, or HIT-6. Models predicting MIDAS scores suggest that higher FFM acts as a protective factor for individuals with low income and minority status, resulting in lower MIDAS scores.

Conclusion: We did not observe a significant difference in migraine frequency or disability by sociodemographic characteristics, suggesting that migraine may equally affect people regardless of demographics, income and employment. Higher levels of mindfulness were associated with decreased perceived stress, indicating that interventions to increase mindfulness may help alleviate stress and prevent negative effects of migraine. Models suggest that mindfulness could be a powerful protective factor for individuals with low income and minority status. These results should be further explored with a future randomized study.
Chapter 1.0

1.1 Introduction

This chapter provides background information on the relationships between migraine, stress, sociodemographic factors and mindfulness. Gaps and limitations in the existing literature become evident, demonstrating the importance of further understanding these relationships and the need and value of our research study.

1.2 Migraine Prevalence & Impact

Migraine is defined by having a headache lasting 4-72 hours, with two of the following four pain features: throbbing/pulsating pain, unilateral, moderate-severe in intensity, worsened by activities/movement; with one of the following two non-pain features: nausea and/or vomiting OR photophobia and phonophobia (International Headache Society. Headache Classification Subcommittee, 2004). These symptoms can be very crippling, leading to a significant negative impact on disability and quality of life. Migraine is the sixth leading cause of disability worldwide according to the World Health Organization (Steiner et al., 2015). A systematic review and meta-analysis of 6,216,995 participants from 302 community based studies reported a global overall migraine prevalence of 11.6%, with 13.8% in women and 6.9% in males affected (Woldeamanuel & Cowan, 2017). Variation of migraine prevalence by region exists with higher rates in Central/South American (16.4%) and lower rates in Europe (11.4%), Africa (10.4%), Asia (10.1%), and North America (9.7%) (Woldeamanuel & Cowan, 2017). Migraine is much more common than many realize, affecting 45 million people in the United States translating to an annual prevalence of roughly one out of seven individuals (Burch Rebecca C et al., 2015).
The disabling and painful impact of migraine symptoms is not the only burden placed on individuals as a result of migraine. Migraineurs often feel a great deal of emotional suffering in their personal lives as a result of having migraines. In the CAMEO study, 13,064 migraineurs completed a Family Burden module that showed that 60% of individuals with migraine did not participate in activities with other family members at least one time in the past thirty days (Buse et al., 2016). This imposed burden was also observed in parent-child interactions, as many participants felt as though their migraines affected their ability to parent at an ideal or optimum level.

In addition to the tremendous personal suffering and disability caused by migraines, migraines also have a significant negative impact on the economy both directly and indirectly (Burch Rebecca C. et al., 2015). In the International Burden of Migraine study, Messali and colleagues stated that direct costs are the majority of migraine related health costs and include financial costs directly associated with migraine care (ER/clinical visits) and pharmaceutical costs (Messali et al., 2016). Migraine is the fourth leading cause of emergency department visits in the United States in 2010 and a leading cause of outpatient visits (Burch Rebecca C. et al., 2015). Pharmaceutical utilization is responsible for a large portion of direct medical costs associated with the disorder (Messali et al., 2016). Indirect costs associated with migraine include both absenteeism from work (i.e. missed work days) and lost productivity while at work. In the United States the loss of productivity at work and total absence contributes to an estimated 13 billion dollars a year in lost work wages while direct costs associated with migraine are estimated to total around 1 billion dollars a year (Hu. et al., 1999).

Thus, migraine is a debilitating disorder which places a large physical, psychological and emotional burden on patients and a large economic burden on society. Despite the overwhelming impact migraine has on patients and society,
migraine continues to be underdiagnosed, undertreated and underfunded. The National Institutes of Health in 2016 spent only $24 million dollars on headache research (compared to roughly 3 billion on aging research) ("NIH Categorical Spending - NIH Research Portfolio Online Reporting Tools (RePORT)," n.d.). With such a small amount of money dedicated to the vast category of headache, which encompasses more than just migraine, migraine specific research remains severely under supported and underfunded (Schwedt et al., 2009).

1.3 The Association between Stress and Migraine

Stress is a well-documented trigger of migraine. Nearly 60% of migraine sufferers report stress as the number one trigger for an impending migraine attack (Peroutka, 2014). Additionally, stress is of particular clinical interest because it represents a modifiable risk factor (Lipton et al., 2014). Houle and colleagues investigated the influence of stress and sleep on headache severity in those with migraine and tension-type headache (TTH). Participants in the study tracked daily stress levels and kept a daily sleep and headache log. They found that two consecutive days of either low stress or adequate sleep acted as a protective factor for impending migraine attacks. They also found an additive negative effect of two consecutive days of both high stress and inadequate sleep, which resulted in the most headache activity (Houle et al., 2012). The main limitation of this study was the small sample size (n=33 migraine; n=22 TTH) which could result in a lack of generalizability.

Although Houle’s 2012 research demonstrated a direct positive association between perceived stress and migraine attacks, the relationship may not be so clear (Schoonman et al., 2007). In 2014, Lipton and colleagues tested the “let down headache hypothesis” – that a decrease in perceived stress triggers the onset of a migraine (Lipton et al., 2014). Participants (n=22) kept daily headache logs and tracked daily subjective
stress levels (with the Perceived Stress scale and the Self-Reported Stress Scale) and analyses assessed the impact of change in stress levels on migraine attacks. Interestingly, they found that a decline in stress from one evening to the next was consistently associated with migraine attack onset on the third day. Specifically, a decrease in stress had an increased likelihood of a migraine attack over the next 6, 12 and 18 hours (p<.05), with the odds ratios for the Perceived Stress Scale ranging from 1.5 to 1.9 (p<.05) (Lipton et al., 2014). Although this study was also limited by a small sample size, the results imply that the relationship between migraine and stress is complicated and may involve other factors and/or mediators playing important roles. The different results from Houle and Lipton’s research highlight the need for additional research to help understand this complex relationship between stress and migraine.

In addition to psychological measures of stress, biological measures of stress have also been used to assess their impact on migraine. Schoonman and colleagues examined the impact of both the psychological and biological components of stress on migraine attacks in 17 patients (Schoonman et al., 2007). Using the objective biological markers of stress of salivary cortisol, heart rate average, and heart rate variability, they failed to detect any objective evidence of changes in a biological stress response before or during a migraine attack. Post-hoc analyses of the “stress sensitive patients,” (n=9, those that felt stress was a trigger for >2/3 of their migraine attacks) found an increase in perceived psychological stress, but not biological measures, prior to migraines (Schoonman et al., 2007). This research suggests that psychological or mental stress could be the primary trigger for migraine attacks. They also raised awareness of the possibility of “stress sensitive” migraine patients. Their study was also limited by the small sample size (n=17) as seen in prior studies.
1.4 Socioeconomic Status and its Impact on Migraine

Socioeconomic status is a sociodemographic factor determined by factors such as one’s household income, education level, employment status and access to health care. Socioeconomic status, alongside social, physical and emotional trauma are examples of psychological stressors, with their counterparts being labeled as physical stressors (Maleki, Becerra, & Borsook, 2012). Socioeconomic stressors are known to add to the burden of any disease, but this has not been specifically evaluated in migraine. Thus the question of the effect of socioeconomic status, as a psychological stressor, on the burden imposed by migraine still remains.

Two different hypotheses have been introduced to explain the association between migraine prevalence and socioeconomic status. The first hypothesis, the social selection hypothesis, suggests that the disease causes a lower socioeconomic status due to an inability to perform at an optimum level (Charleston et al., 2018). This inability to perform possibly interrupts opportunities which could result in lowering one’s socioeconomic status. Buse and colleagues in the CAMEO study reported that roughly one third of its sample size reported that their headaches resulted in long term worry about their individual and families’ financial future and security (Buse et al., 2016). The second theory, social causation, suggests that a lower socioeconomic status increases exposures to stressors, resulting in an increase migraine prevalence. The social causation theory suggests that the stressors that come with a lower socioeconomic status add to the burden of the disorder. Both hypotheses are plausible explanations for the association between migraine prevalence and socioeconomic status.

The authors of the population based American Migraine Prevalence and Prevention (AMPP) Study, the largest study of migraine sufferers (n=162,576 Americans), defined 3 features they felt were necessary for patients to receive
appropriate headache care: (1) seeking care from a health care professional; (2) receiving a migraine diagnosis; and (3) using migraine-specific medications. They found that the SES factors of insurance status and income impacted the ability for patients to receive appropriate headache care. Further analyses of the AMPP data demonstrated that migraine prevalence increased as household income decreased (Stewart, Roy, & Lipton, 2013), directly supporting the social causation theory. Since this study is cross-sectional, researchers were unable to determine causation. After adjusting for cofounders, this study suggested that the association was not due to race and other confounders (Stewart et al., 2013). Opposed to prevalence rates, remission rates however did not differ based off of household income (Stewart et al., 2013). Since authors considered education to be directly associated with income, education was not considered during analysis. Although household income is a stronger predictor of socioeconomic status, it is not the only predictor. This study, although effective at making an association between income and migraine, may not have captured the full impact of socioeconomic status on migraine.

An increase in emergency department visits among migraineurs has also been associated with lower household income. As part of a sub-study of the larger AMPP study, Friedman and colleagues noted that in terms of household income, migraineurs with a household income of twenty-two thousand, five hundred dollars were 2.4 times more likely to visit the emergency department at least once and 11.5 times more likely to visit the emergency department at least four times, compared to those that made more than ninety-two thousand dollars (Friedman et al., 2009).

Health insurance may be another socioeconomic factor that has a direct impact on migraine care. Wu and colleagues showed that of 1,961 migraine patients from the Medical Expenditure Panel Survey, individuals who were uninsured were less likely to receive triptans, a migraine-specific abortive medicine, compared to those with
insurance (Wu. et al., 2015). This disparity directly impacts migraine care as ineffective treatment for migraine may result in consequences such as medication overuse headache and the progression of episodic migraine to chronic migraine (Atasoy et al., 2005). In a population-based study examining the association between insurance status and migraine care, Wilper and Colleagues showed that individuals who lacked insurance and individuals with Medicaid received substandard care by receiving less attention in physician’s offices but more care in emergency departments (Wilper et al., 2010).

In addition to insurance and income, authors have suggested that employment status may have an impact on migraine. Burch and colleagues analyzed data from the national health interview survey (n=21,157) and determined that those who were employed were less likely to report migraine episodes compared to unemployed or part time individuals (Burch Rebecca C. et al., 2015). In addition to employment status, individuals who reported commercial insurance in this study were less likely to report migraine episodes compared to individuals who were uninsured or insured with Medicaid (Burch Rebecca C. et al., 2015). Due to this study’s cross-sectional nature, researchers were unable to determine causation.

While many studies have assessed a single socioeconomic variable on migraine, the need exists for a multifaceted study which encompasses multiple socioeconomic factors.

1.5 Mindfulness as a Possible Protective Factor for Migraine

Meditation programs may be a non-pharmacological treatment option for individuals with chronic pain disorders. Meditation may alter how individuals cope and process pain (Zeidan et al., 2011). Mindfulness meditation is a type of meditation practice taught in the standardized mindfulness based stress reduction (MBSR)
program. Mindfulness is “the awareness that arises through paying attention on purpose in the present moment, and non-judgmentally” (Kabat-Zinn, University of Massachusetts Medical Center/Worcester., & Stress Reduction Clinic., 1990). In a systematic review and meta-analysis of the health benefits of meditation practices, Goyal and colleagues examined 47 trials containing 3,320 participants of various meditation techniques, including mindfulness based stress reduction techniques (Goyal et al., 2014). Mindfulness programs on average required eight weeks of training averaging 20-27.5 hours of training (Goyal et al., 2014). Results from this meta-analysis and systematic review showed moderate evidence for the improvement of anxiety, depression, and pain but a low amount of evidence for the improvement of quality of life and stress with mindfulness based meditations. This study, however, had some significant limitations, such as including studies which lacked a standardization for trainers, standardization to modern standards, and a lack of registration on ClinicalTrials.gov. Thus, due to the limited details and information, researchers were unable to make certain conclusions on effect modifiers (i.e duration, dose etc.) (Goyal et al., 2014). Other studies have looked at specific pain conditions such as low back pain. Although chronic back pain is not migraine, it is a highly prevalent pain disorder which has similarities to migraine.

Zgierska conducted a 26 week parallel arm pilot randomized controlled study (n=35) evaluating the effect of mindfulness meditation vs. standard care and cognitive behavioral therapy on pain sensitivity and severity in elderly patients with chronic low back pain previously treated with regular opioid use (Zgierska et al., 2016). This study examined various aspects such as disability, pain intensity, self-reported psychological health, pain psychophysical testing, (looking at pain intensity and unpleasantness) and biomarkers (serum levels of C-reactive protein and inflammatory cytokines four) (Zgierska et al., 2016). Participants experienced a statistically significant reduction in pain severity ratings (p=0.045) and statistically significant decrease in pain sensitivity to
thermal stimuli (p<0.05) after mindfulness meditation (Zgierska et al., 2016). A significant limitation of this study was the lack of blinding of participants and study personnel after randomization, which could have biased the results such that a placebo effect could explain the effect seen in the intervention group. The small sample size (n=21 in the experimental arm; n=14 control arm) limits generalizability of results as well.

Pain is a subjective experience constructed from interactions among affective, cognitive, and sensory brain processes (Zeidan et al., 2011). Meditation may alter how individuals cope and process pain. Using healthy volunteers, Zeidan and colleagues conducted a randomized study that showed that mindfulness may affect pain regulation via multiple mechanisms (n=18). Participants reported a statistically significant decrease in pain unpleasantness (57%) and pain intensity (40%) after mindfulness based meditation. Researchers noted an associated increase in activity in the anterior insula, anterior cingulate cortex, orbitofrontal cortex activation, as well associated thalamic deactivation, all areas important to the construction of the pain experience. While this study evaluated experimental pain in healthy volunteers and may lack generalizability to the migraine population, these results could offer a particular explanation for how mindfulness may impact the pain component of migraine.

Although there is significant research looking at the behavioral treatment options of cognitive behavioral therapy and stress reduction for migraines, little research exists for evaluating mindfulness specifically for migraine. In a randomized control trial of 107 migraineurs, Feuille and colleagues looked at the effect of mindfulness, relaxation and spiritual mindfulness meditation on migraine (n=22 mindfulness; n=27 spiritual mindfulness; n=25 relaxation). Researchers noted a decrease in pain related stress for those who completed mindfulness meditation in relation to relaxation (Feuille & Pargament, 2015). This study had major limitations, such as only including college
students which may lack generalizability. This study suggests mindfulness may have an impact on the pain component of migraine.

Although pain is a major component of migraine, migraine is comprised of much more than simply pain. Very few studies have focused on the effects of mindfulness meditation on characteristics outside of pain in migraine. In a randomized study comparing mindfulness training and pharmacological prophylaxis, Grazzi & colleagues examined the effects of treatment on the withdrawal process in chronic migraine suffers with medication overuse headache (n=44). In this study researchers noted similar improvements in migraine frequency, medication intake and a decrease in MIDAS scores, in both experimental groups. Although this study examined a very specific population, affecting generalizability, this study suggests the effectiveness of mindfulness on non-pain related migraine features. In the first randomized study of MBSR in adults with migraines (n=19), Wells and colleagues found that MBSR was safe and feasible to migraineurs (Wells et al., 2014). Compared to the wait-list control group, those who completed MBSR had 1.4 fewer migraines/month, and their headaches were less severe and of shorter duration (Wells et al., 2014). This pilot study demonstrated a potential positive benefit for MBSR on adults with migraines, leading to the need for a larger study with an active control group. The data from our present study is from the baseline evaluations of this follow-up, larger study.
1.6 Literature Review Conclusion

Migraine is a disabling and debilitating disorder affecting millions. Stress is the number one reported trigger for migraines. Socioeconomic status is a sociodemographic factor characterized as a psychological stressor and may be associated with migraine prevalence. Mindfulness represents a possible protective factor in relation to migraine. This study aims to explore the impact of factors such as stress and sociodemographic factors on migraine to identify potential additional treatment approaches. This study assesses the relationship between perceived stress, migraine disability, migraine frequency, and mindfulness and examines how these associations vary by sociodemographic factors. Understanding the relationship between sociodemographic factors and stress on migraine is important to identify programs that could specifically target these factors. Further, if mindfulness mitigates the impact of stress and/or sociodemographic factors on migraine, then this could bring awareness to the need for the development of mindfulness programs specific for migraineurs.
Chapter 2.0

2.1 Objectives

This preliminary investigation will help inform larger studies where possible confounders in the associations observed can be considered. Our primary aim is to determine whether sociodemographic factors (socioeconomic and minority status) are associated with perceived stress in the past month in migraineurs (See Table 1). Our primary hypothesis is that adults with migraine with lower socioeconomic or minority status will report higher levels of perceived stress over the past month than individuals with higher socioeconomic statuses or non-minority status (See Figure 1A).

Our secondary aim is to determine whether stress and sociodemographic factors (socioeconomic status and minority status) are associated with migraine disability and frequency (See Table 1). Our secondary hypothesis is that individuals with high levels of perceived stress over the past month with lower socioeconomic or minority status will report higher migraine disability and migraine frequency compared to individuals with low perceived stress and higher socioeconomic status/non-minority status (See Figure 1B).

Our tertiary aim is to determine whether mindfulness offsets the impact stress and socioeconomic status have on migraine disability and frequency (See Table 1). Our tertiary hypothesis is that individuals with low mindfulness, and lower socioeconomic or minority status who report higher levels of stress will be associated with a higher migraine disability and migraine frequency compared to individuals with high mindfulness and lower socioeconomic or minority status who report higher levels of stress. (See Figure 1C).
2.2 Methods and Measures

2.2.1 Study Design

The study was approved by Wake Forest Internal Review Board (IRB#00027845, Principal Investigator REW) Participants in this study completed one in-person study visit as part of the ongoing Stress Reduction for Migraine study, (PI Wells). Study team members conducted telephone screens for potential participants with detailed questions about their health and background in order to determine eligibility. After the phone screen, baseline in-person visits were conducted in order to fully determine eligibility with a United Council of Neurological Subspecialist Headache Certified (UCNS) neurologist (REW), who conducted a complete neurological history and physical exam to confirm migraine diagnosis and eligibility criteria. Individuals completed a 1:1 baseline interview which included questions about sociodemographic information. Participants also completed a series of instruments\(^1\). This study assessed the results from the baseline

\(^1\) The following instruments were also included in the baseline questionnaire for the Stress Reduction for Migraines study but were not included in these analyses: Difficulty in Emotion Regulation (DERS), Pain Catastrophizing Scale (PCS), Chronic Pain Acceptance Questionnaire (CPAQ), Migraine Specific Quality of Life, version 2.1 (MSQOL), Patient Health-related Questionnaire-depression module 9 (PHQ-9), Generalized Anxiety Disorder 7 (GAD-7), Hope-Herth Hope Index (HHI), Optimism-Life Orientation Test-revised (LOT-R), NIH PROMIS Sleep Disturbance, NIH PROMIS Global Health (first question only), Social Connectiveness Scale, Alldynia Symptom Checklist, Quality of Life-MSQOL, V.21, Flourishing Scale, Brief Resilience Scale, Pittsburgh Sleep Quality Index, HA Management Self –Efficacy & Credibility/Expectation Questionnaire
interview and the following instruments: Migraine Disability Assessment Scale (MIDAS), Perceived Stress Scale (PSS), Five Facet Mindfulness Questionnaire (FFM) & Headache Impact Test (HIT-6)). Thus, information collected and analyzed from this study included migraine diagnosis, race, ethnicity, socioeconomic status, levels of perceived stress over the last month, migraine disability and migraine frequency. Participants who completed baseline in-person evaluations from August 2016-February 2018 were included in analyses. Study data were collected and managed using REDCap electronic data capture tools hosted at Wake Forest Baptist Medical Center. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources (Harris et al., 2009). RedCap was protected by Wake Forest’s security measures (Harris et al., 2009).

Additional testing also occurred for the full Stress Reduction for Migraine study and was not included as part of this study. Participants also completed quantitative sensory testing (QST) at the baseline visit. After the baseline visit individuals tracked their headaches for four weeks and eligibility was determined. Eligible individuals were randomized into one of two groups. After randomization, individuals began classes, once a week for 8 weeks, lasting two hours each. After the 8 weekly classes individuals returned to Wake Forest Baptist Medical Center for three addition follow-up study visits (Initially, Three month follow-up and Six month follow-up). The Stress Reduction for Migraine study was conducted in cohorts. The baseline data from the first five cohorts of this study are included in this analysis (Data from August 2016-February 2018).
2.2.2 Subject Recruitment Methods

This study recruited adults with migraine to participate in eight weekly classes aimed at stress reduction. Participants with migraine were recruited by several different mechanisms. 1) Wake Forest Departments of Neurology, Internal Medicine, Family Medicine and Emergency Department (i.e. Migraine Research Participant, Direct Provider Referral, & Online Provider Referral); 2) Wake Forest Houle Headache Research Center; 3) Wake Forest Electronic Medical Record System; 4) Local Flyers, Radio/Television/Newspaper Advertisements; 5) Social Media Advertisements (i.e Facebook, Twitter, & Instagram); 6) Bus Ads; 7) Online Registry (i.e. ClinicalTrials.gov); 8) Other (i.e. Presentations, Craigslist, etc)

2.2.3 Participants

2.2.3.1 Inclusion criteria

Inclusion Criteria for our study reflected the inclusion criteria for the Stress Reduction for Migraine study, which included being at least 18 years of age, having migraines for more than one year and having 4-20 days per month with migraines.

2.2.3.2 Exclusion criteria

Exclusion criteria for our study reflected the exclusion criteria for the Stress Reduction for Migraine study; individuals who practiced current regular (weekly or more often) practice of meditation; had any major unstable medical/psychiatric illness (e.g., hospitalization within 90 days prior to screening, suicide risk, etc.); had other non-migraine chronic pain condition (e.g., fibromyalgia, low back pain, etc.) or sensory nerve problems (e.g., neuropathy, Raynaud’s, etc.); Medication overuse headache diagnosis
(International Classification of Headache Disorders-II); current or planned pregnancy or breastfeeding; or any new medication started within four weeks of screening visit.

2.2.4 Setting

Study visits were conducted at Wake Forest Baptist Medical Center. Advertisements targeted individuals within Winston-Salem, NC.

2.2.5 Variables

**Migraine diagnosis:** A diagnosis of migraine (ICHD-III-B) is “at least five attacks, not attributable to another disorder, with: headache lasting 4-72 hours (untreated or unsuccessfully treated); with at least two of the following: unilateral location, pulsating quality, moderate or severe pain intensity or aggravation by or causing avoidance of routine physical activity; and one of the two: nausea and/or vomiting; or photophobia and phonophobia” (International Headache Society. Headache Classification Subcommittee, 2004). Migraine diagnosis was initially assessed with the telephone screen and confirmed by a neurologist with UCNS Headache Certification (REW) at the baseline in-person visit. Migraine frequency was assessed via self-report; the accuracy for self-reported migraine frequency has previously been validated (McKenzie & Cutrer, 2009).

**Migraine disability:** Migraine disability was assessed by the MIDAS and HIT-6 scales. The MIDAS and HIT-6 scales have both been previously validated (Stewart et al., 2013) (Rendas-Baum et al., 2014). A description as well as a full descriptive range of scores for the MIDAS and HIT-6 are listed in Table 2.
**Psychological Stress:** Psychological stress is defined as when the environmental demands exceed the body's adaptive capacity to fill those needs. (Cohen S, Janicki-Deverts D, & Miller GE, 2007). Psychological stress over the past month was assessed via the 10 item Perceived Stress Scale (PSS). The PSS has previously been validated (Andreou et al., 2011). A description as well as a full descriptive range of scores for the PSS is listed in Table 2.

**Mindfulness:** Mindfulness is defined as the awareness that arises through paying attention on purpose in the present moment, and non-judgmentally (Kabat-Zinn et al., 1990). Baseline mindfulness was assessed by the Five-facet Mindfulness Questionnaire (FFM) during the initial baseline visit. The FFM has been previously validated (Neuser, 2010). A description as well as a full descriptive range of scores for the FFM is listed in Table 2.

**Sociodemographic Factors:** Self-reported sociodemographic factors are further categorized into socioeconomic status and minority status.

**Socioeconomic status:** Socioeconomic status is determined by one’s self-reported household income, highest education level completed, employment status and insurance status. The levels for highest education were less than 9th grade, 9th-12th grade, high School/GED, associate’s degree, some college (no degree), bachelor’s degree (i.e BA, AB, BS, BBA) and graduate degree (i.e PhD, EdD, MD). The levels for employment status were employed/self-employed full time (>30 hours a week), employed part time (<30 hours a week), student, homemaker, volunteer, disabled, unemployed, retired, other. We grouped individuals who were disabled, employed part time, and unemployed together. Additionally, individuals who were employed full-time, homemakers and students were grouped together while retired individuals were grouped separately. The levels for insurance status were private, medicaid or medicare, other.
public insurance, none. The levels for yearly household income were less than $50,000, $50-$100,000, $100-$150,000, $150,000+ and declines to answer.

**Minority Status:** The self-reported levels for race were American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian or other Pacific Islander, White. The levels for ethnicity were Hispanic or Latino (a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race) and Not Hispanic or Latino. Any individual who did not classify as white for race and non-Hispanic for ethnicity defined minority status. The levels for minority status were non-minority and minority.

### 2.3 Interventions and Interactions

A complete list of the instruments used in this study are listed in Table 2 alongside their respective variable measured, description and range.

### 2.4 Statistical Methods

All baseline data were entered prospectively at each baseline visit by the study team and/or directly by the patient into REDCap. Data were analyzed using SAS version 9.4 software (Cary, NC). Regression models were used to analyze the data for the three aims of this study. Linear regression was used for continuous outcomes (i.e. migraine frequency, perceived stress, daily hassles of stress, and migraine disability).

For the Primary Aim, the form of the models for each individual (i) was:

\[
\text{perceived\_stress}_i = \beta_0 + \beta_1 \times \text{SES}_i
\]
For the Secondary Aim, the form of the models for each individual (i) was:

\[ \text{migraine}_i = \beta_0 + \beta_1 \times SES_i + \beta_2 \times PSS_i + \beta_3 \times SES_i \times PSS_i \]

\[ \text{migraine}_i = \beta_0 + \beta_1 \times SES_i + \beta_2 \times PSS_i + \beta_3 \times SES_i \times PSS_i \]

For the Tertiary Aim, the form of the models for each individual (i) was:

\[ \text{migraine}_i = \beta_0 + \beta_1 \times SES_i + \beta_2 \times PSS_i + \beta_3 \times SES_i \times PSS_i + \beta_4 \times SES_i \times FFM_i + \beta_5 \times \text{SES}_i \times FFM_i + \beta_6 \times FFM_i \times PSS_i + \beta_7 \times SES_i \times PSS_i \times FFM_i \]

\[ \text{migraine}_i = \beta_0 + \beta_1 \times SES_i + \beta_2 \times PSS_i + \beta_3 \times FFM_i + \beta_4 \times SES_i \times PSS_i + \beta_5 \times \text{SES}_i \times FFM_i + \beta_6 \times FFM_i \times PSS_i + \beta_7 \times SES_i \times PSS_i \times FFM_i \]

To further explore the association between income and minority status with PSS, FFM and MIDAS we compared the predicted MIDAS scores in individuals with varying income and minority status by using PSS and FFM scores representing scenarios of varying PSS and FFM (either high or low), see Tables 6 & 7.

2.5 Results

2.5.1 Baseline Characteristics

116 individuals were assessed for eligibility in person visits for the Stress Reduction for Migraines study and the data from 106 individuals were analyzed (Figure 2). Baseline characteristics of the study participants (Table 3) indicated that a large portion of our participants reported making $0-50K (36.19%), having private insurance (83.96%), being employed full-time/a student/homemaker (71.70%) and having a bachelor's degree
(41.51%). Additional noteworthy characteristics included 4.72% of participants reporting having a high school/diploma and 2.83% of individuals reporting having no insurance or unknown insurance. Participants had an average monthly self-reported migraine frequency of 7.78 (3.99) [results reported as average (standard deviation)]. Participants were severely impacted by their headaches (average total HIT-6 of 63.54 (6.05) and moderately disabled (average total MIDAS of 15.22 (11.80)), see Table 2 for interpretation of ranges of results from the instruments. They were also moderately stressed (total PSS of 16.66 (6.39) and moderately/highly mindful (total FFM of 135.39 (19.19).

Figure 3A. shows the distribution of MIDAS scores with the highest percentage of MIDAS scores being around 10. Figure 3B. shows the distribution of Hit-6 scores with the highest percentage scores being around 62.6-67.5. Figure 3C. shows the distribution of PSS scores with the highest percentage of PSS scores being around 17.5. Figure 3D. shows the distribution of FFM score scores with the highest percentage of FFM scores being around 135. Figure 3E. shows the distribution of migraine frequency scores with the highest percentage of reported migraines at around 6 migraines.

The distribution of scores for the MIDAS were skewed to the right with the majority of the scores remaining tightly grouped around the mean (Figure 3A). The distribution of scores for the HIT-6 were skewed to the left with the majority of the scores remaining tightly grouped around the mean (Figure 3B). The distribution of scores for the PSS assumed the shape of a bell curve with the majority of the scores remaining tightly grouped around the mean (Figure 3C). The distribution of scores for the FFM assumed the shape of a bell curve with the majority of the scores remaining tightly grouped around the mean (Figure 3D). The distribution of scores for migraine frequency were skewed to the right with the majority of the scores remaining tightly grouped around the mean (Figure 3E).
2.5.2 Key Results

The first aim was to examine whether sociodemographic factors are associated with perceived stress in migraineurs in the past month. There was not a statistically significant association between income (p=0.22), education (p=0.84), insurance (p=0.71), minority status (p=0.84) and PSS scores. Employment status however did show a statistically significant association with PSS scores (p=0.0003), see Table 4. Those who worked full time with employment, in the home (homeworkers) or students, had statistically significantly lower perceived stress scores compared to those disabled/working part-time/unemployed (β=3.67, p=0.02, 95% CIs [0.58, 6.77]) but higher perceived stress scores compared to retirees (β=-5.43 p=0.0021, 95% CIs [-8.89, -1.96]), see Table 5.

To further understand perceived stress, we also assessed the association between mindfulness and perceived stress in migraineurs. There was a statistically significant association between higher FFM scores and lower perceived stress in our study (β=-0.17, p<0.0001, 95% CIs [-0.22, -0.11]), see Table 5. We also assessed the association between PSS and migraine frequency. Our results also lacked a statistically significant association between PSS scores and migraine frequency (p=0.68), see Table 4.

The second aim was to determine whether stress and sociodemographic factors are associated with migraine disability and migraine frequency. There was not a statistically significant interaction between sociodemographic factors (income (p=0.81), education (p=0.09), insurance (p=0.43), employment status (p=0.47), minority status p=0.75)) and PSS when assessing the outcome of migraine frequency, see Table 4. There was not a statistically significant interaction between sociodemographic factors (income p=0.98, education p=0.84, employment status p=0.06, insurance p=0.09 and minority status p=0.52) and perceived stress levels when assessing the outcome of
MIDAS, see Table 4. There also was no statistically significant interaction between sociodemographic factors (income \( p=0.20 \), education \( p=0.95 \), employment \( p=0.29 \), insurance \( p=0.64 \) and minority status \( p=0.44 \)) and stress levels obtained from perceived stress scale when assessing the outcome of the HIT-6, see Table 4.

The third aim was to determine whether mindfulness offsets the impact stress and socioeconomic status have on migraine disability and frequency. Our results lacked a statistically significant interaction between socioeconomic status factors (income \( p=0.61 \), education \( p=0.13 \), employment \( p=0.53 \) and minority status \( p=0.88 \)), PSS and mindfulness when assessing the outcome of migraine frequency (Table 4). In relation to our third aim education \( (p=0.55) \) and employment \( (p=0.94) \), PSS and FFM did not have a statistically significant interaction when assessing migraine disability (MIDAS). The analysis of our third aim however did show a statistically significant interaction between income \( (p=0.03) \), stress levels, and mindfulness when assessing MIDAS, see Table 4. In our study, there also was a statistically significant interaction between minority status, stress levels, mindfulness and MIDAS \( (p=0.0052) \), see Table 4. The association among sociodemographic factors (income \( p=0.32 \), education \( p=0.60 \), employment \( p=0.15 \), and minority status \( p=0.71 \)), stress levels obtained from PSS, mindfulness and the HIT-6 were not statistically significant (Table 4). The estimates, comparison groups, and the variables for the statistically significant regression models from the previous aims are listed in Table 5, alongside their respective 95% confidence intervals and \( p \)-values. To further explore the statistically significant associations between income and minority status with PSS, FFM and MIDAS we compared the predicted MIDAS scores in individuals with varying income and minority status by plugging in PSS and FFM scores
representing scenarios of varying PSS and FFM (either high or low), see Table 6 & 7.

For the scenarios involving income we used the following model\(^2\):

\[
migraine\_disability_i = -40.77 + 3.29 \times PSS_i + 0.41 \times FFM_i - 0.02 \times FFM_i \times PSS_i + 53.65 \times (income\ 50k - 100k) + 222.09 \times (income\ 100k - 150k) + 50.35 \times (income\ 150k+) - 0.48 \times (income\ 50k - 100k) \times FFM_i - 1.61 \times (income\ 100k - 150k) \times FFM_i - 0.53 \times (income\ 150k+) \times FFM_i - 4.32 \times (income\ 50k - 100k) \times PSS_i - 11.31 \times (income\ 100k - 150k) \times PSS_i - 8.89 \times (income\ 150k+) \times PSS_i + 0.04 \times (income\ 50k - 100k) \times PSS_i \times FFM_i + 0.08 \times (income\ 100k - 150k) \times PSS_i \times FFM_i + 0.08 \times (income\ 150k+) \times PSS_i \times FFM_i,
\]

When analyzing the various income groups, the income variable in question was equal to “1” while the remaining income variables were equal to “0”. For example, when analyzing Income 50k-100k, “income 50k-100k” was equal to “1”, while the other income variables were equal to “0”.

The predicted MIDAS scores for varying household incomes are shown in Table 6 based on predetermined PSS and FFM scores (as either low or high). If the predetermined PSS and FFM scores are high, all income groups were severely disabled (>20 predicted MIDAS score) although with differing scores above 20, with those with the highest income of 150K+ having the highest predicted MIDAS scores (93.58) and individuals who reported an income of 0-50k having the lowest predicted MIDAS scores (29.43) (Table 6 and Figure 4). Individuals who reported an income between 50-100k (MIDAS 61.48) and 100k-150k (MIDAS 30.72) had predicted MIDAS scores in between the formally mentioned values (Table 6 and Figure 4).

In the second scenario where the predetermined PSS is low and the FFM is high individuals who reported 0-50k, 50k-100k, and 150 + were “moderately disabled” (11-20

\(^2\) Individuals who reported an income of 0-50k were the reference group in this model.
predicted MIDAS score) while individuals who reported 100-150k were “mildly disabled (6-10 predicted MIDAS score), see Table 6 and Figure 4. Individuals who reported an income of 150K+ had the highest predicted MIDAS scores (32.38) while individuals who reported an income of 100-150k had the lowest predicted MIDAS scores (13.08), see Table 6 and Figure 4. Individuals who reported an income between 0-50k (MIDAS 24.21) and 50-100k (MIDAS 26.02) had predicted MIDAS scores in between the formally mentioned values, see Table 6 and Figure 4.

In the third scenario, where the predetermined PSS was high and the predetermined FFM was low, individuals who reported an income of 0-50k and 50k-100k were “severely disabled” (>21 predicted MIDAS score) while individuals who reported 100k-150k and 150k+ had “little to no disability” (0-5 predicted MIDAS score), see Table 6 and Figure 4. Individuals who reported an income of 0-50k had the highest predicted MIDAS scores (38.93) while individuals who reported an income of 100-150k had the lowest predicted MIDAS scores (0.72), see Table 6 and Figure 4. Individuals who reported an income between 50k-100k (MIDAS 34.98) and 150K+ (MIDAS 9.58) had predicted MIDAS scores in between the formally mentioned values, see Table 6 and Figure 4.

In the fourth scenario, where both FFM and PSS scores were low, individuals who reported 150k+ had “little to no disability” while individuals who reported 0-50k and 50k-100k were “moderately disabled” and individuals who reported 100-150k were “severely impacted”, see Table 6 and Figure 4. Individuals who reported an income of 100-150k had the highest predicted MIDAS scores (37.08) while individuals who reported an income of 150k+ had the lowest predicted MIDAS scores (2.38), see Table 6 and Figure 4. Individuals who reported an income between 0-50k (MIDAS 15.71) and 50k-100k (MIDAS 17.52) had predicted MIDAS scores in between the formally mentioned values, see Table 6 and Figure 4.
After our initial analyses, we also compared the predicted MIDAS scores in individuals with minority status to individuals with non-minority status by plugging in predetermined PSS and FFM scores (either high or low), see Table 7 and Figure 5. For the scenarios involving minority status we used the following model\(^3\):

\[
migraine\_disability_i = -125.15 + 151.22 \times \text{not minority}_i + 7.15 \times PSS_i + 1.01 \times FFM_i - 8.41 \times \text{not minority}_i \times PSS_i - 1.16 \times \text{not minority}_i \times FFM_i - 0.05 \times FFM_i \times PSS_i + 0.06 \times \text{not minority}_i \times PSS_i \times FFM_i.
\]

When analyzing the non-minority group, the “not minority” variable was equal to “1”. When analyzing the minority group, the “not minority” variable was equal to “0”.

Predicted MIDAS scores for the minority group, compared to the non-minority group, were higher in every situation excluding the low stress/low mindfulness scenario, see Table 7 and Figure 5. In the high PSS/high FFM scenario both groups were moderately disabled, see Table 7 and Figure 5. Individuals with minority status had higher predicted MIDAS scores (15.85) compared to individuals with non-minority status who had lower predicted MIDAS scores (10.77), see Table 7 and Figure 5. In the low PSS/high FFM scenario the non-minority group had “mild disability” while the minority group were “severely disabled”, see Table 7 and Figure 5. Individuals with minority status had higher predicted MIDAS scores (22.15) compared to individuals with non-minority status who had lower predicted MIDAS scores (6.45), see Table 7 and Figure 5. In the high PSS/low FFM scenario the non-minority group had scores were classified as having “little to no disability” while the minority group had scores which classified as being “severely disabled”, see Table 7 and Figure 5. Individuals with minority status had higher predicted MIDAS scores (40.35) compared to individuals with non-minority status who had lower predicted MIDAS scores (3.27), see Table 7 and Figure 5. In the last

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\(^3\) Individuals with minority Status were the reference group in this model.
scenario comparing low PSS/low FFM, the minority group had predicted scores which would be categorized as “little to no disability” while the non-minority group had predicted scores which were “mildly disabled”, see Table 7 and Figure 5. Individuals with non-minority status had higher predicted MIDAS scores (7.95) compared to individuals with non-minority status who had lower predicted MIDAS scores (1.65), see Table 7 and Figure 5.

2.6 Discussion

In our study of 106 migraineurs, we obtained a diverse distribution of individuals in every level across every sociodemographic variable measured, apart from insurance. The first aim was to examine whether sociodemographic factors are associated with perceived stress in migraineurs in the past month. The analysis of Aim one highlighted employment status as the only variable to affect perceived stress in which individuals who were unemployed, disabled or part time reported the highest perceived stress scores in comparison to all other groups. The second aim was to determine whether stress and sociodemographic factors are associated with migraine disability and migraine frequency. The analysis of Aim two suggested that sociodemographic factors do not show a statistically significant association with perceived stress and migraine features (disability and frequency). The third aim was to determine whether mindfulness, stress and sociodemographic factors are associated with migraine disability and migraine frequency. Analysis of aim three suggest that there may be an association between income and minority status with PSS, FFM and MIDAS. In scenarios involving high PSS, individuals with low household income (0-50k) alternate between having the lowest predicted MIDAS scores (high FFM model) to having the highest predicted scores (low FFM model). Thus, suggesting that high baseline mindfulness is more efficient at
offsetting high stress, possibly acting as a protective factor, in lower income groups than in higher incomes.

Alongside individuals with low household income income, high mindfulness may also be a strong protective factor against high stress in individuals with minority status. In high PSS scenarios, the predicted MIDAS scores for individuals with minority status increased tremendously by a decrease in FFM. While we did not find a statistically significant relationship between sociodemographic factors, perceived stress and migraine, certain protective factors such as mindfulness could affect individuals differently based off their income or minority status.

Our results differ from results reported in other studies in the existing literature. In our study, there was no statistically significant interaction between sociodemographic factors, FFM and PSS scores when assessing the outcome of HIT-6. We did not see the same effect of baseline mindfulness on HIT-6 scores previously seen after mindfulness based interventions in previous mindfulness intervention studies (Wells et al., 2014). This observed difference could be due to the introduction of various interactions, which were not accounted or assessed for in the previous studies, such as the addition of socioeconomic status or the apparent difference in study designs. In addition to lowered Hit-6 scores, Wells and colleagues reported, that in their study, MBSR individuals reported 1.4 fewer migraines (Wells et al., 2014). In another study, Grazzi and colleagues also noted a decrease in migraine frequency (6-8 days) after mindfulness intervention (Grazzi et al., 2017). Our results, however, did not reflect the results previously noted in these studies.

In the context of the existing literature our results did however confirm the association between certain variables previously noted. Our results did show an influence on baseline mindfulness on the MIDAS scores for a few particular groups, specifically varying minority and income status, coinciding with the results reported by
Wells and colleagues where MBSR individuals reported lower MIDAS scores. In a separate study, Feuille and colleagues reported that migraineurs reported a decrease in pain-related stress after mindfulness. (Feuille & Pargament, 2015). It is possible that higher mindfulness scores resulted in lower pain-related stress, which could result in lower disability scores. Again, it must be noted that the previously observed impact of mindfulness on HIT-6 & MIDAS scores were after an mindfulness based intervention and not at baseline, like in our study.

In addition to our initial aims, the results from our additional analyses also varied compared to the literature. In our study, perceived stress was not directly associated with migraine frequency (p=0.68), unlike the relationship between stress and migraine previously reported by Lipton and Houle (Lipton et al., 2014) (Houle et al., 2012). This difference could be a result of the combination of interactions analyzed in our study. Our results, however, do confirm the previously noted association between mindfulness levels and perceived stress reported by Wells and Colleagues (Wells et al., 2014).

The noted differences in results between our study and the established literature could be due to multiple factors. For example, we did not find a statistical significant relationship between sociodemographic factors with PSS and migraine disability and frequency. The lack of a statistically significant association may be due to our limitations rather than the absence of this relationship. With the addition of FFM into the interaction, regression analysis indicated a statistically significant association between minority status and income with PSS and migraine disability. This association, alongside hypothetical scenarios, suggest that FFM could have a different impact on an individual’s disability from migraine depending on their income or minority status. Our results suggest that it might be a combination of interactions, which result in the varying socioeconomic associations, such as prevalence, mentioned in chapter one.
2.71 Limitations

Our study had several important limitations which may affect the interpretability of our results. For example, this was a cross-sectional study, so while we could not assess causation, this is the first pilot study to assess the relationships between these variables. Although the variables in this study were self-reported and were subjected to self-reporting bias, the instruments used, as previously stated have been validated. Also, while our sample size may have been too small to detect any of the relationships we were assessing, this pilot study is the first study to assess the relationships between these variables.

Another limitation to our study resulted from the design of the Stress Reduction for Migraines study. While migraineurs assessed at baseline for this study were those interested and available to complete 8 weekly classes of a non-drug intervention, these participants may not be representative of all those with migraines, the variables analyzed resulted in an equal spread of data for each category suggesting a representative and comparable sample of the population. The Stress Reduction for Migraines study also recruited individuals unbiasedly which also suggest the study population is a representative and comparable sample of the population.

Another consideration that limited our results included the variable psychological stress. While psychological stress is an arbitrary term and we were unable to quantify and measure all levels of stress, the PSS is heavily used as the golden standard in clinical trials assessing stress. Although the PSS is unable to account for all types of stress, our study is the first pilot study to assess the relationships between any type of stress, FFM and other socioeconomic variables in migraine. While sudden stressful events such as heart attacks or deaths in the family occurring during the initial collection of the data, which may greatly impact one’s stress levels, may also not correctly reflect one’s typical stress level, with the aid of this pilot study future studies may incorporate
additional stress measures. As a result of the instruments used and our study design, we were also unable to account for any compound stress prior to when the data was initially collected with the aid of this pilot study future studies may incorporate additional stress measures. Completely avoiding this limitation is unrealistic thus perceived stress is heavily used as the golden standard in clinical trials assessing stress.

Finally, the small sample size of our study may limit our generalizability. In our study, there was not enough data to test the tertiary aim involving insurance. Although there was not enough data to test an interaction between insurance, PSS, FFM, and frequency for aim three, this a pilot study and the first to evaluate these relationships. In particular, we were unable to assess public insurance and no insurance/unknown insurance. Also, when evaluating the association between insurance, PSS and FFM on MIDAS scores there wasn’t enough data to test a three-way interaction for aim three, due to the same sample size in public insurance and no insurance/unknown insurance. This limitation did not allow us to properly assess these interactions but this will help guide future studies to ensure that enough data is collected to properly assess the interaction.

Overall, this study was the first study to analyze the interaction between multiple variables related to socioeconomic status, migraine frequency, migraine disability, and mindfulness. This pilot study insists further investigation into to further investigate these interactions in a larger sample size.

2.72 Possible Threats to Validity

As stated earlier in this chapter, our study is cross-sectional in study design therefore self-reporting bias is a large threat to validity. Although migraine diagnosis was confirmed by a neurologist, factors such as monthly migraine frequency and sociodemographic factors were self-reported. Future studies could possibly be designed
to adjust and limit self-reporting bias. The largest threat to validity, however lies in confounding bias. Due to the complexity of our aims we did not adjust for the most common confounders in migraine, including age and gender. However, as this is a preliminary investigation, larger studies could possibly address confounders.

2.8 Future Directions

It would be beneficial to the field to perform a large scaled study, since our study was unable to properly assess our tertiary aim due to a lack of data. Analyzing the effects of MBSR on migraine in potential subgroups, including socioeconomic and minority groups, is an ideal future prospective study. By prospectively analyzing the different impacts certain interventions have on migraine disability and frequency, such as mindfulness meditation to increase mindfulness levels, researchers could gain further knowledge on the interaction between these variables. With the proposed study researchers could enhance our current research and possibly have an even larger impact in the field.

2.9.1 Conclusion

This study provided insight into the relationship between sociodemographic factors, stress, and mindfulness and outcomes in migraine. We did not find a statistically significant relationship between varying sociodemographic factors in relation to migraine disability and frequency. Higher baseline mindfulness may have a different effect on migraine disability depending on an individual’s household income and minority status. In scenarios predicting MIDAS scores, high mindfulness seemed to act as a protective factor against high stress in individuals with lower income and minority status. Additionally, the models suggested that minority individuals, compared to non-minorities, have higher predicted MIDAS scores in almost every hypothetical situation when FFM is
included in the model. Analyzing the relationship between sociodemographic factors and migraine helps further distinguish the influence of sociodemographic factors on one's health. Further understanding this relationship could be useful to fully understanding what role socioeconomic status plays in migraine treatment, prevalence and progression. If higher mindfulness does have a different impact on individuals with varying socioeconomic and minority status, then additional research further research is needed in order to consider mindfulness meditation as a non-pharmacological treatment for migraines.

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Chapter 3.0

3.1 Summary

Although our sample size was very small, our study objectives were novel and our results were interesting. As suggested in chapter one, previous migraine studies have only analyzed one sociodemographic factor such as household income or insurance status in migraine. In chapter one we assert that even fewer studies have focused on the interaction between mindfulness on migraine while none of the literature has looked at the interaction between mindfulness, sociodemographic factors, perceived stress and migraine. In our study we analyzed baseline data from the Stress Reduction for Migraines Study in order to analyze various interactions discussed in chapter two. Our results suggest that there isn’t a statistically significant association between sociodemographic factors, perceived stress and migraine. However, our results suggest that there may be a varying influential effect of higher mindfulness levels on migraine disability based off of an individual’s minority or income status.

3.2 Interpretations

The results from our current suggest various associations not previously noted in the literature. For example, our results suggest that individuals who are unemployed report higher levels of stress compared to every other level of employment. Stress resulting from an inability to find a job, questions about one’s future and other stressors are all plausible explanations for the observed increase in perceived stress noted in chapter two. The significant association between only one sociodemographic factor is interesting because all sociodemographic aspects seem to be interrelated in one way or another. One might assume that outside of a few exceptions an individual who is
unemployed might possess a lower household income, which would result in higher perceived stress. Our results suggest that there may not be one sociodemographic factor best suited for modeling outcomes in migraine as it relates to perceived stress.

As Mentioned in Chapter Two, we did not detect a statistically significant difference in the way migraine affects individuals with different socioeconomic or minority status. Our results suggest that in terms of migraine features there is not a health disparity in migraine. These results are contrary to deductive reasoning, in that one would assume that individuals with varying sociodemographic factors would report different outcomes. For example, one might expect for an individual with lower socioeconomic status to report higher levels of stress, and thus report a higher migraine disability and frequency. Results from models analyzing our tertiary aim suggested that higher mindfulness may impact individuals in varying socioeconomic status and minority status differently, thus resulting in varying MIDAS scores. In these scenarios, high mindfulness acted as a protective factor in high stress scenarios for individuals with low income or minority status. This suggest that one’s socioeconomic status or minority status may, however, influence their well-being and how particular interventions could impact them. Particular treatments, such as mindfulness meditation previously discussed in chapter one, may have a differential impact on individuals of different socioeconomic and minority status. One puzzling result is the observed association mindfulness has on the MIDAS scale and not the Hit-6 scale, when both instruments are used in tangent to evaluate migraine disability.

Our study highlights the sparsely used terms, health equality and health equity. These two terms are commonly discussed but carry heavy consequences and are a part of our society and our reality. After discovering a statistically significant association between variables such as income, employment and minority status with other variables such as perceived stress and migraine disability, the notion of health equality still
remains. Although our results show that there isn’t a health disparity initially when analyzing the simple interactions of sociodemographic factor, perceived stress and migraine features, this health equality changed once mindfulness was included into the model. For mindfulness to possibly impact individuals differently based off their income or minority status still shows a possible variance between the various sociodemographic factors.

In conducting this study, we were unable to find statistically significant evidence of a health disparity between sociodemographic factors and migraine. The statistically significant association between income and minority status with mindfulness, MIDAS and PSS seen in our study warrants further investigation into this interaction. In scenarios, Mindfulness was suggested to be an important protective factor against high stress for individuals with lower household income and minority status. In almost every scenario individuals with minority status had higher predicted MIDAS scores than those who had non-minority status. These results, although from statistical models, suggest a very powerful notion, warranting further investigation. While mindfulness meditation continues to grow in popularity, it is imperative to see whether or not mindfulness meditation actually has a differential influence on individuals of varying socioeconomic or minority status. We hope our research brings to light further research into the differential influences of protective factors such as mindfulness, on individuals in varying socioeconomic/minority status. We hope our research is a beneficial addition to the literature to ensure that one day we finally find a cure for migraine.

3.3 Future Analysis

In view of our findings, further research on these interactions and variables, is still needed. It would be beneficial to the field to perform a large scaled study, resulting in
a much larger data base. Larger studies such as the American Migraine Prevalence and Prevention study (AMPP) and the Chronic Migraine Epidemiology and Outcomes study (CaMEO) suggest that larger studies focusing on migraine are feasible. The field would greatly benefit from the replicated analysis of our conducted aims using a larger data set, since we were unable to properly assess certain aims due to a lack of data. With a large enough sample size, we could fully understand the interaction between stress, insurance and migraine.

In addition to a larger sample size, the conduction of a prospective study could be beneficial. Analyzing the effects of MBSR or migraine in potential subgroups, including socioeconomic and minority groups, is an ideal future prospective study. By prospectively analyzing the different impacts MBSR has on migraine disability and frequency, researchers could gain further knowledge on the interaction between these variables. With the proposed study, researchers could enhance our current research and possibly have an even larger impact in the field.

In addition to a prospective study, it is possible to analyze our data and proposed aims using other sociodemographic variables such as age, race and gender, in addition to the variable sociodemographic factors. Future researchers could also make small applicable changes to our study by analyzing interactions we did not consider. Such interactions as the effects of FFM on Midas and HIT-6, as well as the effect of socioeconomic status on FFM, were not analyzed and could possibly yield statistically significant results.
3.4 Conclusion

As stated in chapter one, migraine is a disabling disorder which affects millions. Even with such a high prevalence rate, migraine still lacks the research and funding compared to other diseases. In our study, we analyzed the association between migraine with possible protective factors, its reported trigger, and sociodemographic factors. We noted that there was no statistically significant association between these factors and migraine. Although our results did not reflect a blatant disparity, they do suggest that the relationship between migraine and socioeconomic status is complex. Our results from regression models, as discussed in chapter two, suggest that higher baseline mindfulness may affect individuals differently depending on their income or minority status. Accordingly, although, our results in their current state have moderate impact on the field, they could have a larger impact if built upon.
Tables, Figures and Illustrations

Figure 1: Central Hypothesis

**Figure 1A: Primary Hypothesis**

Migraineurs with Lower Socioeconomic Status or with Minority Status → Higher levels of Stress

**Figure 1B: Secondary Hypothesis**

Migraineurs with Lower Socioeconomic Status or with Minority Status → Higher levels of Stress → Higher Migraine Frequency & Higher Migraine Disability

**Figure 1C: Tertiary Hypothesis**

Migraineurs with Lower Socioeconomic Status or with Minority Status → Higher levels of Stress → Higher Migraine Frequency & Higher Migraine Disability → Mindfulness
Figure 2. CONSORT Flow Diagram

Assessed for eligibility at in-person study visit (n=116)

Excluded (n=10)
  • Medication Overuse Headache (n=4)
  • Cluster Headache (n=2)
  • Daily Headache (n=4)

Analyzed (n=106)

Figure 2 CONSORT Flow Diagram: Flow of study participants
Figure 3: Score Distribution of Instruments

A. MIDAS

B. HIT-6
C. PSS

D. FFM
E. Migraine Frequency
Figure 4: Predicted MIDAS Scores by Income

- **150k+**
  - Predicted MIDAS Score: 93.58
  - High PSS & High FFM: 9.58

- **100-150k**
  - Predicted MIDAS Score: 61.48
  - High PSS & High FFM: 0.72

- **50-100k**
  - Predicted MIDAS Score: 34.98
  - High PSS & High FFM: 30

- **0-50k**
  - Predicted MIDAS Score: 29.43
  - High PSS & High FFM: 29.43

- **0-50k**
  - Predicted MIDAS Score: 38.93
  - High PSS & High FFM: 38.93
Figure 5: Predicted MIDAS Scores by Minority

- Minority status:
  - Minority
    - Predicted MIDAS Scores: 10.77 (Green) and 15.85 (Red)
  - Non-minority
    - Predicted MIDAS Scores: 3.27 (Green) and 40.35 (Red)

Legend:
- Green: High PSS & High FFM
Table 1: Predictors and Outcome Measures

<table>
<thead>
<tr>
<th>Aim</th>
<th>Predictors</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Aim</td>
<td>Lower Socioeconomic status (SES) or minority status</td>
<td>Higher Reported Stress</td>
</tr>
<tr>
<td>Secondary Aim</td>
<td>Higher Stress + Lower SES or minority status + All interactions</td>
<td>Higher Migraine Disability and Migraine Frequency</td>
</tr>
<tr>
<td>Tertiary Aim</td>
<td>Higher Stress + Lower SES or minority status + Level of Mindfulness + All interactions</td>
<td>Higher Migraine Disability and Migraine Frequency</td>
</tr>
</tbody>
</table>

Table 2: Validated Instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Variable (s) Measured</th>
<th>Description</th>
<th>Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Item Headache Impact Test (HIT-6)</td>
<td>Migraine Disability Assessment</td>
<td>Impact migraines have on an individual's ability to function at school, home, work and social activities.</td>
<td>≤49: Little or no impact 50-55: Some impact 56-59: Substantial impact 60-78: Severe impact</td>
</tr>
<tr>
<td>7 Item Migraine Disability Assessment (MIDAS)</td>
<td>Migraine Disability Assessment</td>
<td>Impact migraines have on an individual's daily life.</td>
<td>0-5, I, Little or no disability 6-10, II, Mild disability 11-20 - III, Moderate disability 21+, IV, Severe disability</td>
</tr>
<tr>
<td>10 Item Perceived Stress Scale</td>
<td>Perceived stress within the last month</td>
<td>Determines how stressful one believes their life has been over the past month.</td>
<td>0-13 Low stress 14-26 Moderate stress 27-40 High stress</td>
</tr>
<tr>
<td>Baseline Assessment of Sociodemographic Status</td>
<td>Race/Ethnicity Age Income Education Insurance Status Employment Status Minority Status</td>
<td>Self-reported Sociodemographic factors</td>
<td>See text</td>
</tr>
<tr>
<td>39 Item Five Facet Mindfulness Scale</td>
<td>Mindfulness</td>
<td>Measures one's Mindfulness</td>
<td>0-195 Higher Mindfulness Scores Reflect Higher Mindfulness</td>
</tr>
</tbody>
</table>


Table 3: Baseline Characteristics of Study Participants

<table>
<thead>
<tr>
<th>Category</th>
<th>Overall Cohort (N=106)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%) or mean (SD)</td>
</tr>
<tr>
<td>Age (n=106)</td>
<td>43.48 (13.37)</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>98 (92.45)</td>
</tr>
<tr>
<td>Ethnicity (Not Hispanic or Latino)</td>
<td>100 (94.34)</td>
</tr>
<tr>
<td>Minority</td>
<td>22 (20.75)</td>
</tr>
<tr>
<td>Race (n=105)</td>
<td></td>
</tr>
<tr>
<td>Native Hawaiian or other Pacific Islander</td>
<td>0</td>
</tr>
<tr>
<td>American Native or Alaskan Native</td>
<td>0</td>
</tr>
<tr>
<td>White</td>
<td>89 (84.76)</td>
</tr>
<tr>
<td>Black</td>
<td>16 (15.24)</td>
</tr>
<tr>
<td>Yearly Household Income (n=105)</td>
<td></td>
</tr>
<tr>
<td>0-50k</td>
<td>38 (36.19)</td>
</tr>
<tr>
<td>50-100k</td>
<td>36 (34.29)</td>
</tr>
<tr>
<td>100-150k</td>
<td>18 (17.14)</td>
</tr>
<tr>
<td>150k+</td>
<td>13 (12.38)</td>
</tr>
<tr>
<td>Insurance Status (n=106)</td>
<td></td>
</tr>
<tr>
<td>Private Insurance</td>
<td>89 (83.96)</td>
</tr>
<tr>
<td>Public Insurance</td>
<td>4 (3.77)</td>
</tr>
<tr>
<td>Medicare/Medicaid</td>
<td>10 (9.43)</td>
</tr>
<tr>
<td>No Insurance/Unknown Insurance</td>
<td>3 (2.84)</td>
</tr>
<tr>
<td>Highest Education level Achieved (n=106)</td>
<td></td>
</tr>
<tr>
<td>High School/GED</td>
<td>5 (4.72)</td>
</tr>
<tr>
<td>Some college (no degree)</td>
<td>21 (19.81)</td>
</tr>
<tr>
<td>Bachelor’s Degree</td>
<td>44 (41.51)</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>19 (17.92)</td>
</tr>
<tr>
<td>Associate Degree</td>
<td>17 (16.04)</td>
</tr>
<tr>
<td>Employment Status (n=106)</td>
<td></td>
</tr>
<tr>
<td>Disabled, Part time, or Unemployed</td>
<td>17 (16.04)</td>
</tr>
<tr>
<td>Retired</td>
<td>13 (12.26)</td>
</tr>
<tr>
<td>Full time, homemaker, or Student</td>
<td>76 (71.70)</td>
</tr>
<tr>
<td>Headache Features</td>
<td></td>
</tr>
<tr>
<td>Monthly Migraine Frequency (n=106)</td>
<td>7.78 (3.99)</td>
</tr>
<tr>
<td>Headache Impact Test (n=105)</td>
<td>63.54 (6.05)</td>
</tr>
<tr>
<td>Migraine Disability Assessment (n=106)</td>
<td>15.22 (11.83)</td>
</tr>
<tr>
<td>Stress and Mindfulness (n=106)</td>
<td></td>
</tr>
<tr>
<td>Perceived Stress Scale</td>
<td>16.66 (6.39)</td>
</tr>
<tr>
<td>Five Facet Mindfulness</td>
<td>135.39 (19.19)</td>
</tr>
</tbody>
</table>
Table 4: Regression Model P-Values from the analysis of the Primary, Secondary and Tertiary Aims.

<table>
<thead>
<tr>
<th>Aim</th>
<th>Predictor</th>
<th>Outcome</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Income</td>
<td>PSS</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>PSS</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td><strong>Employment</strong></td>
<td><strong>PSS</strong></td>
<td><strong>0.0003</strong></td>
</tr>
<tr>
<td></td>
<td>Insurance</td>
<td>PSS</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>Minority</td>
<td>PSS</td>
<td>0.84</td>
</tr>
<tr>
<td>Two</td>
<td>Income * PSS</td>
<td>Frequency</td>
<td>0.81</td>
</tr>
<tr>
<td></td>
<td>Education * PSS</td>
<td>Frequency</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>Employment * PSS</td>
<td>Frequency</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Insurance * PSS</td>
<td>Frequency</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Minority * PSS</td>
<td>Frequency</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Income * PSS</td>
<td>MIDAS</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Education * PSS</td>
<td>MIDAS</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td>Employment * PSS</td>
<td>MIDAS</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Insurance * PSS</td>
<td>MIDAS</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>Minority * PSS</td>
<td>MIDAS</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Income * PSS</td>
<td>HIT-6</td>
<td>0.20</td>
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<tr>
<td></td>
<td>Education * PSS</td>
<td>HIT-6</td>
<td>0.95</td>
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<tr>
<td></td>
<td>Employment * PSS</td>
<td>HIT-6</td>
<td>0.29</td>
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<td></td>
<td>Insurance * PSS</td>
<td>HIT-6</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>Minority * PSS</td>
<td>HIT-6</td>
<td>0.44</td>
</tr>
<tr>
<td>Three</td>
<td>Income * PSS * FFM</td>
<td>Frequency</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Education * PSS * FFM</td>
<td>Frequency</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Employment * PSS * FFM</td>
<td>Frequency</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>Minority * PSS * FFM</td>
<td>Frequency</td>
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</tr>
<tr>
<td></td>
<td><strong>Income * PSS * FFM</strong></td>
<td><strong>MIDAS</strong></td>
<td><strong>0.03</strong></td>
</tr>
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<td></td>
<td>Education * PSS * FFM</td>
<td>MIDAS</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Employment * PSS * FFM</td>
<td>MIDAS</td>
<td>0.94</td>
</tr>
<tr>
<td></td>
<td><strong>Minority * PSS * FFM</strong></td>
<td><strong>MIDAS</strong></td>
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</tr>
<tr>
<td></td>
<td>Income * PSS * FFM</td>
<td>HIT-6</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Education * PSS * FFM</td>
<td>HIT-6</td>
<td>0.60</td>
</tr>
<tr>
<td></td>
<td>Employment * PSS * FFM</td>
<td>HIT-6</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Minority * PSS * FFM</td>
<td>HIT-6</td>
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<tr>
<td>Additional</td>
<td>FFM</td>
<td>PSS</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td></td>
<td>PSS</td>
<td>Frequency</td>
<td>0.68</td>
</tr>
</tbody>
</table>

*Statistically Significant Values (P<0.05) are bolded in the above table. Due to a lack of data, the P-values from the tertiary aim involving insurance were not included in the above table.
Table 5 Statistically Significant Associations

<table>
<thead>
<tr>
<th>Aim</th>
<th>Comparison Group</th>
<th>Variable</th>
<th>Estimate</th>
<th>95% C.I.</th>
<th>95% C.I.</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Full time, home maker, or student</td>
<td>Disabled, part time, unemployed</td>
<td>3.67</td>
<td>0.58</td>
<td>6.77</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retired</td>
<td>-5.43</td>
<td>-8.89</td>
<td>-1.96</td>
<td>0.0021</td>
</tr>
<tr>
<td>Three</td>
<td>pss_total</td>
<td></td>
<td>0.00</td>
<td>0.05</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>0-50k</td>
<td>100-150K</td>
<td></td>
<td>220.09</td>
<td>14.37</td>
<td>429.82</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>150K+</td>
<td></td>
<td>50.35</td>
<td>-120.02</td>
<td>220.71</td>
<td>0.56</td>
</tr>
<tr>
<td>0-50k</td>
<td>50-100K</td>
<td></td>
<td>53.65</td>
<td>-36.12</td>
<td>143.42</td>
<td>0.24</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_total*income 100-150k</td>
<td></td>
<td>-11.31</td>
<td>-22.36</td>
<td>-0.25</td>
<td>0.05</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_total*income 150k+</td>
<td></td>
<td>-8.89</td>
<td>-18.02</td>
<td>0.24</td>
<td>0.06</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_total*income 50-100k</td>
<td></td>
<td>-4.32</td>
<td>-8.70</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>ffm_total</td>
<td></td>
<td>0.41</td>
<td>-0.08</td>
<td>0.90</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>pss_total*ffm_total</td>
<td></td>
<td>-0.02</td>
<td>-0.05</td>
<td>0.0018</td>
<td>0.07</td>
</tr>
<tr>
<td>0-50k</td>
<td>ffm_total*income 100-150k</td>
<td></td>
<td>-1.61</td>
<td>-3.05</td>
<td>-0.17</td>
<td>0.03</td>
</tr>
<tr>
<td>0-50k</td>
<td>ffm_total*income 150k</td>
<td></td>
<td>-0.53</td>
<td>-1.66</td>
<td>0.60</td>
<td>0.36</td>
</tr>
<tr>
<td>0-50k</td>
<td>ffm_total*income 50-100k</td>
<td></td>
<td>-0.48</td>
<td>-1.12</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_to<em>ffm_to</em>income 100-150k</td>
<td></td>
<td>0.08</td>
<td>0.0033</td>
<td>0.16</td>
<td>0.04</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_to<em>ffm_to</em>income 150k</td>
<td></td>
<td>0.08</td>
<td>0.01</td>
<td>0.14</td>
<td>0.02</td>
</tr>
<tr>
<td>0-50k</td>
<td>pss_to<em>ffm_to</em>income 50-100k</td>
<td></td>
<td>0.04</td>
<td>0.0027</td>
<td>0.07</td>
<td>0.03</td>
</tr>
<tr>
<td>Three</td>
<td>pss_total</td>
<td></td>
<td>7.15</td>
<td>2.67</td>
<td>12.38</td>
<td>0.01</td>
</tr>
<tr>
<td>Minority group</td>
<td>Not Minority Group</td>
<td></td>
<td>151.22</td>
<td>28.04</td>
<td>274.40</td>
<td>0.02</td>
</tr>
<tr>
<td>Minority group</td>
<td>pss_total*Not Minority Group</td>
<td></td>
<td>-8.41</td>
<td>-14.13</td>
<td>-2.67</td>
<td>0.0041</td>
</tr>
<tr>
<td></td>
<td>ffm_total</td>
<td></td>
<td>1.01</td>
<td>0.17</td>
<td>1.85</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>pss_total*ffm_total</td>
<td></td>
<td>-0.05</td>
<td>-0.09</td>
<td>-0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Minority group</td>
<td>ffm_total*Not Minority Group</td>
<td></td>
<td>-1.16</td>
<td>-2.06</td>
<td>-0.26</td>
<td>0.01</td>
</tr>
<tr>
<td>Minority group</td>
<td>pss_to<em>ffm_to</em>Not Minority Group</td>
<td></td>
<td>0.06</td>
<td>0.02</td>
<td>0.11</td>
<td>0.0047</td>
</tr>
<tr>
<td>Additional</td>
<td>FFM</td>
<td>PSS</td>
<td>-0.17</td>
<td>-0.22</td>
<td>-0.11</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

*Statistically Significant Values (P<0.05) are bolded in the above table.
### Table 6: Predicted MIDAS scores for individuals with varying household income

<table>
<thead>
<tr>
<th>Hypothetical PSS Scores</th>
<th>Hypothetical FFM Scores</th>
<th>Predicted MIDAS for 0-50k</th>
<th>Predicted MIDAS for 50k-100k</th>
<th>Predicted MIDAS for 100k-150k+</th>
<th>Predicted MIDAS for 150k+</th>
</tr>
</thead>
<tbody>
<tr>
<td>High PSS (PSS=30)</td>
<td>HIGH FFM (FFM=150)</td>
<td>29.43</td>
<td>61.48</td>
<td>30.72</td>
<td>93.58</td>
</tr>
<tr>
<td>LOW PSS (PSS=12)</td>
<td>HIGH FFM (FFM=150)</td>
<td>24.21</td>
<td>26.02</td>
<td>13.08</td>
<td>32.38</td>
</tr>
<tr>
<td>HIGH PSS (PSS=30)</td>
<td>LOW FFM (FFM=100)</td>
<td>38.93</td>
<td>34.98</td>
<td>0.72</td>
<td>9.58</td>
</tr>
<tr>
<td>LOW PSS (PSS=12)</td>
<td>LOW FFM (FFM=100)</td>
<td>15.71</td>
<td>17.52</td>
<td>37.08</td>
<td>2.38</td>
</tr>
</tbody>
</table>
### 2.8.4 Table 7: Predicted MIDAS scores for individuals with varying minority status

<table>
<thead>
<tr>
<th>Hypothetical PSS Scores</th>
<th>Hypothetical FFM Scores</th>
<th>Predicted MIDAS for Minority Status</th>
<th>Predicted MIDAS for Non-minority status</th>
</tr>
</thead>
<tbody>
<tr>
<td>High PSS (PSS=30)</td>
<td>HIGH FFM (FFM=150)</td>
<td>15.85</td>
<td>10.77</td>
</tr>
<tr>
<td>LOW PSS (PSS=12)</td>
<td>HIGH FFM (FFM=150)</td>
<td>22.15</td>
<td>6.45</td>
</tr>
<tr>
<td>HIGH PSS (PSS=30)</td>
<td>LOW FFM (FFM=100)</td>
<td>40.35</td>
<td>3.27</td>
</tr>
<tr>
<td>LOW PSS (PSS=12)</td>
<td>LOW FFM (FFM=100)</td>
<td>1.65</td>
<td>7.95</td>
</tr>
</tbody>
</table>
References:


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NIH Categorical Spending - NIH Research Portfolio Online Reporting Tools (RePORT).

(n.d.). Retrieved April 14, 2018, from

https://doi.org/10.1007/s11916-014-0454-z

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https://doi.org/10.1016/j.psyneuen.2007.03.006

https://doi.org/10.1111/j.1526-4610.2008.01323.x


https://doi.org/10.1212/WNL.0b013e3182a43b32


CHARLES PIERCE

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PROFESSIONAL SUMMARY
Motivated Research Assistant with success in independent and team-driven research environments. Proven public speaking skills and experienced in presenting research at conferences. Completing Masters of Science in Health Disparities and Neuroscience-related disorders.

SKILLS

- Research Assistant
- SAS expertise
- Research reporting
- Clinical trial support
- Experiment development
- Data collection and analysis

WORK HISTORY

Research Assistant, 08/2016 to Current
Wake Forest Baptist Medical Center – Winston-Salem, North Carolina
- Implemented over 200 hours recruiting and screening participants for Stress Reduction for Migraine study.
- Planned, modified, and executed research techniques, procedures and tests.
- Performed statistical, qualitative and quantitative analysis using SAS integrated software

Tutor, 06/2014 to 07/2016
Emmanuel Baptist Church – Winston-Salem, NC
- Coached and mentored students on successful social skill strategies, value and self-esteem
- Lead seminars focused on encouraging personal growth and cultural awareness
- Completed training and development sessions to maximize effectiveness as a tutor.
- Advocated for students to connect with additional school resources.
Bookkeeping Office Assistant, 08/2012 to 05/2014

Exchange SCAN, Stop Child Abuse Now – Winston-Salem, NC

- Supported staff in providing emotional support to participants in the program who experienced child abuse or neglect.
- Assisted in the management of office staff schedules and pay.
- Performed administrative tasks such as taking and responding to calls, maintaining office files, and keeping common areas clean.

CAMPUS ACTIVITIES

- New Investigators & Trainees
- American Headache Society
- Health Occupations Students of America (HOSA) UNCG
- Red Cross Club, UNCG

ACCOMPLISHMENTS

- Presented research at the 60th Annual Scientific Meeting - San Francisco, CA
- Selected to attend Scottsdale Headache Symposium - Scottsdale, AZ
- Deans List 3.75 GPA - UNCG
- Sir Walter Mack Scholarship Recipient

EDUCATION

M.S.: Health Disparities and Neuroscience-Related Disorders, 2018

Wake Forest University - Winston Salem, NC

GPA: 3.25 / 4.0

B.S.: Biology, Chemistry, 2014

University of North Carolina Greensboro - Greensboro, NC