8-2022

The combined benefits of dispositional mindfulness and trait self-compassion as potential buffers of the effects of perceived stress on sleep quality in college-aged young adults.

Jackie Ma
University of Louisville

THE COMBINED BENEFITS OF DISPOSITIONAL MINDFULNESS AND TRAIT SELF-COMPASSION AS POTENTIAL BUFFERS OF THE EFFECTS OF PERCEIVED STRESS ON SLEEP QUALITY IN COLLEGE-AGED YOUNG ADULTS

By

Jackie Ma, M.S.

B.A., James Cook University, 2014

B.A. (Hons), Flinders University, 2015

M.S., University of Louisville, 2020

A Dissertation

Submitted to the Faculty of the

College of Arts and Sciences of the University of Louisville

in Partial Fulfillment of the Requirements

for the Degree of

Doctor of Philosophy

in Clinical Psychology

Department of Psychological and Brain Sciences

University of Louisville

Louisville, Kentucky

August 2022

THE COMBINED BENEFITS OF DISPOSITIONAL MINDFULNESS AND TRAIT SELF-COMPASSION AS POTENTIAL BUFFERS OF THE EFFECTS OF PERCEIVED STRESS ON SLEEP QUALITY IN COLLEGE-AGED YOUNG ADULTS

By

Jackie Ma, M.S.

B.A., James Cook University, 2014

B.A. (Hons), Flinders University, 2015

M.S., University of Louisville, 2020

A Dissertation Approved on

May 2, 2022

by the following Dissertation Committee:

_____

Paul Salmon, Ph.D.

Dissertation Chair

_____

Marci DeCaro, Ph.D.

_____

Richard Lewine, Ph.D.

_____

Amanda Mitchell, Ph.D.

_____

Bernadette Walter, Ph.D.

DEDICATION

This dissertation is dedicated to my father. I am deeply inspired by his creativity, excellence in the performing arts, work ethic, and resilience as well as perseverance. He instilled a great love for reading, writing, and storytelling in me, and I am positive these passions have shaped me into the clinician and researcher that I am today. This dissertation is also dedicated to all of my undergraduate and graduate mentors, without whom I would not have gained admission into graduate school nor have been able to navigate my various doctoral milestones successfully thus far. I am truly grateful to each and everyone of you for your time, guidance, and support.

ACKNOWLEDGMENTS

This dissertation would not have been possible without the support of the following people. First and foremost, I would like to sincerely thank my dissertation chair and mentor, Dr. Paul Salmon, for his steadfast guidance, encouragement, and support throughout my time in graduate school and throughout the process of completing this project. I could not have asked for a more kind, warm, wise, intentional, and supportive mentor. Additionally, Dr. Salmon embodies mindfulness and compassion in his speech and actions; combined with his expertise in mindfulness, he has indelibly shaped my clinical and research interests. I am excited to carry forward the innumerable lessons I have learnt from Dr. Salmon into my future professional steps. Second, I would like to extend my gratitude towards Dr. Bernadette Walter for being on my dissertation committee and for her mentorship and endless encouragement throughout my graduate training. I am incredibly thankful for her kindness, support, thoughtfulness, wisdom, and willingness to advocate for students (myself included) and patients. She has played an instrumental role in shaping me into the clinician that I am today. I have very positive and fond memories of our conversations in her office, and I will truly miss our drop-in chats.

I would also like to sincerely thank Drs. Marci DeCaro, Richard Lewine, and Amanda Mitchell for being on my dissertation committee. I am especially grateful for their time, effort, and expertise in facilitating the completion of this project. I have benefited greatly from their feedback and wisdom. Thank you to Dr. Amanda Mitchell

for her contributions to the statistical aspects of this project. Thank you also to Dr. Richard Lewine for his excellent mentorship and supervision during my time on his clinical team.

Further, I would like to thank the study's participants for taking the time to complete the current study and their generous willingness to contribute to psychological research.

Additionally, I am very grateful for my labmate and friend, Allie Rodgers, for her generosity, guidance, and support throughout my time in graduate school. I would also like to thank my cohort-mates and friends, Diana Hedrick and Kelly Shryock, for their encouragement and support as we navigated graduate school together (we did it!).

I am eternally grateful for my family and friends for their unwavering love, support, and encouragement to pursue my dreams. I would especially like to thank my family for their understanding and patience as attending graduate school in a different country has regrettably meant being away from them for extended periods of time. Last but not least, I am deeply thankful for my partner and our dog for their tremendous love and support and for being my ultimate cheerleaders. Completing a dissertation while on internship can be challenging, but it was made much more manageable because of my partner's great support.

ABSTRACT

THE COMBINED BENEFITS OF DISPOSITIONAL MINDFULNESS AND TRAIT SELF-COMPASSION AS POTENTIAL BUFFERS OF THE EFFECTS OF PERCEIVED STRESS ON SLEEP QUALITY IN COLLEGE-AGED YOUNG ADULTS

Jackie Ma

May 2, 2022

Using a nonclinical sample of 108 undergraduates between the ages of 18 to 25 years old, this cross-sectional study investigated the relationship between dispositional mindfulness (as measured by the Five Facet Mindfulness Questionnaire; Baer et al., 2006) and sleep quality (as measured by the Pittsburgh Sleep Quality Index; Buysse et al., 1989). Second, it evaluated the association between trait self-compassion (as measured by the Self-Compassion Scale; Neff, 2003b) and sleep quality. Third, it aimed to test for an interaction effect between dispositional mindfulness and trait self-compassion as buffers against the adverse effects of perceived stress on sleep quality. Results showed that there was a significant moderate and negative association between dispositional mindfulness and sleep quality (r = -.48, p < .01). Similarly, results showed that there was a significant moderate and negative association between trait self-compassion and sleep quality (r = -.38, p < .01). Taken together, these findings indicate that in this sample of college-aged young adults, higher levels of dispositional mindfulness and trait self-compassion respectively were associated with better sleep

quality. This is consistent with previous research examining the associations between dispositional mindfulness and sleep quality (Howell et al., 2008; Lau et al., 2008; Murphy et al., 2012) as well as between trait self-compassion and sleep quality (Brown et al., 2021; Butz & Stalhberg, 2018; Hu et al., 2018). Therefore, the present study's findings add to the extant body of literature demonstrating associations between higher levels of dispositional mindfulness and trait self-compassion respectively with better sleep quality.

Contrary to the study's Hypotheses 3a and 3b, the hypothesized three-way interaction among perceived stress, dispositional mindfulness, and trait self-compassion was not supported, given that moderated moderation analyses revealed no significant interaction among these three variables (b = -.001, $t(100)$ = -.53, p = .60, 95% Confidence Interval: [-.006, .004], ΔR^2 = .002, ΔF = .28). This indicates that in the current sample, the strength of the association between perceived stress and poor sleep quality did not vary based on participants' levels of dispositional mindfulness *and* trait self-compassion.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

FIGURES PAGE

CHAPTER I: INTRODUCTION

The Problem of Poor Sleep

The Centers for Disease Control and Prevention (CDC) have identified poor sleep as a public health epidemic (CDC, 2020a). Poor sleep is characterized by problems such as difficulty falling asleep, frequently waking after initial sleep onset, waking too early without being able to fall back asleep, and/or experiencing feelings of daytime sleepiness or distress following a poor night's sleep (CDC, 2020a). Although the CDC recommends that adults get 7 to 8 hours of sleep per night, 36.5% of currently employed American adults report that they get an average of 7 or less hours of sleep per night (Shockey & Wheaton, 2017). Additionally, using data from the Longitudinal Survey of Midlife Development in the United States (MIDUS), Friedman (2016) reported that 39% of the sample (adults aged 24 to 75 years; $N = 3620$) endorsed chronic sleep problems. Furthermore, using data from the National Comorbidity Survey Replication (NCS-R), Roth and colleagues examined the prevalence rates of four types of sleep problems (i.e., difficulty initiating sleep; difficulty maintaining sleep; early morning awakening; and non-restorative sleep) over a one-year period in a sample of 9282 adults living in the United States (Roth et al., 2006). After controlling for *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994) anxiety, mood, impulse-control, and substance use disorders, Roth and colleagues (2006) found that 36.3% of the sample endorsed experiencing one or more sleep problems. Also, non-

restorative sleep (i.e., not feeling well-rested even after spending sufficient time in bed) was the most endorsed complaint (25% of the sample). All in all, evidence indicates that sleep complaints are fairly common in the general population in the United States.

Sleep and College-Aged Young Adults

Although the prevalence of sleep difficulties increases with age, young adults are the fastest growing group of individuals endorsing poor sleep quality (American Psychological Association [APA], 2015). Indeed, Petrov and colleagues found that within a sample of undergraduate students aged 17 to 25 years (N = 1684), 36% of the sample was at risk for at least one sleep disorder and 14.3% of the sample reported experiencing clinically significant insomnia symptoms (Petrov, Lichstein, & Baldwin, 2014). Similarly, using a sample of 1039 college students, Taylor and colleagues found that only 57.1% of students were considered "normal" sleepers. That is, such students had no complaints of poor sleep and they did not meet *DSM-5* (American Psychiatric Association, 2013) criteria for chronic insomnia (Taylor, Bramoweth, Grieser, Tatum, & Roane, 2013). Among the remaining 42.9% of students in the sample, 9.5% met *DSM-5* criteria for chronic insomnia, 6.5% endorsed sleep-related difficulties but did not meet full criteria for chronic insomnia, and 26.9% met severity-, frequency-, and duration criteria for chronic insomnia but did not endorse an insomnia complaint. Of note, in terms of the 26.9% of students that met severity-, frequency-, and duration criteria for chronic insomnia but did not endorse complaints of insomnia, Taylor and colleagues posited it is possible that these students could be struggling with poor sleep but assume that what they are experiencing is just part of the college experience and may in fact be unaware of their poor sleep patterns (Taylor et al., 2013).

In addition, evidence suggests that sleep difficulties in college-aged young adults appear to start before and worsen soon after the transition to college (Cheng et al., 2012). Furthermore, these sleep difficulties appear to worsen over time throughout college, which suggests that college-aged young adults could be vulnerable to the progression of sleep difficulties from acute to chronic (Milojevich & Lukowski, 2016).

Consequences of Poor Sleep in College-Aged Young Adults

Approximately 67% of young adults have expressed subjective concerns over their lack of sleep due to associated impairments in daytime cognitive and physical functioning (Gradisar et al., 2013). Indeed, poor sleep is associated with increased daytime sleepiness (Alapin, Fichten, & Libman, 2000), decreased attention, and poorer concentration (Buboltz Jr., Brown, & Soper, 2001; Sawyer & Weaver, 2010; Vandekerckhove & Cluydts, 2010). Particularly, in college students, poor sleep is also associated with decreased school performance (Thacher, 2008). In fact, Trockel and colleagues found that sleep patterns of college students predicted their academic performance above and beyond all other health-related behaviors (Trockel, Barnes, & Egget, 2000). Further, Gaultney (2010) demonstrated that nearly 27% of undergraduate students were at risk for sleep disorders and that this risk significantly predicted an objective grade point average less than 2.0 out of a 4.0 scale. These findings suggest that students at greater risk for sleep disorders are also more likely to be at risk for academic failure (Gaultney, 2010).

Poor sleep is associated with maladaptive health practices such as smoking, alcohol use, and physical inactivity among all ages (CDC, 2020b). These associations may be especially more likely for young adults in college. This is because while

attending college, young adults are more likely to experience minimal supervision, engage in risk-taking activities, and have greater easy access to tobacco products, alcohol, and recreational-, prescription-, and over-the-counter drugs (Lund et al., 2010). Further, poor sleep is associated with the onset and maintenance of obesity in college students (Melton, Langdon, & McDaniel, 2013). It is posited that poor sleep negatively affects the body's ability to use insulin, thereby resulting in changes to one's metabolic processes that lead to weight gain, increased body mass index, and subsequent obesity (Vargas, Flores, & Robles, 2014).

Taken together, given the comorbidity between poor sleep and each of the problem areas outlined above, poor sleep in college-aged young adults is a significant public health issue in need of further exploration. Furthermore, early identification, prevention, and intervention efforts of poor sleep are critical to prevent the onset of chronic and more severe sleep problems (e.g., sleep disorders such as clinical insomnia) in college-aged young adults (Gaultney, 2016).

What is Sleep and How Does It Function?

To understand how poor sleep influences our physical and psychological health, it is first necessary to recognize the role of sleep as a physiological process. Sleep is a universal behavior that occupies a significant proportion of the 24-hour day. In fact, human beings will spend approximately one-third of their lives asleep (Jensen, 2003). Sleep is regarded as a state of "adaptive inactivity" (Vyazovskiy, 2015). Specifically, it is a neurophysiological and behavioral state that includes immobility and reduced behavioral responsiveness to external stimuli (Sotelo, Tyan, Dzera, & Eban-Rothschild, 2020; Vyazovskiy, 2015).

Sleep and wakefulness are coordinated by the nervous system, a drive for homeostatic balance, and a biological clock called the circadian rhythm (Jensen, 2003). In terms of the drive for homeostatic balance, the homeostatic pressure to sleep increases the longer a person stays awake. On top of the homeostatic sleep drive, the circadian ("about a day" or around 24 hours; CDC, 2020c) rhythm controls the timing and organization of our sleep. The circadian timing mechanism is located within the suprachiasmatic nucleus of the hypothalamus (Luyster, Strollo, Zee, & Walsh, 2012). This mechanism consists of three components: 1) input pathways that transmit light and other signals to the circadian clock and synchronize circadian rhythms with environmental cues such as the light-dark cycle; 2) an endogenous circadian pacemaker that generates rhythms within an approximate 24-hour period; and 3) output pathways controlled by the pacemaker (Luyster et al., 2012). There is an interaction between the homeostatic pressure to sleep and our circadian rhythms such that the pressure to sleep increases throughout the day and peaks at night to facilitate the onset and maintenance of sleep.

Human sleep consists of two different states: non-rapid eye movement (NREM) and rapid eye movement (REM; Luyster et al., 2012). During NREM sleep, the amplitude of electroencephalography (EEG) waves in humans increases and the frequency of the EEG waves decreases. In contrast, while in REM sleep, EEG is indistinguishable from those obtained during waking (i.e., low-amplitude, high-frequency waves). Additionally, muscle tone (as measured using electromyography [EMG]) and saccadic eye movements (as measured using electro-oculography [EOG]) are implicated in sleep as well. In waking, muscle tone is high. Contrastingly, it decreases in NREM sleep and practically

disappears in REM sleep (Porkka-Heiskanen, Zitting, & Wigren, 2013). During REM sleep, our eyes undergo characteristic rapid movements, which is how the state derived its name. During NREM sleep, we experience low-frequency, high-amplitude waves (i.e., slow-wave activity) as measured by EEG. NREM sleep is divided into three stages (i.e., Stage 1; Stage 2; and Stage 3; Luyster et al., 2012) in increasing order of slow-wave activity. Sleep typically commences in Stage 1 and deepens via Stage 2 to Stage 3. It then proceeds to REM sleep (Porkka-Heiskanen et al., 2013). After the REM sleep period, the cycle starts from the beginning again (i.e., Stage 1). A typical night comprises four to six repeated cycles of NREM and REM, each lasting around 90 to 110 minutes (National Institute of Neurological Disorders and Stroke, 2019).

Importance of Sleep for Physical and Psychological Well-Being

Why do we spend approximately a third of our lives asleep? Increasing evidence supports the role that sleep may serve or influence a range of bodily functions (Czeisler, 2011). Indeed, evidence from positron emission tomography (PET), electroencephalogram (EEG), and animal research studies indicates that sleep may serve six crucial functions: improving immunity; reducing caloric use (i.e., energy stores depleted during wakefulness are restored during sleep); restoring brain energy stores; removing toxins and other brain products from the brain (i.e., serving a glymphatic function); optimizing cognitive and behavioral performance; and serving a neuronal/glial connectivity function (e.g., consolidating new memories and increasing synaptic efficacy; Krueger, Frank, Wisor, & Roy, 2016). Consequently, sleep deficiency negatively affects our immune, cardiovascular, and metabolic functions (Czeisler, 2011). The experience of chronic sleep deprivation is associated with adverse health outcomes such as coronary

heart disease, glucose intolerance, obesity, increased susceptibility to colds, and high blood pressure (Ayas et al., 2003; Buxton et al., 2010; Cohen, Doyle, Alper, Janicki-Deverts, & Turner, 2009; Czeisler, 2011; Knutson et al., 2009; Medic, Wille, & Hemels, 2017; Taheri, Lin, Austin, Young, & Mignot, 2004). Further, compared to good sleepers, individuals who experience sleep disturbance experience heightened negative affect (e.g., sadness, anger, and frustration) and dampened positive affect (e.g., happiness and joy; Ong, Cardé, Gross, & Manber, 2011). Additionally, sleep disturbances could be a precipitating risk factor for mental health conditions such as depression and anxiety (Jackson, Sztendur, Diamond, Byles, & Bruck, 2014). Moreover, sleep deprivation may increase our reactivity to negative events and blunt our reactions to positive events (Zohar, Tzischinsky, Epstein, & Lavie, 2005). Taken together, sleep could be considered an essential component of our physical, cognitive, and psychological health (Porkka-Heiskanen et al., 2013).

Comparing and Contrasting "Sleep Quantity" and "Sleep Quality"

Overall, good sleep is essential for optimal physical- and mental health as well as quality of life (Porkka-Heiskanen et al., 2013). Besides, there are two distinct but related sleep-related outcomes: sleep *quantity* (or duration); and sleep *quality*.

What is "Sleep Quantity"?

In terms of sleep quantity, insufficient sleep predicts the development of obesity, diabetes, cardiovascular diseases, and mortality (Chaput, Despres, Bouchard, & Tremblay, 2008; Gangwisch et al., 2007; Ikehara et al., 2009; Patel et al., 2004). With regards to cardiovascular outcomes, associations between sleep duration and adverse cardiovascular-related outcomes are typically *U*-shaped (Matthews et al., 2018). That is,

the lowest health risks are observed in individuals averaging 7 to 8 hours of sleep per night; the highest risk is associated with shorter and longer sleep durations. This is consistent with the Centers for Disease Control and Prevention's recommendation that adults aged 18 to 60 years should aim to obtain 7 to 8 hours of sleep per night (Barnes & Drake, 2015; Consensus Conference Panel, 2015). Of note, the American Academy of Sleep Medicine (AASM) and the Sleep Research Society (SRS) also assert that sleeping more than 9 hours per night may be appropriate for young adults, individuals recovering from sleep debt, and individuals with illnesses (Consensus Conference Panel, 2015).

What is "Sleep Quality"?

Good sleep quality is restorative for both our bodies and minds (Nordin et al., 2013). In contrast, poor sleep quality can adversely affect our psychosocial, physical, cognitive and occupational functioning; increase feelings of fatigue and lethargy; contribute to mood disturbance; and decrease quality of life (Zisapel, 2007). Indeed, sleep quality is a well-recognized predictor of physical and mental health, overall wellness, and vitality (Ohayon et al., 2017). Considering its benefits, the term "sleep quality" is commonly used in sleep medicine. However, there appears to be a lack of consensus or consistency regarding an established definition of the term (Krystal & Edinger, 2008). "Sleep quality" is sometimes used to refer to a collection of indices related to sleep duration including total sleep time, sleep onset latency, number of awakenings, total wake time throughout the night, and sleep efficiency (Krystal & Edinger, 2008). "Sleep quality" is also sometimes inferred from objective indices measured using polysomnography such as the proportions or temporal amounts of NREM and REM sleep experienced throughout the night. Besides the above definitions and their included

indices, “sleep quality” is sometimes used to imply an aspect of sleep that is related to but distinct from “sleep quantity.” For instance, it is possible to obtain an optimal amount of sleep each night (e.g., 7 to 8 hours of sleep) but not feel refreshed because one’s sleep has been fragmented or non-restorative (i.e., poor sleep quality). Therefore, sleep *quantity* and sleep *quality* are distinct constructs.

Significantly, a large proportion of individuals with insomnia cannot be differentiated from healthy sleepers based on sleep-related indices such as total sleep time, sleep onset latency, number of awakenings, and total wake time throughout the night (Krystal & Edinger, 2008). This may indicate that the basis for many such complaints lies not in the amount or timing of sleep but in more subjective features not reflected by common sleep parameters, such as depth of sleep, how well-rested one feels after awakening, and one’s general satisfaction with one’s sleep (Pilcher, Ginter, & Sadowsky, 1997; Seow et al., 2020).

Sleep Quantity vs. Sleep Quality: Why Focus on Sleep Quality?

Compared to sleep duration, subjectively perceived poor sleep quality may in fact play a larger role in determining one’s well-being. For example, Pilcher and colleagues (Pilcher et al., 1997) conducted two studies to determine whether measures of perceived health, subjective well-being, and daytime sleepiness are better associated with sleep *quality* or sleep *quantity*. The first study was conducted during a stressful period of the semester (i.e., on the day preceding each participant’s last final exam). The second study was conducted with the aim of replicating the first study during a less stressful period of the semester (i.e., at an earlier point of the semester). In both studies, nonclinical undergraduate participants [study 1: n = 30 students; mean age = 20.9 years (SD = 0.98);

study 2: n = 87 students; mean age = 18.9 years (SD = 1.1)] completed a 7-day sleep log as well as a battery of self-report surveys measuring sleep quality, perceived physical- and psychological health, subjective well-being, and daytime sleepiness (Pilcher et al., 1997). Findings from both studies indicate that during the first third of the semester (i.e., study 2) and during final exam week (i.e., study 1), compared to sleep *quantity*, sleep *quality* was more strongly associated with greater perceived health; greater subjective well-being; and decreased feelings of tension, depression, anger, fatigue, confusion, and daytime sleepiness. Moreover, the relationships between sleep quality and measures of perceived health, subjective well-being, and daytime sleepiness were independent of the effect of sleep quantity on sleep quality. Of note, in both of these studies, Pilcher and colleagues investigated a nonclinical sample who reported an average of 7 to 8 hours of sleep per night; sleep duration outside of the 7-8 hour range may have a different effect on perceived health, subjective well-being, and daytime sleepiness than what Pilcher and colleagues had found (Pilcher et al., 1997). Based on their findings, the authors recommended that research on sleep and preventive medicine in nonclinical populations should focus on sleep quality in addition to sleep quantity.

In addition, Bassett and colleagues investigated a sample of college students to understand the effects of sleep quality and quantity on cortisol responses to acute psychosocial stress (Bassett, Lupis, Gianferante, Rohleder, & Wolf, 2015). To measure both sleep quantity and quality, they used the self-report Pittsburgh Sleep Quality Index (Buysse et al., 1989). The researchers also measured participants' salivary cortisol responses to the Trier Social Stress Test (Kirschbaum, Wüst, & Hellhammer, 1992). Their results revealed gender-specific patterns. In terms of male participants, results

showed that compared to those who experienced poor sleep quality, participants who endorsed fairly good or very good sleep quality demonstrated blunted or exaggerated cortisol responses to the stress test. This suggests that better sleep quality is associated with decreased stress reactivity. Average sleep duration did not appear to modulate cortisol stress responses. On the other hand, female participants' stress responses were less dependent on self-reported sleep quality. Hence, Bassett and colleagues' findings suggest that perceptions of one's sleep quality can negatively affect the body's ability to respond to stress in a gender-dependent manner. However, like Pilcher and colleagues, the authors of this study investigated an undergraduate student sample, which limits the ability to generalize their findings given that college students tend to keep erratic sleep schedules (Lund et al., 2010).

Thus, epidemiological and population-based studies can be useful in addressing these limitations of Pilcher and colleagues' as well as Bassett and colleagues' studies and to further illustrate the role sleep quality plays in determining well-being. To begin with, using population-based data, Jean-Louis and colleagues (Jean-Louis, Kripke, & Ancoli-Israel, 2000) explored whether habitual sleep duration or sleep satisfaction is a stronger predictor of better health-related quality of life as measured by the Quality of Well-Being scale (QWB; Kaplan, Sieber, & Ganiats, 1997). The results revealed that neither subjective sleep duration nor sleep duration as measured by actigraphy were related to health-related quality of life. Instead, higher sleep satisfaction was associated with greater health-related quality of life. Thus, their findings suggest that increasing sleep duration may not directly improve quality of life and highlights the importance of investigating sleep quality on top of sleep quantity.

Similarly, using data from the National Comorbidity Survey Replication, a nationally representative survey of adults (aged 18 and older) living in the United States, Roth and colleagues (Roth et al., 2006) examined the prevalence of four different types of sleep complaints over a one-year period: difficulty initiating sleep; difficulty maintaining sleep; early morning awakening; and non-restorative sleep. They found that after controlling for *DSM-IV* (American Psychiatric Association, 1994) anxiety, mood, impulse-control, and substance use disorders, 36.3% of the sample endorsed experiencing one or more of the sleep problems. Particularly, these authors demonstrated that non-restorative sleep was the most commonly endorsed sleep complaint, with 25% of the sample reporting they experienced non-restorative sleep for an average of 25.2 weeks within a one-year period (Roth et al., 2006). The prevalence rates of the remaining three sleep complaints—difficulty initiating sleep, difficulty maintaining sleep, and early morning awakening—fell within the range of 16.4% to 19.9%.

The finding that non-restorative sleep was the most common of the four sleep complaints could reflect the possibility that non-restorative sleep can occur as a result of difficulty initiating sleep, difficulty maintaining sleep, and/or experiencing early morning awakenings. Further, about one-third of participants endorsing the experience of non-restorative sleep report neither difficulty initiating sleep, difficulty maintaining sleep, nor experiencing early morning awakenings. This finding suggest that non-restorative sleep could be indicative of poor sleep quality or continuity rather than short sleep duration. Also, non-restorative sleep was more strongly and consistently related to role impairment compared to the other remaining three sleep complaints. Overall, given its prevalence as well as the significant associations with perceived physical- and psychological health,

subjective well-being, daytime sleepiness, stress response, health-related quality of life, and role impairment, investigating sleep quality could be important and relevant.

Measuring Sleep Quality

Various measurement tools are available for the assessment of sleep-related outcomes, including retrospective self-reports (e.g., sleep-related indices and questionnaires), prospective self-reports (e.g., sleep diaries), longitudinal measures of rest-activity patterns using wrist actigraphy, physiological recordings (i.e., polysomnography), and functional imaging measures (Yu et al., 2012). Cardiorespiratory polysomnography (PSG) is considered to be the gold standard method of assessing sleep duration in sleep medicine and sleep research (Matthews et al., 2018). However, PSG can be time-consuming, expensive, and have low patient acceptability rates (Zinkhan et al., 2014). Plus, it takes place in an artificial environment. An alternative to PSG may be actigraphy (e.g., wrist or hip actigraphy; Zinkhan et al., 2014). Wrist actigraphy is an unobtrusive method used to measure sleep duration; a wrist actigraphy monitor typically looks like a wristwatch with a blank face. By utilizing highly sensitive accelerometers, actigraphs digitally record gross motor activity, which is in turn analyzed to identify sleep periods (Lauderdale, Knutson, Yan, Liu, & Rathouz, 2008). Compared to PSG, actigraphy is less expensive and more accessible. However, actigraphy may overestimate the amount of sleep and underestimate the amount of wakefulness experienced during the night (Lichstein et al., 2006). Therefore, it is not recommended to be used as a diagnostic instrument for the evaluation of sleep disorders. It is instead recommended for the assessment of sleep patterns in healthy adult populations or as an adjunct in the

evaluation of circadian rhythm disorders, delayed sleep phase syndrome, and shift work disorder (Zinkhan et al., 2014).

Additionally, sleep diaries can be used as a prospective measurement of sleep, which involve an individual taking note of various aspects of their sleep, including *bed time* (i.e., noting the time one attempted to go to sleep), *wake time* (i.e., noting the time one finally awoke for the day), *sleep latency* (i.e., time it took one to fall asleep), and *wake time after sleep onset* (i.e., total time one spent awake after initially falling asleep due to awakenings throughout the night).

Next, self-report sleep questionnaires such as the *Pittsburgh Sleep Quality Index* (PSQI; Buysse et al., 1989) can be used to measure sleep quality and quantity over a preceding period of time. For example, the PSQI, which is the most widely used scale for the measurement of sleep disturbance (Yu et al., 2012), assesses sleep quality and quantity over the past month. The *Insomnia Severity Index* (ISI; Bastien, Vallières, & Morin, 2001) is another questionnaire that is commonly used for the assessment of insomnia-related symptoms and one's perceptions of sleep-related problems such as one's dissatisfaction and distress associated with the experience of sleep-related difficulties.

Though PSG and actigraphy are preferred methods of collecting objective data related to sleep, utilizing these methods in this study may not be appropriate for identifying nonclinical young adults with poor sleep quality since this population does not typically present to medical centers or sleep disorder clinics where such methods are more widely available. Further, although wearable devices such as portable fitness trackers (e.g., Fitbit®) are popular and affordable, limitations of these devices include

low specificity in overestimating total sleep time and underreporting number of awakenings throughout the night (Kolla, Mansukhani, & Mansukhani, 2016). For these reasons, this study used the *Pittsburgh Sleep Quality Index* (PSQI; Buysse et al., 1989) as the main outcome measure of sleep quality, as this would be cost-effective and naturalistic. The PSQI is also less time-intensive than completing weekly sleep diaries, which therefore would ease respondent burden.

Poor Sleep Quality in College-Aged Young Adults

Poor sleep quality is a particular problem for college students. It has been estimated that between 40% to 88% of students suffer from poor sleep quality (i.e., a broad measure of general sleep difficulties such as frequent awakenings, difficulties initiating sleep, experiencing nonrestful sleep, and low total sleep time; Buboltz Jr. et al., 2001; Lund et al., 2010; Vail-Smith, Felts, & Becker, 2009). For example, in a national survey of college students (N = 99,066), 57.1% of the sample reported receiving enough sleep to feel rested on fewer than 4 days a week and 26.4% of the participants reported that their experience of sleep difficulties during the previous 12 months felt "traumatic or very difficult to handle" (American College Health Association, 2012). Similarly and more recently, Becker and colleagues assessed the sleep patterns and problems in college students aged 18 to 29 years recruited from six universities (N = 7626; Becker et al., 2018). They found that 27% of participants met cut-off criteria for poor sleep quality over the past month, 36% of participants reported obtaining less than 7 hours of sleep per night, and 43% reported that it takes them more than 30 minutes to fall asleep at least once per week.

Thereby, attention to poor sleep quality in college-aged young adults is crucial, especially considering that sleep difficulties appear to worsen over time throughout college and may confer risk for more chronic and clinical sleep disturbances (Milojevich & Lukowski, 2016). Hence, the following section focuses on a major risk factor for poor sleep quality: stress.

Stress as a Major Risk Factor for Poor Sleep Quality

Many definitions of stress exist (O'Connor et al., 2021; Segerstrom & O'Connor, 2012). To date, three definitions of stress are widely cited (Segerstrom & O'Connor, 2012; Verlander, Benedict, & Hanson, 1999). First, stress can be viewed as a stimulus or situation (e.g., life event) to which an individual is exposed. The greater the intensity of the stressor, the higher the level of stress it may cause. Second, stress can be viewed as a response of the body to a demand placed on it (Verlander et al., 1999). This response could include affective, cognitive, and biological mechanisms. Third, according to stress and coping theory, stress can be viewed as a transaction between the person and the environment (Lazarus, DeLongis, Folkman, & Gruen, 1985). That is, the way in which an individual perceives, appraises, and copes with daily environmental events influences how they adapt to the stressful event.

Particularly, physiological responses to stress have been shown to increase risk for poor sleep quality. McEwen developed the concept of allostasis and the term "allostatic load" (McEwen & Akil, 2020). Allostasis refers to the process of adapting and maintaining physiological equilibrium in fluctuating environmental circumstances through mediators like cortisol that promote adaptation (McEwen & Akil, 2020). However, if one's stress remains chronic and unrelenting, the equilibrium set point has to

be altered to accommodate a "new normal," which can in turn be costly to the body. Thereby, allostatic load refers to the mechanism the body has developed to adapt to these variable and often adverse psychosocial and/or physical stressors (McEwen & Akil, 2020). Given that sleep is a regulatory process that occurs during non-wakefulness (Jensen, 2003), stress may therefore disrupt the underlying psychological and physiological mechanisms underlying sleep (Han, Kim, & Shim, 2012; McEwen, 1998).

Indeed, the experience of stress may result in increased emotional, cognitive, and physiological hyperarousal especially before bedtime that could impair one's sleep. Hyperarousal refers to heightened and elevated physiological, affective, and/or cognitive activity that decreases the likelihood of sleep (Levenson, Kay, & Buysse, 2015). For instance, individuals who experience hyperarousal at bedtime may report feeling keyed up or experiencing difficulties "turning off" their minds. Such hyperarousal results in increased activity of the autonomic nervous system that, in turn, causes and maintains a state of alertness. However, sleep and alertness are mutually competitive and necessarily exclusive (Han et al., 2012). In fact, results from experimental studies have shown that increased cognitive arousal leads to increased time needed to fall asleep (Lichstein & Fanning, 1990). Also, individuals with chronic insomnia demonstrate increased heart rates and decreased high-frequency power of heart rate variability during all sleep stages compared to healthy sleepers (Bonnet & Arand, 1998). This suggests that individuals with chronic insomnia experience increased sympathetic nervous system activity throughout all stages of sleep. Taken together, evidence indicates that stress causes psychophysiological responses that are incompatible with good sleep.

Stress and College

Entering college constitutes a major and potentially stressful life transition for students, as this is a process that often entails leaving one's home, taking demanding classes, and encountering new social contexts. Further, throughout college, students face a range of academic, social, vocational, financial, and other extracurricular stressors. These stressors tend to be ongoing, rather than single life-events such as a job loss or losing a loved one (Wallace, Boynton, & Lytle, 2017). Therefore, attending college is often associated with increased levels of stress, which may consequently negatively affect one's sleep (Åkerstedt, 2006; Petrov et al., 2014). Indeed, Lund and colleagues found that 20.1% of students endorsed that experiencing emotional and/or academic-related stress interfered with their sleep at least once a week (Lund et al., 2010).

The Relationship Between Perceived Stress and Poor Sleep Quality in College-Aged Young Adults

This study focused on *perceived* stress, which is grounded within the stress and coping theoretical framework (Lazarus & Folkman, 1984). Perceived stress is defined as the degree to which one views their life as being stressful (e.g., unpredictable, uncontrollable, or overloading; Cohen, Kamarck, & Mermelstein, 1983). According to stress and coping theory (Lazarus, 2000; Lazarus & Folkman, 1984), stress is experienced as a process that is initially triggered by situational demands, but then is influenced mainly by the cognitive appraisal of resources available to meet these demands. The characteristics of the situation (i.e., primary appraisal) are evaluated simultaneously in line with one's available coping capacities or resources (i.e., secondary appraisal). Appraisal therefore refers to the evaluative process through which an individual first perceives situational demands and then determines the degree to which

these situational demands are a threat. This interaction between situational demands and the individual is viewed as *transactional*, because not only is there an interaction between the situational demands and the individual, the individual also brings to this interaction a host of factors such as their personality characteristics and past experiences (Lazarus, 1999).

Several studies have examined the association between perceived stress and sleep quality in college student samples. First, Verlander and colleagues investigated the relationship between three domains of stress (i.e., environmental events; personality mediators; and emotional responses) and sleep quality in a sample of 227 college students aged 18 to 35 years (Verlander et al., 1999). To measure the three domains of stress, the researchers used the Derogatis Stress Profile (DSP; Derogatis, 1987) which contains 77 items that assess for environmental events, personality mediators, and emotional responses to stress. Environmental events include vocational, domestic, and health conditions. Personality mediators include factors that might influence the response an individual chooses to cope with a particular stressor (e.g., need for high achievement, sense of time pressure, and the ability to relax). Emotional responses of stress include anxiety, hostility, and depression. To measure sleep quality, the researchers used the Sleep Questionnaire (SQ; Domino, Blair, & Bridges, 1984). This questionnaire measures the following aspects of sleep: depth of sleep; difficulties in waking up; quality and latency of sleep; negative affect in dreams; length of sleep; dream recall and vividness; and sleep irregularity.

Results from a stepwise multiple regression analysis demonstrated that scores on the Emotional Response subscale of the DSP (Derogatis, 1987) were the best predictor of

poor sleep patterns. Particularly, on the first step of the analysis, scores on the Emotional Response subscale significantly predicted scores on the following subscales of the Sleep Questionnaire: depth of sleep; difficulties in waking up; quality and latency of sleep; negative affect in dreams; and sleep irregularity. None of the scores on the Environmental Events and Personality Mediators subscales of the DSP were significant on the first step of the stepwise multiple regression analysis. The results therefore suggest that an individual's personal *responses* to stressful environmental events may better predict sleep patterns than environmental events or personality factors.

Moreover, in their investigation of 1125 college students, Lund and colleagues also reported that compared to good sleepers, poor sleepers endorsed experiencing increased levels of perceived stress throughout the week (Lund et al., 2010). Additionally, Galambos and colleagues conducted a longitudinal investigation of 186 undergraduate students from their first through fourth year of college to observe their sleep patterns and quality over time (Galambos, Lascano, Howard, & Maggs, 2013). The researchers found that during years where they experienced higher levels of perceived stress, students endorsed getting fewer hours of sleep, experiencing greater levels of sleep disturbances, and having later rise times.

In line with tenets of stress and coping theory (Lazarus & Folkman, 1984), these findings suggest the importance of further investigating the relationship between perceived stress and sleep quality in college-aged young adults. This relationship is particularly important considering the empirical evidence that suggests our emotional responses to stressors might more strongly predict poor sleep compared to environmental

events and personality factors (Verlander et al., 1999) and the known association between perceived stress and poor sleep quality (Galambos et al., 2013; Lund et al., 2010).

Moreover, considering the deleterious physical, psychological, emotional, cognitive, and academic consequences associated with poor sleep quality in college-aged young adults (Alapin et al., 2000; Buboltz Jr. et al., 2001; Thacher, 2008), it is thereby important to identify protective factors that could buffer the negative effects of perceived stress on sleep quality. That is, what are some factors that could protect individuals from the physical, psychological, cognitive, and emotional risks posed by the influence of perceived stress on poor sleep quality? In line with the tenets of prevention science, this study aimed to investigate two potential protective factors—dispositional mindfulness and trait self-compassion—that may contribute to an individual's ability to respond adaptively to perceived stress and therefore attenuate the deleterious effects of perceived stress on one's sleep.

What is Mindfulness?

Early in its incorporation into Western science, mindfulness was defined as "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). Historically, mindfulness is rooted in Buddhist culture and philosophy as well as Eastern contemplative traditions and involves a state of consciousness during which one brings awareness and attentiveness to their present-moment experience (Bluth & Blanton, 2014; Grossman, 2010). The term itself is derived from the Pali language and is broadly defined as awareness, circumspection, discernment, and retention (Shapiro, 2009). In Buddhism, mindfulness is an attribute that involves leading a skillful, ethical, and principled life (i.e., the eight-fold path). It was

proposed by the historical Buddha (if indeed such an individual existed) as an antidote to *suffering*, or the inevitable unsatisfactoriness of everyday life. Mindfulness emerged in prominence in Western science largely due to the influence of Kabat-Zinn, who considered the ability to pay attention in a sustained, nonjudgemental manner to present-moment experience to be of fundamental importance in navigating the challenges of everyday life.

Mindfulness may refer to either an outcome (referred to herein as *mindfulness*) or a process (referred to herein as *mindfulness practice*), or a state (i.e., '*being* mindful'). Mindfulness and mindfulness practice are sometimes used interchangeably. However, they are distinct but related constructs. *Mindfulness* refers to a state or trait in which an individual is aware and attentive in the present moment (Bluth & Blanton, 2014). It can include qualities such as an ability to identify an inner experience (e.g., sensations, emotions, and perceptions) and a mental attitude of acceptance toward one's present-moment experiences (Lindsay & Creswell, 2017). Additionally, *dispositional mindfulness* refers to an individual's innate level of mindfulness and is viewed as a trait construct. It has been found to occur at varying levels within the population, regardless of one's mindfulness practice (Tomlinson, Yousaf, Vittersø, & Jones, 2018). *Mindfulness practice* refers to the engagement in various techniques such as breath awareness, mindful movement (e.g., yoga), and body awareness practices (e.g., body scan) that cultivate mindfulness. Through consistent practice, mindfulness could result in shifts in metacognition (i.e., thinking about thinking). For instance, rather than focusing on changing the content of one's thoughts, one could change how one relates to one's thoughts through de-centering or disengaging from the thoughts themselves. Further, a

fourth term, "*mindfulness intervention*", refers to a program of a number of classes wherein one is taught mindfulness practice techniques and is encouraged to cultivate a daily, consistent mindfulness practice. For example, the most empirically studied mindfulness intervention is mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1982).

A key assumption of mindfulness is that we are typically largely unaware of our moment-to-moment experience (e.g., our physical sensations, perceptions, affective states, thoughts, and mental imagery; Grossman, 2010). In fact, Grossman (2010) asserts that we are often operating on an "autopilot mode" (Grossman, 2010, p. 89). As a result, we may react emotionally to situations in our lives without discernment and often misperceive situations (Grossman, 2010). Mindfulness therefore offers an alternative way of processing and perceiving inner and external experiences by cultivating a moment-to-moment, nonjudgmental, and highly discerning sense of awareness of our internal and external experiences (Grossman, 2010; Van Dam et al., 2018).

Nonetheless, there exists a fair amount of debate over how mindfulness is defined (Baer, 2011). This ongoing debate is reflected in the various scales that have been developed to measure mindfulness, with some scales conceptualizing the construct of mindfulness as unidimensional and other scales defining the construct as multidimensional. Many measures of mindfulness exist (Van Dam et al., 2018) and a comprehensive review of all existing questionnaires designed to measure mindfulness is beyond the scope of this study. Lindsay and Creswell (2017) identified two components that are commonly described across uni- and multidimensional conceptualizations of mindfulness: 1) the use of *attention* to monitor one's present-moment experiences; and 2)

a mental attitude of *acceptance* toward these present-moment experiences. Therefore, the definition that will be used in this study is one which encompasses the two identified components of *attention* and *acceptance* (Lindsay & Creswell, 2017) as well as one which is widely used in empirical studies: "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). Hence, in this study, "dispositional mindfulness" is used in reference to an individual's innate tendency to pay attention to their present-moment experiences and to extend a mental attitude of acceptance toward these present-moment experiences regardless of one's mindfulness practice (Tomlinson et al., 2018). Additionally, it refers to one's typical level of mindful awareness on a day-to-day basis (Brown, West, Loverich, & Biegel, 2011). This study aimed to use the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) to measure dispositional mindfulness. After running a factor analysis that pooled items from five mindfulness scales, Baer and colleagues (2006) operationalized mindfulness as consisting of five factors that emerged from the factor analysis: Observing; Describing; Acting with Awareness; Nonjudging; and Nonreacting (Baer et al., 2006). Thus, the FFMQ contains 39 items that assesses for these five factors.

Dispositional Mindfulness, Psychological Health, and Physical Health

Within nonclinical samples, studies have shown an inverse relationship between dispositional mindfulness and psychopathological symptoms such as depressive symptoms (Barnhofer, Duggan, & Griffith, 2011), posttraumatic stress disorder symptoms (Smith et al., 2011), borderline personality disorder symptoms (Fossati, Feeney, Maffei, & Borroni, 2011), and eating behavior pathology (Masuda, Price, & Latzman, 2012; Masuda & Wendell, 2010). Further, evidence suggests that there exists a

significant negative association between dispositional mindfulness and stress (Hicks et al., 2020). In addition, Bajaj and colleagues demonstrated a significant positive association between dispositional mindfulness and psychological well-being (Bajaj, Gupta, & Pande, 2016). Moreover, Tomlinson and colleagues conducted a systematic review of studies that both investigated the relationship between dispositional mindfulness and psychological health within nonclinical samples and did not involve interventions to manipulate or train mindfulness (Tomlinson et al., 2018). After reviewing 93 studies, three main themes emerged from their analyses: 1) dispositional mindfulness appears to be inversely related to psychopathological symptoms; 2) dispositional mindfulness is positively associated with adaptive cognitive processes such as reduced rumination and pain catastrophizing; and 3) dispositional mindfulness appears to be associated with greater emotional processing and emotional regulation (Tomlinson et al., 2018).

Additionally, evidence suggests that dispositional mindfulness is positively and significantly associated with indices of physical health, including smoking avoidance and high levels of weekly physical activity (Loucks, Britton, Howe, Eaton, & Buka, 2015). Dispositional mindfulness is also positively associated with healthier eating habits and better self-rated physical health in college students over a 10-week period (Murphy, Mermelstein, Edwards, & Gidycz, 2012). In a sample of 394 adults obtained from a prospective birth cohort (median age = 47 years), Loucks and colleagues found that after adjusting for age, gender, race/ethnicity, birth weight, childhood socioeconomic status, and childhood intelligence, individuals with low levels of dispositional mindfulness were more likely to be obese (prevalence ratio for obesity = 1.34). Further, prospective

analyses indicated that participants who were not obese in childhood and then became obese in adulthood demonstrated lower dispositional mindfulness scores compared to participants who were not obese in childhood or adulthood (Loucks et al., 2016). In addition, in a sample of participants with multiple sclerosis, higher levels of dispositional mindfulness predicted lower pain interference (Senders, Borgatti, Hanes, & Shinto, 2018). Taken together, these studies suggest that dispositional mindfulness is positively associated with various psychological and physical health indices (Bajaj et al., 2016; Barnhofer et al., 2011; Fossati et al., 2011; Hicks et al., 2020; Loucks et al., 2015; Masuda & Wendell, 2010; Masuda et al., 2012; Murphy et al., 2012; Senders et al., 2018; Smith et al., 2011; Tomlinson et al., 2018).

The Mindfulness Stress Buffering Model

How might dispositional mindfulness affect both psychological and physical health outcomes? According to the mindfulness stress buffering model developed by Creswell and Lindsay (2014), mindfulness could mitigate stress appraisals and therefore attenuate stress-reactivity responses. Consequently, these stress reduction effects could explain how mindfulness positively influences physical and psychological health outcomes. From a biological pathway perspective, mindfulness is posited to alter stress processing in the brain, which consequently alters peripheral stress-response cascades and associated risk for stress-related diseases. Extant empirical evidence suggests that both dispositional mindfulness and mindfulness training interventions are associated with increased recruitment of prefrontal regulatory regions that may reduce activity in stress processing regions, especially when participants are engaged in active emotion regulation

tasks such as affect labeling (Creswell, Way, Eisenberger, & Liberman, 2007; Modinos, Ormel, & Aleman, 2010).

Evidence from neuroimaging studies also suggests that mindfulness could modulate the reactivity of stress processing regions. For example, individuals with higher levels of dispositional mindfulness demonstrate lower resting-state amygdala activity (Way, Creswell, Eisenberger, & Lieberman, 2010) and smaller right amygdala volumes (Taren, Creswell, & Gianaros, 2013). Taken together, these findings suggest that high levels of mindfulness are associated with reduced activity and volume of brain networks driving stress reactivity.

Creswell and Lindsay (2014) proposed that if mindfulness is associated with altered stress processing dynamics in the brain, then mindfulness might also alter stress-related hypothalamic-pituitary-adrenal (HPA) axis activation and result in decreased release of glucocorticoids such as the stress hormone cortisol. For example, Brown and colleagues assessed undergraduate participants' levels of dispositional mindfulness and then randomly assigned participants to a high- versus low-stress situation (Brown, Weinstein, & Creswell, 2012). In the high-stress condition, participants were asked to perform speech and math tasks in the presence of evaluators. In the low-stress condition, participants were asked to perform the same speech and math tasks but instead alone into an audio recorder. In line with the stress buffering hypothesis, individuals with higher levels of dispositional mindfulness demonstrated lower stressor-evoked cortisol reactivity in the high-stress condition. Contrastingly, Brown and colleagues did not find a significant association between mindfulness and cortisol reactivity in the low-stress condition (Brown et al., 2012).

According to the mindfulness stress buffering model (Creswell & Lindsay, 2014), if mindfulness could alter neural stress processing dynamics and reduce HPA-axis reactivity, then mindfulness could also subsequently affect biological and psychological health outcomes by influencing the biological pathways in which stress leads to disease. Therefore, the model posits that mindfulness-based health effects are most likely to be observed in high-stress populations (e.g., participants high in psychological distress) and for health conditions that are known to be triggered or exacerbated by stress that, in turn, affect the disease pathogenic process (e.g., cardiovascular diseases, cancer, and HIV).

Moreover, from a psychological perspective and in line with stress and coping theory (Lazarus & Folkman, 1984), mindfulness may buffer stress responses and their deleterious effects on psychological and physical health by buffering initial threat appraisals and increasing secondary appraisals of coping resources. That is, given that mindfulness could be associated with a greater capacity to observe stressors nonjudgmentally as they arise with a sense of equanimity (vs. reactivity), this may mitigate primary threat appraisals and instead facilitate secondary appraisals for coping (Creswell & Lindsay, 2014). Indeed, electroencephalographic (EEG) studies have shown that individuals high in dispositional mindfulness demonstrate lower levels of early attentional reactivity to threatening stimuli and thereby attenuated threat appraisals (Brown, Goodman, & Inzlicht, 2013). Further, individuals high in dispositional mindfulness are more likely to make benign stress appraisals. They are also more likely to engage in less frequent use of avoidant coping strategies and instead use approach coping strategies (Weinstein, Brown, & Ryan, 2009).

Dispositional Mindfulness and Sleep Quality

Therefore, given that stress is a major risk factor for poor sleep quality and considering the potential benefits of dispositional mindfulness as a buffer against perceived stress, dispositional mindfulness is one of the key constructs of interest in this study. Indeed, extant evidence suggests that higher levels of dispositional mindfulness are associated with better sleep quality (Lau, Leung, Wing, & Lee, 2018). For example, using a sample of 305 undergraduate students, Howell and colleagues found that dispositional mindfulness is positively associated with sleep quality ($\beta = .55$, $p < .001$; Howell, Digdon, Buro, & Sheptycki, 2008). In addition, Howell and colleagues demonstrated that higher levels of dispositional mindfulness were associated with better self-reported sleep quality as well as lower levels of daytime sleepiness, pre-sleep arousal, and dysfunctional beliefs about sleep in a cross-sectional study of undergraduate college students (Howell, Digdon, & Buro, 2010). Moreover, in a longitudinal investigation of 441 female undergraduate students, Murphy and colleagues (2012) found that dispositional mindfulness measured at the beginning of a 10-week academic quarter (T1) predicted better quality of sleep measured at the end of the quarter (T2). More recently, Nagy and colleagues (2020) investigated the relationship among dispositional mindfulness, posttraumatic stress disorder (PTSD) symptom severity, PTSD-related sleep disturbance, and sleep quality. This study consisted of a sample of 217 participants who endorsed experiencing at least one event that would meet *DSM-5* (American Psychiatric Association, 2013) diagnostic criteria for PTSD. The results revealed that after controlling for PTSD symptom severity, dispositional mindfulness was associated with lower frequency of PTSD-related sleep disturbance as measured by the Pittsburgh Sleep

Quality Index Addendum for PTSD (PSQI-A; Germain et al., 2005) *and* better sleep quality as measured by the PSQI (Buysse et al., 1989).

Relatedly, Gómez-Odriozola and Calvete (2021) examined the longitudinal associations between dispositional mindfulness profiles and sleep quality and the mediating role of rumination in a sample of 304 Spanish adolescents (M_{age} = 16.40, *SD* = 1.61). Participants were assessed at three time points over the span of two months. Dispositional mindfulness was measured using the Five-Facet Mindfulness Questionnaire-Adolescents-Short-Form; rumination was measured using the Spanish adaptation of the ruminative responses subscale from the Children's Responses Style Scale; and sleep quality was measured using the Spanish version of the Pittsburgh Sleep Quality Index. Using latent profile analyses, the researchers reported that a two-profile model emerged wherein participants were either classified as "non-judgmentally aware" (i.e., they displayed higher levels of the FFMQ-A-SF's facets of *Describing*, *Acting with Awareness*, and *Non-Judging*, and lower levels of the FFMQ-A-SF's facet of *Observing*) or "judgmentally observing" (i.e., these participants showed lower levels of the FFMQ-A-SF's facets of *Describing*, *Acting with Awareness*, and *Non-Judging*, and higher levels of the FFMQ-A-SF's facet of *Observing*). Using path analyses, the results revealed that compared to the participants in the "judgmentally observing" group, those who were classified as "non-judgmentally aware" showed a decrease in sleep disturbances at the four-month follow-up and that decreases in rumination significantly mediated this association. The researchers suggest that various dispositional mindfulness profiles may be differentially associated with specific aspects of sleep quality (e.g., sleep latency, sleep duration, sleep efficiency, and daytime dysfunction).

Overall, dispositional mindfulness appears to be a promising protective factor against poor sleep quality (Gómez-Odriozola & Calvete, 2021; Howell et al., 2008; Lau et al., 2018; Murphy et al., 2012; Nagy et al., 2020). Furthermore, emerging evidence (e.g., Gómez-Odriozola & Calvete, 2021) demonstrates that it may be important to investigate the different facets of dispositional mindfulness and their differential associations with aspects of sleep quality. Nonetheless, the mindfulness principles of *awareness* and *acceptance* are congruent with the passive nature of sleep and may work to facilitate the cognitive deactivation and physiological de-arousal necessary to bring about sleep by enabling an individual to disengage from their daily concerns and stressors (Garland et al., 2013). Similarly, Lundh (2005) asserts that mindfulness could facilitate the acceptance of physical and cognitive experiences that precede sleep, reduce excessive thinking or worrying before bedtime, and ameliorate physiological arousal that may interfere with sleep.

What is Self-Compassion?

Self-compassion refers to a compassionate (versus harsh) way of relating to oneself when faced with personal suffering (Neff, 2003b). As defined and conceptualized by Neff (2003b), self-compassion consists of three main elements: self-kindness (versus self-judgment); a sense of common humanity (versus isolation); and mindfulness (versus over-identification). Although these elements are viewed as conceptually distinct, they are thought to mutually interact with one another to create a self-compassionate frame of mind. Drawing from Buddhist traditions, Neff (2003b) defines the three elements in the following ways. First, self-kindness involves being gentle and supportive towards oneself, rather than harshly judging oneself. Common humanity involves recognizing that

all humans fail and make mistakes, and that suffering is part of the human condition. This is in contrast to feeling isolated and alone in one's suffering. Finally, mindfulness—as defined within the self-compassion framework—involves being aware of one's present moment experience of suffering without overly identifying with the aversive or distressing aspects of the experience. Further, in order to give oneself compassion, one must be able to acknowledge and recognize that one is suffering, highlighting the importance of mindfulness in the practice of self-compassion. In considering all three elements together, self-compassion is particularly relevant when considering personal shortcomings and mistakes as well as when struggling with external circumstances that result in emotional, physical, and/or psychological pain (Neff & Dahm, 2015). A self-compassionate person is therefore one who experiences less self-criticism and isolation and tends to be less emotionally overwhelmed when faced with hardship (Lathren, Bluth, & Park, 2019).

Self-compassion can be conceptualized as a traitlike, dispositional construct or as a practice (i.e., extending oneself self-compassion through various exercises designed to induce a sense of self-kindness and self-acceptance). This study focused on trait self-compassion, which is typically measured in the literature using the Self-Compassion Scale developed by Neff (2003b).

Physical and Psychological Benefits of Self-Compassion

Self-compassion has been consistently associated with enhanced physical and psychological well-being. Phillips and Hine (2019) conducted a meta-analysis to investigate the relationship between self-compassion and physical health as well as the relationship between self-compassion and engagement in health-promoting behaviors.

Based on a large pooled sample (N = 29,588), they found that self-compassion predicted outcomes across multiple health domains, with the strongest effects observed on global physical health, functional immunity, health behaviors, danger avoidance, and sleep. In addition, interventions designed to enhance self-compassion predicted increased physical health, further supporting causal relationships between self-compassion and physical health outcomes. Results from the meta-analysis conducted by Phillips and Hine (2019) also revealed that individuals with high levels of self-compassion tend to engage in a range of health-promoting behaviors such as exercising and eating nutritious meals that may consequently promote physical health. In terms of psychological well-being, MacBeth and Gumley (2012) conducted a meta-analysis examining the association between self-compassion and psychopathology. They found that across 14 studies, higher levels of self-compassion were associated with lower levels of depression, anxiety, and stress. Similarly, self-compassion has been associated with increased positive outcomes such as happiness, life satisfaction, and well-being (Zessin, Dickhauser, & Garbade, 2015).

Self-Compassion as a Coping Strategy

Self-compassion can be viewed as an effective way to cope with difficult emotional experiences (Neff & Dahm, 2015). Indeed, self-compassion may become salient during moments of difficulties and influences how an individual relates to their pain and suffering (Neff, 2003a). For instance, individuals high on self-compassion tend to ruminate less than those who are lower on self-compassion (Neff, 2003b). This could be a result of an increased ability to accept negative emotional experiences in a kind and open manner and to give oneself compassion when one is suffering rather than to simply

ruminate. Indeed, self-compassionate individuals are more likely to accept unwanted thoughts and emotions than those who are low on self-compassion (Neff, 2003b) and are more likely to acknowledge that their emotions are valid and important (Neff, Kirkpatrick, & Rude, 2007).

Moreover, Neff and colleagues examined the relationship between self-compassion and reactions to academic failure (Neff, Hsieh, & Dejitterat, 2005). The researchers found that among students who received an unsatisfactory midterm grade, self-compassion was positively correlated with the use of emotion-focused coping strategies (i.e., acceptance and positive reinterpretation focused on growth) and negatively correlated with the use of avoidance-oriented coping strategies and a focus on negative emotions. In addition, results from their study indicate that in the face of receiving an unsatisfactory midterm grade, self-compassionate students were more likely to endorse mastery orientation (i.e., being motivated by curiosity and the desire to develop one's skills) and less likely to endorse performance orientation (i.e., the motivation to defend or enhance one's self-worth; Neff et al., 2005). Based on their findings, the researchers suggest that self-compassion may moderate one's reactions to failure by reducing the aversiveness of events that could threaten one's self-esteem.

Additionally, using a sample of 307 undergraduate students, Wisener and Khoury (2022) investigated the relationships among emotion regulation difficulties, eating in response to cope with negative emotions, dispositional mindfulness, and self-compassion. Their results showed that dispositional mindfulness *and* self-compassion were associated with lower levels of non-acceptance of emotional responses, which, in turn, was associated with less eating to cope with negative emotions. However, when controlling

for self-compassion, dispositional mindfulness was no longer negatively associated with less eating to cope with negative emotions. This suggests that self-compassion may be more relevant to eating to cope with negative emotions than dispositional mindfulness.

Altogether, the studies reviewed here suggest that self-compassion is an adaptive coping and emotion regulation strategy. The results from these studies also reveal that self-compassion may serve as an adaptive coping strategy through several pathways, including reducing rumination (Neff, 2003b), increasing acceptance of difficult emotions (Neff et al., 2005; Neff et al., 2007; Wisener & Khoury, 2022), and increasing a sense of mastery orientation towards difficulties (Neff et al., 2005).

Self-Compassion and Perceived Stress

Similarly, extant evidence suggests that self-compassion could buffer the effects of perceived stress on the development and maintenance of internalizing symptomatology (Lathren et al., 2019). For example, in a cross-sectional investigation of 1057 adolescents (grades 7 to 12), Lathren and colleagues found that after controlling for school and gender effects, adolescents with high self-compassion demonstrated lower levels of perceived stress as well as depressive- and anxiety symptoms compared to those with low self-compassion (Lathren et al., 2019). Therefore, the findings suggest that self-compassion may serve as a protective factor that may attenuate the relationships between perceived stress and depressive- and anxiety symptoms respectively.

Further, Krieger and colleagues investigated the associations among self-compassion, perceived stress, and positive- and negative affect over a two-week period using ecological momentary assessment (Krieger, Hermann, Zimmermann, & Holtforth, 2015). In their study, 105 nonclinical participants aged 18 to 61 years completed

questionnaires on perceived stress as well as positive- and negative affect twice a day for 14 consecutive days on smart phones. Krieger and colleagues found that self-compassion was associated with less daily perceived stress, lower levels of negative affect, and higher levels of positive affect. Also, individuals with higher levels of self-compassion reported lower levels of negative affect and higher levels of positive affect in the face of higher levels of perceived stress, even after controlling for the effects of global self-esteem (Krieger et al., 2015). The researchers' findings support the notion that self-compassion could be a protective factor against the adverse effects of stress on one's daily affect.

Additionally, Neely and colleagues found that self-compassion is associated with lower levels of perceived stress in undergraduate students (Neely, Schallert, Mohammed, Roberts, & Chen, 2009). Plus, using a sample of undergraduate students, Leary and colleagues investigated the relationship between self-compassion and how individuals respond to daily negative life events (Leary, Tate, Adams, Allen, & Hancock, 2007). They found that participants high in self-compassion were more likely to extend kindness to themselves and engage in self-soothing behaviors and less likely to be hard on themselves following daily negative life events (Leary et al., 2007).

All in all, in line with stress and coping theory (Lazarus & Folkman, 1984), self-compassion may mitigate stress by promoting coping through adaptive behavioral or approach-based responses to stressors (Sirois, Molnar, & Hirsch, 2015). In particular, self-compassion may aid individuals in feeling cared for, connected, and emotionally calm through its three components of self-kindness, common humanity, and mindfulness (Neff, 2003b). The self-soothing qualities of self-compassion may in turn facilitate

effective cognitive appraisals, adaptive affect regulation, and successful coping with one's environment (Neff et al., 2007).

Self-Compassion and Sleep Quality

Therefore, given that trait self-compassion may serve as an adaptive coping strategy and as a buffer against the negative effects of perceived stress on psychological outcomes (such as internalizing symptomatology), researchers have begun investigating the association between self-compassion and sleep quality. This line of investigation is nascent but promising. To begin, Kemper and colleagues examined the relationship between self-compassion and sleep quality in a sample of 213 health professionals (Kemper, Mo, & Khayat, 2015). The researchers found that self-compassion was negatively associated with sleep disturbance ($\beta = -.23$, $p < .0001$). Similarly, in a sample of 68 college students, Butz and Stahlberg (2018) reported that higher levels of self-compassion were positively associated with good sleep quality ($r = .31$, $p < .01$).

Furthermore, Butz and Stahlberg (2018) conducted an experiment that occurred in the evening wherein 143 college students were required to think about their personal problems for three minutes. They were then randomized to three conditions: 1) a twenty-minute brief self-compassion meditation; 2) a self-compassionate writing task; and 3) a no instruction control. During the following morning, participants were then asked to rate their sleep quality for the previous night (i.e., a few hours after they had completed the experiment) using the Sleep Problems Questionnaire (Jenkins et al., 1988). They were also asked to indicate how much they ruminated before going to bed. The researchers reported that compared to the control condition, participants in either self-compassion conditions reported significantly better sleep quality. The results suggest that a brief self-

compassion induction could contribute to improved sleep quality. Additionally, compared to the control condition, mediational analyses revealed that participants in either self-compassion experimental conditions demonstrated lower levels of rumination before bedtime and rumination negatively predicted sleep quality. Stated otherwise, there was a significant indirect effect of self-compassion induction on sleep quality through rumination.

Next, Hu and colleagues (Hu, Wang, Sun, Arteta-Garcia, & Purol, 2018) examined the correlational associations among self-compassion, perceived stress, and sleep quality (as measured using the PSQI; Buysse et al., 1989). They found that higher levels of self-compassion were negatively associated with poor sleep quality (r = -.23, p < .01). That is, lower levels of self-compassion were associated with poorer sleep quality. In their second study, Hu and colleagues (Hu et al., 2018) required participants to complete sleep diaries and a daily stressor measure. Participants rated their stressor of the day before bed (i.e., whether they experienced a stressful event that day and if their answer was yes, they then rated how stressful the event was on a 5-point Likert rating scale [0 = least stressful; 5 = most stressful]). In terms of sleep outcomes, participants were required to report how long it took them to fall asleep the night before as well as to rate their overall sleep quality, mood upon final awakening, and alertness upon final awakening. Using multilevel modelling, Hu and colleagues (Hu et al., 2018) found that for individuals lower on self-compassion, experiencing stressful events during the day was associated with taking a long time to fall asleep at night (i.e., longer sleep latency) and lower sleep quality. For participants with higher levels of self-compassion, experiencing stressful events during the day did not affect their sleep latency or sleep

quality. This suggests that self-compassion could buffer the negative and deleterious effects of stress on sleep latency and sleep quality.

Moreover, Hu and colleagues (2018) found that higher levels of self-compassion were indirectly associated with better mood and alertness upon awakening. Taken together, their findings suggest that self-compassion could improve sleep quality as well as mood and alertness experienced upon awakening. Limitations of this study include the use of self-report sleep measurements (i.e., the PSQI and the use of sleep diaries), which could limit the validity of the measurements. Another limitation would be the relatively small sample size included in the diary study (N = 59) which could limit the statistical power of the analyses used in the study.

Recently, Brown and colleagues (2021) conducted a meta-analysis to estimate the overall strength and direction of the relationship between self-compassion and sleep quality. The researchers identified 17 independent studies from 15 publications that investigated the association between self-compassion and sleep quality in adult samples. All studies included in this meta-analysis used either objective or subjective measures of sleep quality. The researchers reported that results from the meta-analysis showed that self-compassion was significantly and negatively associated with poor sleep quality (r = -.32, 95% CI [-.36, -.28]). That is, individuals with higher self-compassion levels reported fewer sleep problems. The researchers also investigated a subgroup of 6 studies that examined the distinct and differential associations of positive self-compassion [i.e., the positively worded items on the Self-Compassion Scale (Neff, 2003b)] and self-coldness [i.e., the negatively worded items on the Self-Compassion Scale (Neff, 2003b)] with sleep quality. They found that there was a small and significant negative association

between positive self-compassion and sleep quality (r = -.15, 95% CI [-.24, -.05]). Results showed a stronger and significant positive association between self-coldness and sleep quality (r = .36, 95% CI [.18, .52]). This may indicate that compared to positive self-compassion, self-coldness could be a stronger predictor of poor sleep quality; the researchers caution that this should be regarded as a preliminary finding as it is based on heterogenous measures of self-reported sleep quality (Brown et al., 2021).

Taken together, evidence suggests that self-compassion could be helpful in downregulating rumination (Butz & Stalhberg, 2018) and strong emotions (e.g., low mood or perceived stress; Hu et al., 2018) to facilitate sleep. Indeed, relating to oneself in a compassionate style has been shown to downregulate neural markers of pain and threat as well as to increase heartrate variability (i.e., a marker of self-regulation; Kim et al., 2020a; Kim et al., 2020b). Thus, individuals who are higher in trait self-compassion may have greater psychological resources to buffer the adverse effects of factors such as perceived stress or rumination on their sleep quality. However, more research on the relationship between self-compassion and sleep quality is clearly needed, including longitudinal investigations that could examine the mechanisms and pathways of how self-compassion results in improved sleep quality.

Mindfulness and Self-Compassion are Related but Distinct Constructs

Both mindfulness and self-compassion are drawn from Buddhist and other Eastern and contemplative traditions, and mindfulness is a core element of self-compassion (Neff, 2003a; 2003b). Hence, both constructs share areas of overlap in that mindfulness includes an element of acceptance and can be applied to turn towards painful experiences rather than avoiding them. Self-compassion also includes elements of

maintaining balanced awareness when confronting challenges (Bluth & Blanton, 2014). However, mindfulness and self-compassion also show some distinctions.

First, mindfulness in general refers to the ability to pay nonjudgmental attention towards one's present-moment experiences, whether they are positive, negative, or neutral. However, mindfulness as conceptualized within the self-compassion framework is narrower in scope and refers to balanced awareness of one's negative thoughts and feelings (Neff & Dahm, 2015). In addition, mindfulness practices applied to clinical concerns such as sleep disturbances involve bringing attention and awareness to moments of suffering to practice decentering. In contrast, self-compassion involves not just awareness of one's suffering but also actively soothing this pain or comforting oneself when painful experiences arise and recognizing that it is part of the human experience (Bluth & Blanton, 2014). In other words, it is possible to be aware of painful thoughts and feelings without actively soothing oneself or remembering that one is not alone in feeling pain. It does require extra, intentional effort to extend compassion toward oneself. Plus, mindfulness may be viewed as a cognitive skill involving attentional abilities such as the capacity for sustained attention, set switching, and cognitive inhibition (Shapiro, Carlson, Astin, & Freedman, 2006). On the other hand, self-compassion may be viewed as the qualities and attitude one brings to the act of paying attention and how one chooses to respond to whatever is arising during the present moment (especially with regards to difficult experiences). Stated otherwise, mindfulness is often associated with a sense of bare, objective, and nonjudgmental awareness. However, the qualities one brings to the act of paying attention can also be crucial (Shapiro et al., 2006). It is possible to attend to one's internal and external experiences without evaluation or interpretation while also

practicing a sense of kindness and warmth. Indeed, in Buddhist traditions, mindfulness and self-compassion are considered to be two wings of the same bird. That is, both are complementary and are theorized to be able to mutually enhance one another.

Evidence for the Complementary Relationship Between Mindfulness and Self-Compassion

Several studies have demonstrated that dispositional mindfulness and trait self-compassion levels interact to promote well-being. First, using a cross-sectional design, Hollis-Walker and Colosimo (2011) studied a sample of 123 participants (73 undergraduate students and 50 demographically-similar community members). Of note, 50% of participants endorsed previous meditation experience and all participants denied current engagement in a regular meditation practice. Most participants were aged 18 to 24 years old, with a mean age of 20.9 years. The researchers were interested in examining whether self-compassion would mediate the association between dispositional mindfulness and psychological well-being. They were also interested in testing whether self-compassion would increase the amount of variance accounted for in psychological well-being compared to dispositional mindfulness alone. Self-compassion was measured using the Self-Compassion Scale (Neff, 2003b); dispositional mindfulness was measured using the Five Facet Mindfulness Questionnaire (Baer et al., 2006); and psychological well-being was measured using the Psychological Well-Being scale (Ryff, 1989). Hollis-Walker and Colosimo (2011) found that self-compassion partially mediated the association between dispositional mindfulness and psychological well-being. Their results also showed that adding self-compassion to dispositional mindfulness in a regression model accounted for greater variance in psychological well-being than

dispositional mindfulness alone, suggesting that self-compassion augmented the association between dispositional mindfulness and psychological well-being. Taken together, their main findings suggest that self-compassion could interact with dispositional mindfulness to promote psychological well-being. Nonetheless, the researchers' use of mediational analyses in a cross-sectional design limits our ability to make inferences about causal relationships.

Subsequently, Baer and colleagues (Baer, Lykins, & Peters, 2012) investigated cross-sectional relationships among self-reported dispositional mindfulness, trait self-compassion, meditation experience, and psychological well-being in 77 experienced meditators and 75 demographically-matched nonmeditators. They found that a significant relationship between meditation experience and psychological well-being was completely accounted for by a combination of dispositional mindfulness and trait self-compassion scores. This finding suggests that both dispositional mindfulness and trait self-compassion could contribute significantly to the improved psychological well-being associated with meditation experience. However, Baer and colleagues' findings are also limited by the cross-sectional nature of their study.

In another relevant study, Keng and colleagues used data from a randomized controlled trial examining the effects of mindfulness-based stress reduction (vs. waitlist control) on improving maladaptive cognitive and behavioral tendencies (i.e., worry, fear of emotion, aggressive anger expression, and suppression of anger) in a nonclinical sample (Keng, Smoski, Robins, Ekblad, & Brantley, 2012). They found that trait self-compassion as measured by the Self-Compassion Scale (Neff, 2003b) and dispositional mindfulness as measured using the Five Facet Mindfulness Questionnaire (FFMQ; Baer

et al., 2006) were significantly and positively correlated at pretreatment ($r = .55$, $p < .001$) and at posttreatment ($r = .60$, $p < .001$). Changes in both trait self-compassion and dispositional mindfulness from pretreatment to posttreatment are also significantly and positively correlated ($r = .53$, $p < .001$). This suggests that mindfulness-based stress reduction, which does not explicitly teach self-compassion, can result in improvements in both trait self-compassion and dispositional mindfulness. This, in turn, lends support for the assertion that mindfulness and self-compassion are interrelated constructs. In addition, considering that the data were obtained from a treatment study (i.e., longitudinal and experimental design), this addresses the limitations of findings reported by Hollis-Walker and Colosimo (2011) and Baer and colleagues (Baer et al., 2012).

The Present Study

Despite theoretical and empirical evidence supporting the complementary relationship between self-compassion and mindfulness (Baer et al., 2012; Hollis-Walker & Colosimo, 2011; Keng et al., 2012), no studies to date have examined the combined benefits of trait self-compassion and dispositional mindfulness as protective factors buffering the effects of perceived stress on sleep quality. Hence, this study aimed to bridge the gap in the extant literature. Grounded within the stress and coping theoretical framework (Lazarus & Folkman, 1984) and consistent with the stress buffering account of mindfulness (Creswell & Lindsay, 2014) as well as evidence suggesting that trait self-compassion serves as an adaptive coping strategy (e.g., Leary et al., 2007; Neff et al., 2007), the purpose of this study was to investigate whether there would be an interaction effect between trait self-compassion and dispositional mindfulness as moderators on the relationship between perceived stress and poor sleep quality in a nonclinical sample of

college-aged young adults. In other words, would individuals who are high in both dispositional mindfulness and trait self-compassion be less likely to experience poor sleep quality even in the face of high levels of perceived stress? From a prevention science perspective, it is important to identify protective factors against poor sleep quality especially in a nonclinical sample. This could, in turn, inform early prevention and intervention efforts to prevent the onset of more severe and clinical levels of sleep disturbances (e.g., sleep disorders).

Research Questions and Hypotheses

To answer three primary research questions, this study evaluated four hypotheses:

Research Question 1. Is there a relationship between dispositional mindfulness and sleep quality in a sample of college-aged young adults?

Hypothesis 1. It was predicted that there would be a significant negative association between dispositional mindfulness and poor sleep quality, with higher levels of dispositional mindfulness being positively associated with better sleep quality.

Research Question 2. Is there a relationship between trait self-compassion and sleep quality in a sample of college-aged young adults?

Hypothesis 2. It was predicted that there would be a significant negative association between trait self-compassion and poor sleep quality, with higher levels of trait self-compassion being positively associated with better sleep quality.

Research Question 3. Will trait self-compassion moderate the moderating effect of dispositional mindfulness on the relationship between perceived stress and poor sleep quality?

Hypothesis 3a. It was predicted that the association between perceived stress and poor sleep quality would be weakest in individuals who are high in both dispositional mindfulness *and* trait self-compassion.

Hypothesis 3b. It was predicted that this association between perceived stress and poor sleep quality would be stronger in individuals who are low in both dispositional mindfulness and trait self-compassion; in individuals who are low in dispositional mindfulness and high in trait self-compassion; and in individuals who are high in dispositional mindfulness and low in trait self-compassion.

CHAPTER II: METHOD

Participants

Participants were recruited from the University of Louisville's online research participation system (SONA). Eligible participants were individuals between the ages of 18 to 25 years old who were currently enrolled in college (either part- or full-time) and were able to read and respond to online questionnaires in English. Ineligible participants were those who had undergone treatment for a sleep disorder within the past six months; were currently taking sedative-hypnotic medications or mood-altering medications for depression or anxiety; had a current diagnosis of a significant condition that may interfere with normal sleep, including bipolar disorder, schizophrenia, acute stress disorder, posttraumatic stress disorder, alcohol abuse/dependence disorder, and substance abuse/dependence disorder; and/or were currently employed in night shift work (i.e., working between the hours of 11pm-5am).

One hundred and forty-eight participants met inclusion criteria and had signed up for this study through SONA. Nine participants had later formally withdrawn after signing up for the study; these participants did not begin or complete their online surveys. Twenty six participants had signed up for this study but did not complete the online surveys. A total of 113 participants consented and completed the online survey. Of note, ten participants completed the online study twice, resulting in a total number of 123 data responses. Their duplicate survey responses were identified and then removed, resulting in a total number of 113 unique data responses. For those with duplicate survey

responses, their initial survey responses were retained as it was felt that these initial responses would have been more authentic and representative.

Embedded in the battery of surveys were five attention check questions (please see study procedure for more information on this); participants who failed three or more attention check questions were dropped from the final analyses as the validity of their responses may have been compromised. Three participants failed three of the five attention check questions; their data were consequently excluded from the sample. One multivariate outlier was detected and this participant was dropped from the main analyses (please see results section for more information on data screening). Further, during the data preparation process, a total PSQI score could not be calculated for one participant due to their invalid response on one of the scale's items (please see results section for more information on this). Given that the PSQI is one of the study's main variables of interest, this participant was dropped from the study's final analytic sample. Thus, the present study's final analytic sample consisted of 108 participants (see Figure 1 for a flowchart of participant enrollment).

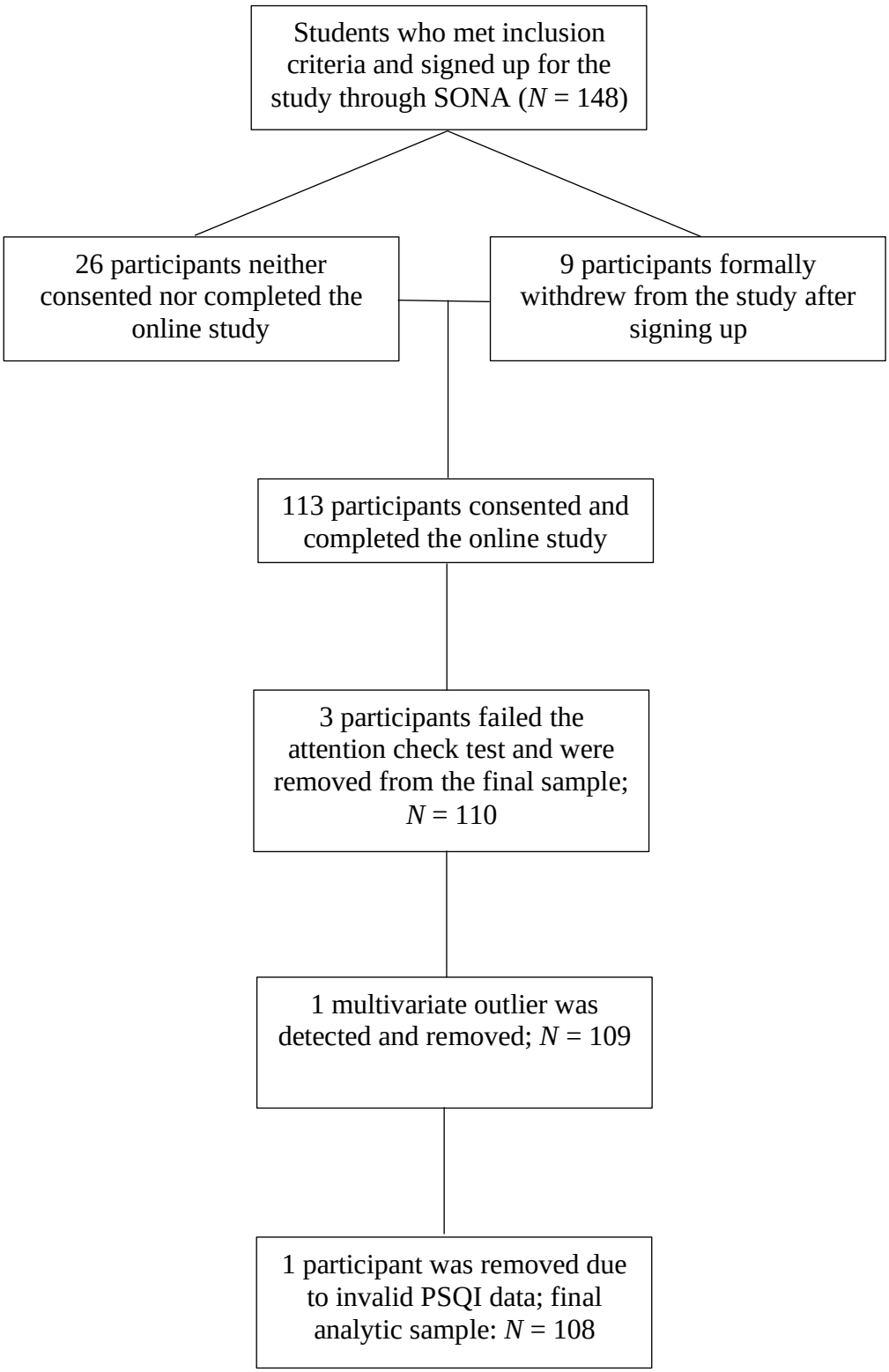

Figure 1. A flowchart of participant enrollment.

Sample Demographics

In this study's sample, participants' mean age was 19.92 (*SD* = 1.61) and 73.1% (*n* = 79) of participants identified as female. The majority of the sample identified as White (75.9%; *n* = 82). 6.5% (*n* = 7) identified as Asian; 2.8% (*n* = 3) identified as Biracial/Multiethnic; 14.8% (*n* = 16) identified as Black/African American; 10.2% (*n* = 11) identified as Hispanic or Latino/a; 0.9% (*n* = 1) identified as Multiracial/Ethnic; and 0.9% (*n* = 1) identified as International (i.e., not native to the United States and U.S. culture). Table 1 summarizes the study's sample demographic characteristics. Please also see Table 2 for academic characteristics of the study sample.

Design

The present study employed a cross-sectional, survey-based design. The predictor variable was perceived stress as measured by the Perceived Stress Scale (Cohen et al., 1983). The primary outcome variable was sleep quality as measured by the Pittsburgh Sleep Quality Index (Buysse et al., 1989). The moderators of interest were dispositional mindfulness as measured by the Five Facet Mindfulness Questionnaire (Baer et al., 2006) and trait self-compassion as measured by the Self-Compassion Scale (SCS; Neff, 2003b).

Procedure

All study activities were approved by the University of Louisville's Institutional Research Board (RB #21.0224). All participants were recruited from the online research participation system (i.e., SONA) operated by the University of Louisville's Department of Psychological and Brain Sciences. The study was described as an investigation of the relationship between personality variables and sleep. Additionally, participants received 0.5 course credits for their participation in this study. Informed consent was obtained

from all participants. That is, participants were informed about the purpose and nature of the study as well as its risks and benefits before completing it. They were informed that they had the right to stop the study at any time without any penalty. It was anticipated that participants would take around 30 to 40 minutes to complete the questionnaires included in the present study.

Participants completed an online survey through REDCap (Research Electronic Data Capture). REDCap is a secure and HIPAA-compliant web-based application designed for survey-based data collection. To minimize risk that REDCap security could be breached, no personally identifiable information was collected to protect the privacy and confidentiality of the research participants. The online survey consisted of an informed consent preamble, demographic questions, and self-report measures on perceived stress, sleep quality, dispositional mindfulness, trait self-compassion, depression and anxiety symptoms, physical activity levels, mindfulness meditation practice frequency, caffeine use, and perceived stress related to the COVID-19 pandemic, and a debriefing statement regarding the study's objectives.

The analyses reported here only include the following variables: perceived stress; sleep quality; dispositional mindfulness; trait self-compassion; and perceived stress related to the COVID-19 pandemic. Data on depression and anxiety symptoms, physical activity levels, mindfulness meditation practice frequency, and caffeine use were collected as potential covariates, but this study ultimately did not include covariates in its main analyses due to power considerations. Thus, these measures were not reported in the below Measures section. Data were collected from November to December 2021 (i.e., towards the end of the university's Fall 2021 semester).

Additionally, to improve the quality of participants' responses and to detect individuals who might have been quickly responding to questions without paying sufficient attention to the item content, five attention check questions were randomly embedded into the online survey (see Appendix A for all five questions). A sample attention check question is as follows: "This item is here to be sure you are paying attention as you respond. If you have read this, please choose the "*Very Often*" response option." The required response option was randomly selected from the response options of the questionnaire in which each attention check question was embedded. Participants who failed three or more attention check questions were dropped from the final analyses as the validity of their survey responses might have been compromised.

Measures

Demographic Information

Information related to participant age, gender, racial/ethnic identity, relationship status, current academic class standing (i.e., freshman, sophomore, junior, or senior), enrollment status (i.e., part- or full-time), current grade point average, college major status (i.e., declared or undeclared), current college major, years of education attained, current employment status, shift work status, current living arrangement, roommate status, and current height and weight (for the calculation of BMI) were collected. Please refer to Appendix B for the study's demographic questionnaire. Of note, years of education attained (item #9) was dropped entirely as a variable given that many participants appeared to have either misunderstood or were confused by the wording of this question. Some participants reported number of years of higher education while other participants shared their total number of years of education (i.e., from elementary school

to college). Therefore, this variable was considered to be poorly measured and therefore may not be reliable nor valid.

Perceived Stress Scale

The Perceived Stress Scale (PSS; Cohen et al., 1983) was used in this study to measure perceived stress (see Appendix C for the PSS). It consists of 14 items and is a widely used self-report measure of perceived stress experienced within the past month. Specifically, it assesses the degree to which individuals find their lives "unpredictable, uncontrollable, and overloading" (Cohen et al., 1983, p. 387). Sample items include "In the last month, how often have you been upset because of something that happened unexpectedly?" and "In the last month, how often have you felt nervous or stressed?" Items are rated on a 5-point Likert-type scale ranging from 0 ("*never*") to 4 ("*very often*"). Global PSS scores thus range from 0 to 56. Higher scores indicate greater levels of perceived stress. The PSS has demonstrated good internal consistency, test-retest reliability, convergent validity, and divergent validity in undergraduate student samples (Cohen et al., 1983). In this study, the PSS showed good internal consistency ($\alpha = .83$).

Pittsburgh Sleep Quality Index

Developed by Buysse and colleagues (1989), the Pittsburgy Sleep Quality Index (PSQI; Buysse et al., 1989) is a questionnaire that assesses subjective sleep quality and sleep disturbances experienced in the past month (see Appendix D for the PSQI). The PSQI contains 19 self-rated items and 5 questions rated by a bedpartner or roommate (if either is available). Sample items of the PSQI include "During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?" and "During the past month, how often have you had trouble staying awake while driving,

eating meals, or engaging in social activity?" Only self-rated questions are included in the scoring of the PSQI; the 19 self-rated items are combined to form seven component scores, each of which has a range of 0-3 points. The seven component scores are then added to yield a total PSQI score that ranges from 0 to 21, with higher scores reflecting poorer sleep in the past month. Furthermore, total PSQI scores > 5 are used to classify individuals as *poor* sleepers and scores ≤ 5 are used to classify individuals as *good* sleepers. In their initial validation study of the PSQI, Buysse and colleagues (1989) found that a PSQI cut-off score of > 5 demonstrated a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing between healthy controls and poor sleepers (i.e., individuals with depression or patients who had been officially diagnosed with a sleep disorder). Of note, the PSQI is designed to distinguish between poor- and good quality sleepers. It is *not* designed to provide clinical diagnoses of sleep disorders (Buysse et al., 1989). The PSQI has demonstrated good internal consistency, test re-test reliability, and acceptable concurrent validity with daily diaries of sleep activity in nonclinical and clinical samples (Mollayeva et al., 2016). It is frequently used in college student samples (Becker et al., 2018; Liu et al., 2021). In this study, the PSQI demonstrated acceptable internal consistency (α = .71).

Five Facet Mindfulness Questionnaire

To assess dispositional mindfulness, the Five-Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) was used in the present study (see Appendix E for the FFMQ). The FFMQ is a 39-item, self-report questionnaire that was derived from an exploratory factor analysis of 112 items from five other dispositional mindfulness measures (i.e., the Mindful Attention Awareness Scale [MAAS; Brown & Ryan, 2003]; the Freiburg

Mindfulness Inventory [FMI; Buchheld et al., 2001]; the Kentucky Inventory of Mindfulness Skills [KIMS; Baer, Smith, & Allen, 2004]; the Cognitive and Affective Mindfulness Scale [CAMS; Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007]; and the Southampton Mindfulness Questionnaire [SMQ; Chadwick et al., 2008]). Results from the exploratory factor analysis suggested that the best-fitting model was a five-factor model. Four of the five factors were found to be similar to the factors on the KIMS (Baer et al., 2004): *Observing*; *Acting with Awareness*; *Nonjudging*; and *Describing*. The fifth factor comprised items from the FMI (Buchheld et al., 2001) and the SMQ (Chadwick et al., 2008) and was identified as a nonreactive stance toward one's internal experiences (i.e., *Nonreactivity*). The highest loading items for each factor were chosen with eight items for four factors (*Observing*; *Acting with Awareness*; *Nonjudging*; and *Describing*) and seven items for the *Nonreactivity* factor (Baer et al., 2006). Sample items of the FFMQ (Baer et al., 2006) include "I pay attention to sensations, such as the wind in my hair or sun on my face", "When I have distressing thoughts or images, I just notice them and let them go," and "I can easily put my beliefs, opinions, and expectations into words." Items are rated on a 5-point rating scale ranging from 1 ("*never or rarely true*") to 5 ("*very often or always true*"). Total scores are obtained by summing item responses after reverse-scoring items that indicate lower (versus higher) levels of dispositional mindfulness. Global FFMQ scores range from 0 to 195, with higher scores indicating greater levels of dispositional mindfulness. The FFMQ (Baer et al., 2006) has demonstrated good internal consistency as well as convergent- and divergent validity in samples of college-aged young adults (Baer et al., 2006; Bogusch et al., 2016). In this study, the FFMQ showed good internal consistency ($\alpha = .86$).

Self-Compassion Scale

To assess self-compassion, the Self-Compassion Scale (SCS; Neff, 2003b; see Appendix F for the SCS) was included in this study. It is a 26-item self-report measure that assesses the main elements of self-compassion as defined by Neff (2003b): self-kindness (versus self-judgment); common humanity (versus isolation); and mindfulness (versus over-identification). All items are prefaced with the statement "how I typically act towards myself during difficult times" and respondents have to indicate how often they behave in the described manner using response options ranging from 1 ("*almost never*") to 5 ("*almost always*"). Sample items include "I try to be loving toward myself when I am feeling emotional pain" and "I'm disapproving and judgmental about my own flaws and inadequacies." To score the SCS (Neff, 2003b), negatively worded items are reverse-scored. Then, the total scores of each subscale (i.e., self-kindness; self-judgment; common humanity; isolation; mindfulness; and over-identification) are averaged to derive a mean subscale score. The total self-compassion score is obtained by averaging the total sum of all six mean subscale scores. Global SCS scores range from 1 to 5, with higher scores indicating higher levels of self-compassion. Evidence indicates that the subscales are best explained by a single higher-order factor of self-compassion as the subscales are highly intercorrelated (Neff, 2003b). The SCS has demonstrated good internal consistency, test-retest reliability, convergent validity, and discriminant validity in undergraduate student samples (Neff, 2003b; Neff & Pommier, 2013). The SCS showed excellent internal consistency in this study ($\alpha = .92$).

Secondary Variable

COVID-19 Pandemic Perceived Stress Scale. Several measures have been developed to measure the psychological impact of the COVID-19 pandemic, including the COVID Stress Scales (Taylor et al., 2020) and the Pandemic Stress Index (Harkness et al., 2020). Although the COVID Stress Scales and the Pandemic Stress Index have demonstrated promising reliability and validity in their initial validation studies (Taylor et al., 2020; Harkness et al., 2020), they are nonetheless lengthy. Additionally, they were not developed to examine pandemic-related stress that may be more specific to college students' needs (e.g., concerns about the pandemic's adverse effects on their higher education experiences). Thus, for the purpose of this study, six items were written to measure perceived stress associated with the COVID-19 pandemic (see Appendix G for this measure). The wording of these items was adapted from the Perceived Stress Scale (Cohen et al., 1983) and modified to measure perceived stress related to the COVID-19 pandemic. The primary goals were to keep this measure brief and also tailored to college students. Sample items include "In the last month, I have felt nervous and stressed about the COVID-19 pandemic" and "In the last month, I have felt upset that the COVID-19 pandemic has disrupted my college experience (e.g., classes; socializing opportunities)." Using the same rating scale included in the Perceived Stress Scale (Cohen et al., 1983), items are rated on a 5-point Likert-type scale ranging from 0 ("*never*") to 4 ("*very often*"). Scores on this measure range from 0 to 24. In the present study, this measure demonstrated good internal consistency (α = .88).

Statistical Analytic Plan

Sample Size Determination

To estimate the necessary sample size for this study, G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was used to run an a priori power analysis for the study's main research question: is there an interaction effect between global dispositional mindfulness and global trait self-compassion as moderators on the relationship between perceived stress and poor sleep quality? Using the design of a linear multiple regression (fixed model, R^2 deviation from zero) with seven variables (i.e., perceived stress; global dispositional mindfulness; global self-compassion; the two-way interaction between perceived stress and global dispositional mindfulness; the two-way interaction between perceived stress and global self-compassion; the two-way interaction between global dispositional mindfulness and global self-compassion; and the three-way interaction among perceived stress, global dispositional mindfulness, and global self-compassion), a small effect size of .15, α set to .05, and power set to .80, results from the G*Power analysis (Faul et al., 2007) revealed a minimum sample size of 100 in order to detect small effects. A small effect size of .15 was selected given that to the best of my knowledge, this is the first study to investigate the three-way interaction between dispositional mindfulness, trait self-compassion, and perceived stress and their associations with sleep quality. Therefore, I could not refer to effect sizes reported in previous studies to inform the a priori power analysis. Overall, the study's final sample of 108 participants met the minimum size requirement of 100 as determined by the a priori power analysis.

Pearson Correlation Coefficient Analyses to Test Hypotheses 1 and 2

To determine the direction and degree of linear relationship between total scale scores, Pearson correlation coefficient analyses were run to test the study's first two hypotheses:

a) **Hypothesis 1**: There would be a significant negative association between dispositional mindfulness and poor sleep quality, with higher levels of dispositional mindfulness being positively associated with better sleep quality.

b) **Hypothesis 2**: There would be a significant negative association between trait self-compassion and poor sleep quality, with higher levels of trait self-compassion being positively associated with better sleep quality.

Moderated Moderation Analysis to Test Hypotheses 3a and 3b

To test the study's Hypotheses **3a** and **3b**, moderated moderation analysis was run. Hypothesis **3a** is as follows: the association between perceived stress and poor sleep quality would be weakest in individuals who are high in both dispositional mindfulness and trait self-compassion. Hypothesis **3b** is as follows: this association between perceived stress and poor sleep quality would be stronger in individuals who are low in both dispositional mindfulness and trait self-compassion; in individuals who are low in dispositional mindfulness and high in trait self-compassion; and in individuals who are high in dispositional mindfulness and low in trait self-compassion.

Through moderation analysis, we test whether the relationship between the predictor variable (X) and the outcome variable (Y) depend on the moderator (W). For example, the relationship between X and Y can increase as W increases, or the relationship between X and Y can decrease as W increases. Therefore, in moderation

analysis, researchers are typically interested in the *conditional effects* of X on Y at different values of W (Montoya, 2019).

Given that this study consisted of two moderator variables (i.e., dispositional mindfulness and trait self-compassion), a moderated moderation analysis was conducted using the Hayes PROCESS for SPSS macro (model 3, release 130612; Hayes, 2017). The PROCESS macro is based on ordinary least squares regression and uses a nonparametric bootstrapping procedure (i.e., 5000 bootstrapped samples). To ease the interpretation and probing of significant interactions, each of the continuous component variables (i.e., perceived stress; sleep quality; trait self-compassion; and dispositional mindfulness) was centered around its sample mean before the interaction terms were computed. The model depicting the moderated moderation analysis is illustrated below (see Figure 2). Moderated moderation analysis allows testing for a three-way interaction. That is, would there be a three-way interaction among perceived stress (X), trait self-compassion (Z), and dispositional mindfulness (W) on sleep quality (Y)?

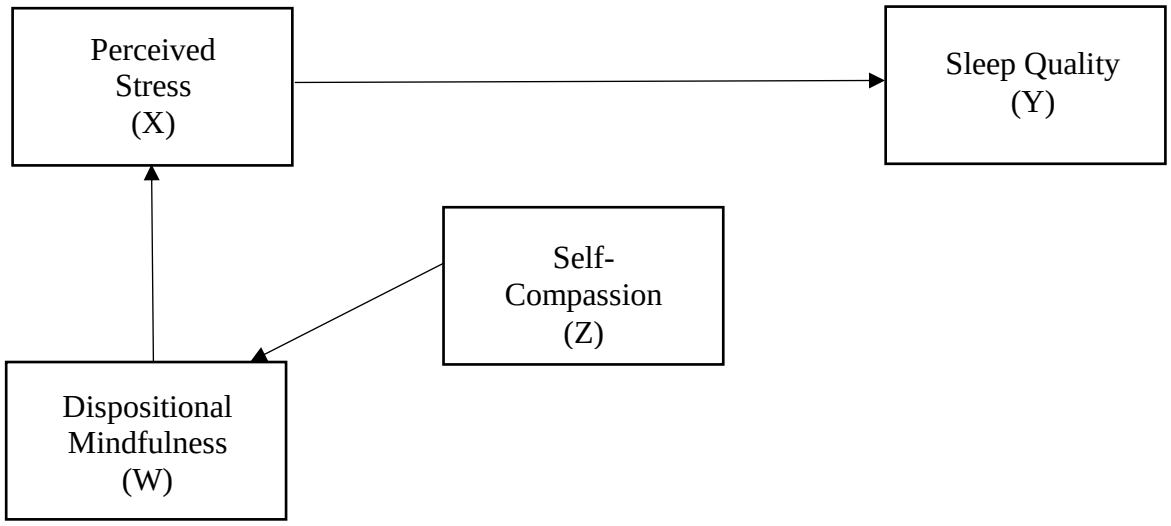

Figure 2. Model depicting perceived stress as the predictor variable (X), sleep quality as the outcome variable (Y), and dispositional mindfulness (W) and trait self-compassion (Z) as moderators.

CHAPTER III: RESULTS

Data Preparation and Preliminary Analyses

Statistical analyses were performed using SPSS 28 (IBM Corp, 2021). To begin, data were examined to confirm one of the study's inclusion criteria (aged 18-25 years old); all participants met this inclusion criterion. Data were also examined to check for duplicate responses. All duplicate responses were identified and then removed.

Next, items in several of the scales were reverse-coded so that all items of each scale reflected the appropriate direction of the variable. Particularly, items 3, 5, 8, 10, 12, 13, 14, 16, 17, 18, 22, 23, 25, 28, 30, 34, 35, 38, and 39 of the FFMQ (Baer et al., 2006) were reverse-coded so that higher scores indicate higher levels of dispositional mindfulness. Items 1, 2, 4, 6, 8, 11, 13, 16, 18, 20, 21, 24, and 25 of the SCS (Neff, 2003b) were reverse-coded so that higher scores indicate higher levels of self-compassion. Items 4, 5, 6, 7, 9, 10, 13 on the PSS (Cohen et al., 1983) were reverse-coded so that higher scores indicate greater levels of perceived stress. Then, using instructions provided by the scales' developers, total scores were calculated for the following measures: PSS (Cohen et al., 1983); PSQI (Buysse et al., 1989); FFMQ (Baer et al., 2006); SCS (Neff, 2003b); and the COVID-19 Pandemic Perceived Stress Scale.

Additionally, a series of preliminary analyses were conducted. First, missing values analysis was run on all scales to ensure that all cases had at least 75% completed data for each set of items on which a total scale score would be computed. The results of the missing values analysis revealed that all cases had at least 75% completed data for each set of items on which a total scale score would be computed. In fact, no single item on any of the main variables (i.e.,

PSS; PSQI; SCS; and FFMQ) had missing data. Next, box plots revealed that the PSS had three univariate outliers, the SCS had two univariate outliers, and the FFMQ had one univariate outlier. However, closer inspection showed that these outliers were all within ± 3 standard deviations from the mean. Thus, these values were not modified nor removed from the final analyses. Additionally, descriptive statistics were calculated to identify out-of-bound values and invalid responses. One participant was identified as providing an invalid response to Item 4 of the PSQI (Buysse et al., 1989). Item 4 queries about the number of hours of sleep an individual estimates they obtain per night, and this participant reported they slept 50 hours per night (it is likely they might have meant to indicate 5 hours). As a total PSQI score could not be calculated for this participant, their data were excluded from the final analyses. Next, Cronbach's alphas were calculated to determine the internal consistency of the scales included in the present study. The Cronbach's alphas of the main scales are reported in the above Method section.

Table 3 displays the correlations among the total scale scores of the main variables of interest (i.e., PSS, PSQI, SCS, and FFMQ) and their means and standard deviations, indicating that relationships were in the predicted directions. Additionally, the total SCS and FFMQ scores were positively and significantly correlated ($r = .65$, $p < .01$), indicating that these scales measured separate constructs. In an attempt to thoroughly examine the measures included in the present study, Table 4 contains the correlations among the components of the PSQI (i.e., sleep duration; sleep disturbances; sleep latency; daytime dysfunction due to sleepiness; sleep efficiency; subjective sleep quality; and use of sleep medications in the past month); subscales of the SCS (i.e., self-kindness; common humanity; mindfulness; self-judgment; isolation; and over-identification); subscales of the FFMQ (i.e., observing; describing; acting with awareness; nonjudging of inner experience; and nonreactivity to inner experience); and the PSS.

Sample Characteristics

Participants' scores on the Perceived Stress Scale (PSS; Cohen et al., 1983) ranged from 8 to 44, with a mean of 30.08 (*SD* = 6.86). Higher scores on the PSS indicate greater levels of perceived stress, with a maximum score of 56. Next, as mentioned previously, the PSQI was designed by Buysse and colleagues (1989) to classify individuals as good versus poor sleepers using a total scale score. Total scale scores > 5 can be used to classify individuals as *poor* sleepers (i.e., those who might be experiencing clinically significant sleep problems) and total scale scores ≤ 5 are used to classify individuals as *good* sleepers. In this study, 72.2% of the study's sample (*n* = 78) were classified as poor sleepers and 27.8% of the study's sample (*n* = 30) were classified as good sleepers. In other words, 72.2% of the study's sample had experienced poor sleep in the last month.

On average, the present study's participants endorsed moderate levels of self-compassion (*M* = 2.69, *SD* = .63), with SCS scores ranging from 1.13 to 4.79. Neff (2003b) suggested that as an ad-hoc rubric, SCS scores ranging from 1.0 to 2.49 indicate low levels of self-compassion. Scores ranging from 2.5 to 3.5 suggest moderate levels of self-compassion. Scores ranging from 3.51 to 5.0 indicate high levels of self-compassion. Higher scores on the SCS indicate higher levels of trait self-compassion; the SCS has a maximum score of 5.

Participants reported an average global score of 115.77 (*SD* = 15.85) on the FFMQ (Baer et al., 2006). In this study, participants' global FFMQ scores ranged from 83 to 163, with higher scores indicating higher levels of dispositional mindfulness. The FFMQ has a maximum score of 195.

Rates of Sleep Problems

As summarized in Table 5, 72.2% of participants were classified as poor sleepers in the past month as they had scored > 5 on their total PSQI scores. 50.9% of participants reported obtaining an average of 7 or more hours of sleep in the past month and 49.1% of participants reported obtaining an average of fewer than 7 hours of sleep in the last month. Approximately 31.4% of participants indicated that on average, it took them more than 30 minutes to fall asleep per night in the last month. 31.5% of participants rated their subjective sleep quality in the past month as *fairly* bad and 2.8% of participants rated their subjective sleep quality in the past month as *very* bad. Slightly over half of the participants (54.6%) reported good sleep efficiency of ≥ 85% in the past month and 65.7% of participants indicated that they did not use any sleep medications in the past month. Most participants endorsed low levels of sleep disturbances (67.6% with component scores of 0 or 1) and low levels of daytime dysfunction (53.7% with component scores of 0 or 1). As shown in Table 6, participants obtained an average of 6.74 hours of sleep in the past month. Average sleep latency (i.e., time in minutes to fall asleep) was 33.06 (*SD* = 26.26). Table 6 also contains the descriptive statistics of the relevant PSQI variables.

Descriptive Statistics of Sample's COVID-19-Related Perceived Stress Scale Scores

As shown in Table 7, participants reported a mean score of 8.31 (*SD* = 5.55) on the COVID-19-Related Perceived Stress Scale that was developed for this study. Higher scores reflect greater levels of perceived stress due to the COVID-19 pandemic. This scale has a maximum score of 24. Table 7 also contains item-level descriptive statistics.

Primary Analyses

Hypotheses 1 and 2

Hypothesis 1 is as follows: there would be a significant negative association between dispositional mindfulness and poor sleep quality, with higher levels of dispositional mindfulness being associated with better sleep quality. Therefore, to test Hypothesis 1, a bivariate Pearson's product-moment correlation coefficient was calculated. The results revealed that there was a significant negative association between dispositional mindfulness and sleep quality, $r(106) = -.48$, $p < .01$. Higher scores on the FFMQ (Baer et al., 2006) indicate higher levels of dispositional mindfulness. Higher scores on the PSQI (Buysse et al., 1989) suggest poorer sleep quality. Therefore, a negative association indicates that higher levels of dispositional mindfulness were associated with better sleep quality. Thus, Hypothesis 1 was supported.

Hypothesis 2 is as follows: there would be a significant negative association between trait self-compassion and poor sleep quality, with higher levels of trait self-compassion being associated with better sleep quality. Therefore, to test Hypothesis 2, a bivariate Pearson's product-moment correlation coefficient was calculated. The results showed a significant negative association between trait self-compassion and sleep quality, $r(106) = -.38$, $p < .01$. Higher scores on the SCS (Neff, 2003b) indicate higher levels of trait self-compassion. Higher scores on the PSQI (Buysse et al., 1989) suggest poorer sleep quality. Therefore, a negative association indicates that higher levels of trait self-compassion were associated with better sleep quality. Thus, Hypothesis 2 was likewise supported.

Hypotheses 3a and 3b

Hypothesis 3a predicted that the association between perceived stress and poor sleep quality would be weakest in individuals who were higher in both dispositional mindfulness and trait self-compassion. As for Hypothesis 3b, it was also predicted that this association between perceived stress and poor sleep quality would be stronger in individuals who are low in both dispositional mindfulness and trait self-compassion; in individuals who are low in dispositional mindfulness and high in trait self-compassion; and in individuals who are high in dispositional mindfulness and low in trait self-compassion. A moderated moderation analysis was proposed to test Hypotheses 3a and 3b.

Assumptions Testing

Moderation analysis is a form of multiple regression. Therefore, prior to running the moderated moderation analysis, several assumptions of multiple regression were evaluated. Multiple regression analyses consist of the following assumptions: 1) normality of each continuous variable that is included in the regression model; 2) absence of univariate and multivariate outliers; 3) absence of multicollinearity among the predictors; and 4) normality, linearity, and homoscedasticity of residuals. To determine whether total scale scores of the main variables of interest (i.e., the PSS, PSQI, SCS, and FFMQ) were normally distributed, frequency distributions and histograms were examined. In addition, using the cut-offs of -2 and +2 for the ratio of skewness/SE and -3 and +3 for the ratio of kurtosis/SE, the total scale scores were examined for skewness and kurtosis (see Table 8 for the skewness and kurtosis scores). Assumptions of normality appeared to have been approximately met for all of these four main variables of interest as there was no evidence of significant skewness or kurtosis, though both the PSS and SCS appeared to be slightly skewed (PSS: skewness/SE = -2.04; SCS: skewness/SE =

2.04). Closer visual examination of the histograms and q-q plots of the PSS and SCS showed that they appeared to be approximately normally distributed. Hence, these variables were not transformed.

Next, box plots revealed that PSS scores had three univariate outliers, SCS scores had two univariate outliers, and FFMQ scores had one univariate outlier. However, closer inspection showed that these outliers were all within ± 3 standard deviations from the mean. Thus, these values were not modified nor removed from the final analyses. Scores on the PSQI did not have any univariate outliers. Plus, to test for multivariate outliers, linear regression analysis was run where total PSQI score was entered as the outcome variable and total PSS, FFMQ, and SCS scores were entered as the predictor variables. Through this analysis, Mahalanobis distance test (i.e., to test for the number of standard deviation(s) an observation is from the centre of a dataset), Cook's distance test (i.e., to test for influential data points), and leverage values test (i.e., to identify data points with high leverage that might pull the regression slope towards them) were run. Results from these three tests revealed that the sample consisted of one multivariate outlier, which was subsequently removed.

Also, multicollinearity was assessed using collinearity statistics (i.e., tolerance and variance inflation factor [VIF] values) and Pearson correlations. To calculate collinearity statistics, linear regression analysis was run where total PSQI score was entered as the outcome variable and total PSS, FFMQ, and SCS scores were entered as the predictor variables. Predictor variables with tolerances < 0.1 are multicollinear with one or more other predictors. The predictors in the regression model all had tolerance values above 0.1. Additionally, predictor variables with VIF values > 10 are multicollinear with one or more other predictors. The predictors in the regression model had VIF values below 10. Therefore, the multicollinearity

assumption of multiple regression was met. Lastly, visual inspection of the normal probability plot of standardized residuals and the scatterplot of standardized residuals against standardized predicted values indicated that the assumptions of normality, linearity, and homoscedasticity of residuals were met.

Given that the above assumptions were met, the Hayes PROCESS for SPSS macro (Model 3, release 130612; Hayes, 2017) was thus used to test Hypotheses 3a and 3b. Model 3 is the moderated moderation analysis template that was developed by Hayes (2017). The moderated moderation analysis revealed that the overall model was significant [$F(7, 100) = 7.95$, $p < .001$, $R^2 = 0.36$]. There was no significant interaction between perceived stress and dispositional mindfulness ($b = .002$, $t(100) = .45$, $p = .65$, 95% Confidence Interval: [-.006, .009]). Similarly, there was no significant interaction between perceived stress and trait self-compassion ($b = .06$, $t(100) = .66$, $p = .51$, 95% Confidence Interval: [-.13, .26]). Additionally, there was no significant interaction between dispositional mindfulness and trait self-compassion ($b = .03$, $t(100) = .91$, $p = .36$, 95% Confidence Interval: [-.03, .09]). Lastly, no significant interaction among perceived stress, trait self-compassion, and dispositional mindfulness was found ($b = -.001$, $t(100) = -.53$, $p = .60$, 95% Confidence Interval: [-.006, .004], $\Delta R^2 = .002$, $\Delta F = .28$). Taken together, neither Hypothesis 3a nor 3b were supported. Table 9 summarizes results of the moderated moderation analysis.

CHAPTER IV: DISCUSSION

Support for the current study's first hypothesis was obtained. Within the present sample of undergraduate students, there was a significant negative association between dispositional mindfulness and sleep quality (r = -.48, p < .01). Dispositional mindfulness was measured using the FFMQ (Baer et al., 2006). Higher scores on the FFMQ (Baer et al., 2006) suggest higher levels of dispositional mindfulness. Sleep quality was measured using the PSQI (Buysse et al., 1989). Higher scores on the PSQI indicate poorer sleep quality. Hence, a negative association suggests that in the current study's sample, higher levels of dispositional mindfulness are associated with better sleep quality. Therefore, this indicates that an individual's *innate* tendency to pay attention to their present-moment experiences and to extend a sense of acceptance toward such experiences is associated with better sleep quality and lesser sleep disturbances. Additionally, this study's finding that dispositional mindfulness and sleep quality are moderately correlated is consistent with previous studies. To begin, Lau and colleagues (2018) also found a negative and moderate correlation between dispositional mindfulness (as measured by the FFMQ) and poor sleep quality (as measured by the PSQI; Buysse et al., 1989) in a nonclinical sample of 364 Chinese adults with no prior meditation experience, r = -.33, p < .001. Similarly, Murphy and colleagues (2012) found that in a sample of 441 female college students, dispositional mindfulness (as measured by the Mindfulness Attention Awareness Scale [MAAS]; Brown & Ryan, 2003) and sleep quality (as measured using a brief 3-item sleep questionnaire that was developed by Murphy and colleagues) were

moderately and positively correlated, $r = .33$, $p = .001$. Given that higher scores on the MAAS (Brown & Ryan, 2003) indicate higher levels of dispositional mindfulness and that higher scores on the brief sleep quality questionnaire developed by the researchers indicate better sleep quality, a positive correlation of .33 found by Murphy and colleagues (2012) suggests that higher levels of dispositional mindfulness are associated with better sleep quality in their sample of female college students.

Furthermore, Howell and colleagues (2008) examined the association between dispositional mindfulness (as measured using the MAAS; Brown & Ryan, 2003) and sleep quality (as measured using the Sleep Quality Scale; Yi, Shin, & Shin, 2006) in a sample of 305 Canadian undergraduate students. Howell and colleagues reverse-scored the total scores of the Sleep Quality Scale so that higher scores reflect better sleep quality. Their correlational analyses revealed a moderate and positive association between dispositional mindfulness and sleep quality, $r = .41$, $p < .001$. This suggests that higher levels of dispositional mindfulness are related to better sleep quality. In summary, the current study's first hypothesis was supported, which is consistent with previous research demonstrating that higher levels of dispositional mindfulness are associated with better sleep quality in a variety of college student and adult samples.

Support for Hypothesis 2 was likewise obtained. There was a significant moderate and negative association between trait self-compassion and sleep quality, $r = -.38$, $p < .01$. As described earlier, trait self-compassion was measured using the SCS (Neff, 2003b). Higher scores on the SCS (Neff, 2003b) indicate higher levels of trait self-compassion. Therefore, a negative association suggests that in the current study, higher levels of trait self-compassion are associated with better sleep quality. This indicates that

an individual's tendency to experience less self-criticism and isolation as well as to be less emotionally overwhelmed when faced with hardship is associated with better quality sleep and fewer sleep disturbances. This is similar to extant findings revealing a moderate association between trait self-compassion and sleep quality. For instance, Butz and Stalhberg (2018) found that in a sample of 68 college students, higher levels of self-compassion were positively associated with good sleep quality (as measured by the Insomnia Severity Index; Bastien et al., 2001), $r = .31$, $p < .01$. Similarly, in a sample of 142 college students, Hu and colleagues (2018) showed that higher levels of self-compassion were negatively associated with poor sleep quality (as measured by the PSQI; Buysse et al., 1989), $r = -.23$, $p < .01$. Furthermore, Brown and colleagues (2021) conducted a meta-analysis wherein they identified 17 independent studies from 15 publications that investigated the association between self-compassion and sleep quality in adult samples. The researchers reported that across these studies, self-compassion was overall significantly and negatively associated with poor sleep quality, $r = -.32$. Given that the present study's second hypothesis was supported, the current findings are in line with previous research demonstrating moderate associations between trait self-compassion and better sleep quality in college student and adult samples.

Support for Hypotheses 3a and 3b of the study was not found. The hypothesized three-way interaction among perceived stress, trait self-compassion, and dispositional mindfulness was not supported given that the moderated moderation analysis failed to find to find a significant interaction among these three variables ($b = -.001$, $t(100) = -.53$, $p = .60$, 95% Confidence Interval: [-.006, .004], $\Delta R^2 = .002$, $\Delta F = .28$). This indicates that in the current sample, the strength of the association between perceived stress and poor

sleep quality did not vary based on participants' levels of dispositional mindfulness *and* trait self-compassion. This suggests a lack of support for the hypothesized interaction effects of dispositional mindfulness and trait self-compassion as buffers against the adverse effects of perceived stress on sleep quality.

Two supplementary analyses were conducted with the intention of delineating the obtained pattern of findings. Specifically, using the Hayes PROCESS for SPSS macro (Model 1; Hayes, 2017), a moderation analysis was run to investigate whether dispositional mindfulness would moderate the relationship between perceived stress and sleep quality. This would allow us to examine whether this relationship between perceived stress and sleep quality would be weaker in participants who were high in dispositional mindfulness. The moderation analysis revealed that there was no significant interaction between perceived stress and dispositional mindfulness in predicting sleep quality (b = .0000, $t(104)$ = -.005, p = .10, 95% Confidence Interval: [-.004, .004], ΔR^2 = .0000, ΔF = .0000).

Additionally, another moderation analysis was run to test whether trait self-compassion would moderate the relationship between perceived stress and sleep quality. This would likewise facilitate an examination of whether the relationship between perceived stress and sleep quality would be weaker in participants who were high in trait self-compassion. This analysis failed to detect a significant interaction between perceived stress and trait self-compassion in predicting sleep quality (b = .01, $t(104)$ = .20, p = .84, 95% Confidence Interval: [-.09, .11], ΔR^2 = .0003, ΔF = .04).

Taking the results from both moderation analyses together, the findings suggest that in this sample, neither dispositional mindfulness nor trait self-compassion appeared

to be buffers or protective factors against the adverse effects of perceived stress on sleep quality. This is in contrast to the mindfulness stress buffering model, which asserts that mindfulness could mitigate stress appraisals and attenuate stress-reactivity responses. Further, the mindfulness principles of *awareness* and *acceptance* could facilitate the cognitive deactivation and physiological de-arousal necessary to bring about sleep by enabling an individual to disengage from their daily stressors (Garland et al., 2013). Additionally, this study's finding that trait self-compassion did not moderate the relationship between perceived stress and sleep quality is surprising, given that Hu and colleagues (2018) showed that for individuals with higher levels of self-compassion, experiencing stressful events during the day did not affect their sleep latency or sleep quality. These researchers also reported that for individuals with lower levels of self-compassion, experiencing stressful events during the day was associated with longer sleep latency and lower sleep quality (Hu et al., 2018).

Given that neither Hypothesis 3a nor 3b were supported, several implications follow. First, it is possible that in the present study's sample, other protective factors may have been more relevant than dispositional mindfulness and trait self-compassion in buffering the deleterious effects of perceived stress on sleep quality. This is especially likely considering the sample's mean FFMQ score was 115.77 (*SD* = 15.85), which is consistent with FFMQ norms reported in the literature for college students. For example, Baer and colleagues (2008) found a mean FFMQ score of 122.34 in a sample of 259 college students. Of note, they did not report the standard deviation of this mean FFMQ score. Also, Bergin and Pakenham (2016) showed that in a sample of 481 Australian undergraduate law students, a mean total FFMQ score of 117.92 (*SD* = 17.69) was

obtained. The FFMQ has a maximum score of 195. Additionally, the current sample's mean SCS score was 2.69 (*SD* = .63), which, using an ad-hoc rubric developed by Neff (2003b), suggests moderate levels of self-compassion. This sample mean is consistent with norms reported in the extant literature. For instance, Brenner and colleagues (2017) investigated a sample of 1115 undergraduate students and found a mean SCS score of 2.92 (*SD* = .62), which is within the moderate range as suggested by Neff (2003b). In addition, Neff and colleagues reported that in a sample of 222 undergraduate students, their analyses revealed a mean SCS score of 3.11 (*SD* = .67), which is within the high range as recommended by Neff (2003b).

Thus, it appears that on average, the current sample reported moderate levels of dispositional mindfulness and trait self-compassion. Yet, these factors did not appear to be significantly beneficial in mitigating the effects of perceived stress on sleep quality. In addition, 72.2% of the present study's participants (*n* = 78) had met criteria for having experienced poor sleep in the past month. This means that 27.8% of the present study's participants (*n* = 30) experienced overall good sleep in the past month. In addition, 54.6% of participants (*n* = 59) reported an average sleep efficiency of 85% or higher in the past month (a sleep efficiency of 85% or higher is considered to be healthy) and 59.3% of participants (*n* = 64) rated their subjective sleep quality as fairly good. Considering that a fair number of participants endorsed good sleep based on various indices (e.g., overal PSQI score; sleep efficiency; and subjective sleep quality), it stands to reason that this study may not have tapped into other more relevant protective factors for this sample that could buffer the effects of perceived stress on sleep quality.

Indeed, evidence suggests that it is important to match coping strategies to specific stressors. The goodness-of-fit hypothesis posits that coping effectiveness is dependent on a match between coping behaviors and other variables in the stress-and-coping process (e.g., an individual's values, beliefs, commitments, preferred coping styles, and temperament; Forsyth & Compas, 1987). Additionally, a key assumption of the goodness-of-fit hypothesis focuses on the notion that a specific coping strategy cannot be regarded as effective or ineffective independent from the context in which it is applied. Another central assumption of this hypothesis is that effective coping occurs when the coping strategies used match the level of appraised controllability of the stressor (Zakowski et al., 2001). For example, Forsythe and Compas (1987) investigated a sample of 84 college students and were interested in examining the goodness-of-fit between the students' appraisals of the controllability of stressful life events and their differential use of problem- versus emotion-focused coping. In terms of stressful life events, the researchers investigated both major life events and daily hassles. With regards to major life events, when there was a poor fit between appraisals and subsequent coping behaviors (e.g., attempting to change a stressor that was appraised as overall uncontrollable), participants endorsed greater levels of emotional, behavioral, and somatic problems. When there was a good fit between appraisals and subsequent coping behaviors (e.g., regulating one's emotions when a stressor was appraised as uncontrollable), participants endorsed lower levels of emotional, behavioral, and somatic problems. The researchers reported that no significant associations between appraisals and coping behaviors were found for daily hassles (Forsythe & Compas, 1987).

As for the present study, in line with the principles of the goodness-of-fit hypothesis, it is possible that depending on the participants' appraisals of their current stressors, other protective factors against the deleterious effects of perceived stress on sleep quality may have been more salient or relevant. Dispositional mindfulness and trait self-compassion can be considered types of emotion-focused coping. Yet, it is possible that depending on the nature of the sample's current stressors, problem-focused coping or a mixture of problem- and emotion-focused coping may have been more beneficial. College students face a host of stressors, including academic, financial, social, and vocational concerns (Lund et al., 2010). It is possible that applying problem-focused coping to address these concerns may be helpful in ameliorating the overall stress-sleep relationship. With regards to this sample, further speculation of what these other protective factors may have been is beyond the scope of the current study given that the two main protective factors under investigation were dispositional mindfulness and trait self-compassion.

In addition, several factors may have contributed to the null findings of Hypotheses 3a and 3b. First, multiple methodological and design limitations may account for these null findings. To start, participants in the current study reported a mean Perceived Stress Scale (PSS) score of 30.08 (*SD* = 6.86), with scores ranging from 8 to 44. This study's mean PSS score is higher than norms reported in previous studies. For instance, Cohen and colleagues (1983) reported a mean PSS score of 23.67 (*SD* = 7.79) in their investigation of college students. Similarly, Hoyt and colleagues (2021) surveyed 707 college students aged 18-22 and found a mean PSS score of 22.72 (*SD* = 9.00). Consequently, there might have been a restricted range of the study's main predictor

variable (i.e., perceived stress) given that relatively fewer participants endorsed low to moderate levels of perceived stress, therefore limiting this study's ability to fully explore moderated associations. Furthermore, data were collected towards the end of the Fall semester (i.e., between November and early December 2021). Given that students were approaching finals and deadlines, it is reasonable to expect that their stress levels would be greater towards the end of the semester (vs. start or middle of the semester). In fact, Bustamante and colleagues (2022) conducted a year-long investigation of first-year college students' affect, sleep, academic outcomes, and social outcomes using actigraphy and daily self-report. The researchers found that these students' stress levels were highest during the first weeks of the academic year, during midterms, and during finals. Therefore, this suggests that only collecting data towards the end of the semester could have limited this study's ability to capture a full range of perceived stress experienced by participants. Likewise, there might also have been a restricted range of participants' scores on the FFMQ (Baer et al., 2006) and SCS (2003b). The sample's mean FFMQ score was 115.77 (*SD* = 15.85) and mean SCS score was 2.69 (*SD* = .63). Therefore, it is possible there was insufficient variability in participants' FFMQ and SCS scores to run moderated moderation analyses.

In addition, a posthoc power analysis revealed that the present study may not have been sufficiently powered to detect small effects. G*Power (Faul et al., 2007) was used to run a posthoc power analysis based on the design of a linear multiple regression (fixed model, R^2 deviation from zero) with seven variables (i.e., perceived stress; global dispositional mindfulness; global self-compassion; the two-way interaction between perceived stress and global dispositional mindfulness; the two-way interaction between

perceived stress and global self-compassion; the two-way interaction between global dispositional mindfulness and global self-compassion; and the three-way interaction among perceived stress, global dispositional mindfulness; and global self-compassion), the obtained effect size (F^2) of .08, alpha error probability of .05, and the total sample size of 108. With these variables and values, the posthoc analysis results revealed a power of 0.51. Thus, the present study was not sufficiently powered to detect small effects.

Furthermore, theoretical limitations that may explain the current study's null findings should also be considered. First, in the interest of parsimony, the current study did not include other potential variables that could indirectly influence the relationship between perceived stress and poor sleep quality, such as rumination or worrying around bedtime. However, it is possible that dispositional mindfulness and trait self-compassion may act as buffers against the adverse effects of perceived stress on sleep quality through influencing these other potential variables. For instance, a strong body of literature has demonstrated that heightened arousal that occurs during the period of sleep onset (i.e., pre-sleep arousal) mediates the relationship between stress and poor sleep quality (Morin, Rodrigue, & Ivers, 2003; Winzeler et al., 2014). Particularly, there are two subcomponents of pre-sleep arousal: *cognitive* arousal (i.e., intrusive or uncontrollable cognitions); and *somatic* arousal (i.e., physiological arousal). With regards to cognitive pre-sleep arousal, rumination and worry are two forms of repetitive, negatively-valenced thought that are commonly implicated in the relationship between stress and poor sleep quality. Rumination is oriented towards the past; worry is oriented towards the future (Tousignant et al., 2019). Indeed, previous research has demonstrated that stressful life

events can indirectly affect sleep quality in college students through rumination. For instance, in their investigation of 1065 Chinese college students, Li and colleagues (2019) found that rumination partially mediated the relationship between stressful life events (as measured using the Adolescent Self-Rating Life Events Checklist; Liu et al., 1997) and poor sleep quality. Their finding suggests that rumination may be a mechanism through which stressful life events result in poor sleep quality. Nonetheless, a main limitation of Li and colleagues' study is that they used cross-sectional data to run mediational analyses, which limits our ability to make causal inferences.

Next, using a sample of 178 participants, Tousignant and colleagues (2019) used multilevel moderated mediation analyses to compare the effects of cognitive arousal and somatic arousal within the stress-sleep relationship. They were also interested in testing whether rumination and worry are similarly involved in the stress-sleep relationship. The participants completed baseline self-report measures examining baseline rumination tendencies (as measured using the Response Styles to Depression Questionnaire, Rumination Subscale [RSDQ; Nolen-Hoeksema, 1991]) and worry tendencies (as measured using the Penn State Worry Questionnaire [PSWQ; Meyer et al., 1990]). Over the span of two weeks, participants completed daily questionnaires assessing for their daily stress levels (as measured using the Daily Stress Inventory [DSI; Brantley et al., 1987]), pre-sleep arousal (as measured using the Pre-Sleep Arousal Scale [PSAS; Nicassio et al., 1985]), and sleep quality (as measured using the Core Consensus Sleep Diary; Carney et al., 2012). The researchers reported that within-participant mediation analyses revealed significant indirect effects via both cognitive and somatic arousal. In other words, both cognitive and somatic arousal mediated the stress-sleep relationship at

the within-participant level. Increases in both cognitive and somatic arousal were associated with significant decreases in subjective sleep quality. Compared to somatic arousal, *cognitive* arousal accounted for more of the variance in the stress-sleep relationship. Additionally, participants endorsing high levels of baseline rumination and worry had stronger relationships between stress and pre-sleep arousal. The researchers assert that this indicates that the common elements of rumination and worry (i.e., repetitive and negative thoughts) may predict poorer sleep, rather than their distinct elements (i.e., past versus future focus). Further, the longitudinal design that included the use of daily questionnaires addresses the cross-sectional limitations faced by Li and colleagues' study as described above.

Therefore, tying it back to the current study's theoretical limitations, it is possible that dispositional mindfulness and trait self-compassion may act as buffers against the deleterious effects of perceived stress on sleep quality by contributing to decreased pre-sleep arousal and/or decreased worrying and rumination. Indeed, evidence suggests that the mindfulness principles of *awareness* and *acceptance* support the passive nature of sleep and may in fact facilitate the cognitive deactivation and physiological de-arousal necessary to cue the onset of sleep. That is, mindfulness could reduce excessive ruminating or worrying before bedtime and ameliorate physiological arousal that could interfere with sleep (Garland et al., 2013; Lundh, 2005). Similarly, self-compassion could be helpful in downregulating rumination (Butz & Stalhberg, 2018) and strong emotions (e.g., low mood or perceived stress; Hu et al., 2018) to facilitate sleep. Research has shown that self-compassion is associated with the downregulation of neural markers of pain and threat as well as increased heartrate variability (Kim et al., 2020a; Kim et al.,

2020b). However, the current study did not include constructs such as pre-sleep arousal (e.g., cognitive and somatic arousal) or rumination and worry especially around bedtime in its proposed model. Consequently, this may have prevented the present study's ability to fully delineate the protective roles of dispositional mindfulness and trait self-compassion in buffering the effects of perceived stress on sleep quality.

Furthermore, this study used global FFMQ and SCS scores in its moderated moderation analysis, which might have obscured significant interaction effects. Indeed, evidence suggests that facets of dispositional mindfulness may be more important than the global dispositional mindfulness score in accounting for specific aspects of sleep quality (Gómez-Odriozola & Calvete, 2021). Similarly, in their meta-analysis of 17 independent studies that investigated the association between self-compassion and sleep quality in adult samples, Brown and colleagues (2021) reported that the negatively-valenced or the Self-Coldness subscales of the SCS (i.e., the Overidentification, Isolation, and Self-Judgment subscales; Neff, 2003b) may be more predictive of poor sleep quality than the positively valenced subscales of the SCS (i.e., Mindfulness, Common Humanity, and Self-Kindness). Nevertheless, this study only included the total scale scores of the FFMQ and the SCS in its main analyses. This could have limited this study's ability to differentially examine the associations among facets of dispositional mindfulness, self-compassion vs. self-coldness subscales of the SCS, and sleep quality. Taken together, it is possible that using scores on the facets of dispositional mindfulness and subscales of the SCS might have revealed significant interaction effects.

The Context of the COVID-19 Pandemic

Although the present study did not aim to investigate the effects of the pandemic on participants' sleep quality, data were after all collected during the pandemic and the present study's results may be interpreted within the context of the current health crisis. Hence, a brief, six-item measure was developed for the purpose of the present study to assess for participants' perceived stress due to the COVID-19 pandemic. Overall, participants endorsed relatively low levels of perceived stress due to the pandemic. Of note, this finding should be interpreted cautiously given the preliminary nature of the measure that was used to assess for participants' pandemic-related perceived stress. Although it demonstrated good internal consistency in the present study ($\alpha = .88$), its test-retest reliability and construct validity remain to be examined.

Nonetheless, the COVID-19 pandemic has significantly and dramatically altered daily life across the world. Besides the physical, emotional, and psychological toll of the virus, mitigation efforts such as lockdowns and social distancing practices have resulted in reduced and altered social interactions, transitions to working and schooling from home, and financial strain (e.g., due to loss or reduction in income; Cox & Olatunji, 2021). Indeed, as a result of these disruptions to daily life, the pandemic has led to increased psychological distress (Gruber et al., 2021; Keel et al., 2020). Therefore, since the onset of the pandemic, researchers have begun examining sleep patterns during the pandemic given the known association between stress and sleep.

Jahrami and colleagues (2021) conducted a systematic review and meta-analysis of 44 papers that have examined the prevalence of sleep problems during the COVID-19 pandemic. Across these papers, 54,231 participants from 13 countries were recruited. The authors reported that in general populations, 32.3% of people reported experiencing sleep

problems since the onset of the pandemic (Jahrami et al., 2021). Moreover, researchers have attempted to quantify the differences in individuals' sleep before the pandemic and during the pandemic. Particularly, studies examining differences in sleep quality pre- and during the pandemic have demonstrated inconsistent findings. In samples from Italy (Cellini et al., 2020; Marelli et al., 2020), Germany, Switzerland, and Austria (Blume et al., 2020), individuals rated their sleep quality as poorer during lockdown compared to pre-lockdown. However, a majority of these studies used participants' retrospective recollection of their pre-pandemic sleep quality. Contrastingly, Gao and Scullin (2020) investigated a sample of American adults and asked participants to retrospectively rate their pre-lockdown sleep quality using the PSQI (Buysse et al., 1989). The participants rated their pre-lockdown sleep quality as significantly better than their sleep quality experienced during lockdown. However, participants who completed baseline PSQI pre-lockdown (in mid-February 2020) and a follow-up PSQI post-lockdown (in late-March 2020) demonstrated no significant changes in sleep quality. Thus, the inconsistent findings reported in the literature examining sleep quality throughout the pandemic may be explained by methodological differences (i.e., use of retrospective recall vs. actual baseline, pre-pandemic data). These inconsistent findings may also be explained by differences in timepoints during which one is investigating the effects of the pandemic on sleep. That is, throughout the course of the pandemic, mitigation efforts have changed dramatically and often with great unpredictability depending on the onset and identification of new variants as well as fluctuating positivity and death rates. Given the changing and fluid nature of the pandemic and its associated stressors, it is reasonable to expect participants’ stress and sleep quality to change over time as well. Furthermore,

these inconsistent findings may also hinge on the fact that across time, countries have differed in their approaches in responding to the pandemic due to various factors, including for example differences in healthcare systems, available infrastructure, vaccination access, and infection and death rates.

Overall, it is likely that the physical and emotional consequences of the pandemic may lead to worsened sleep quality. However, the field of research is faced by several contextual and methodological limitations. In this study, perceived stress due to the COVID-19 pandemic and sleep quality were weakly correlated, $r = .15$, $p = .12$. Nonetheless, it is unclear the extent to which participants' sleep quality was affected by the pandemic. This is due to the study's limitations such as the use of a brief, novel measure examining pandemic-related perceived stress and the cross-sectional design employed by the current study, which thus excludes the possibility of examining changes in sleep quality throughout the course of the pandemic and comparing sleep quality pre-pandemic and during the pandemic.

Limitations and Future Directions

Apart from the limitations already discussed in the above sections, findings of the current study should be interpreted cautiously considering additional limitations present. First, the cross-sectional nature of the data prevents assumptions from being made about causality among the key variables to be made. Therefore, future research would benefit from using longitudinal designs to examine the long-term buffering effects of dispositional mindfulness and trait self-compassion on the relationship between perceived stress and poor sleep quality. Such longitudinal designs could include daily diary or ecological momentary assessments of participants' stress and sleep quality. Additionally,

experimental manipulation of dispositional mindfulness and trait self-compassion (e.g., through mindfulness and self-compassion training) could be studied to determine causal and temporal relationships among the variables. Furthermore, the sample consisted of primarily White female college students (73.1%; n = 79), which limits the findings' generalizability to other populations. Hence, future studies should examine the relationships among perceived stress, sleep quality, dispositional mindfulness, and trait self-compassion in diverse, underrepresented, and community samples. Plus, the use of a retrospective self-report sleep quality measure may have resulted in recall bias. Future studies could consider using more objective measurements of sleep quality such as actigraphy watches. Similarly, the use of other self-report measures in the present study may have led to response biases such as social desirability bias.

In addition, to better capture a greater range of perceived stress levels, future studies should aim to collect data across the entire length of a semester given extant evidence indicating that college students' stress levels tend to vary across the semester and peak during the first weeks of the academic year, during midterms, and during finals (Bustamante et al., 2022). Also, to allow for sufficient power to detect small to moderate effects, future studies should aim to recruit larger sample sizes. Besides, as discussed earlier, it is possible that dispositional mindfulness and trait self-compassion may serve as buffers against the deleterious effects of perceived stress on sleep quality by targeting pre-sleep arousal and reducing worrying and rumination before bedtime. Future studies may benefit from including measures of pre-sleep arousal (e.g., the Pre-Sleep Arousal Scale; Nicassio et al., 1985), rumination (e.g., the Response Styles to Depression Questionnaire, Rumination Subscale; Nolen-Hoeksema, 1991), and worry (e.g., the Penn

State Worry Questionnaire; Meyer et al., 1990) in their overall models examining the protective roles of dispositional mindfulness and trait self-compassion in buffering the adverse effects of perceived stress on sleep quality.

Finally, as stated previously, emerging evidence suggests that using scores on the five facets of the FFMQ may be more illuminating than merely using a global FFMQ or dispositional mindfulness score in accounting for specific aspects of sleep quality (Gómez-Odriozola & Calvete, 2021). Similarly, evidence indicates that the negatively-valenced or Self-Coldness subscales of the SCS (i.e., the Overidentification, Isolation, and Self-Judgment subscales; Neff, 2003b) may be more predictive of poor sleep quality than the positively-valenced subscales of the SCS (i.e., the Mindfulness, Common Humanity, and Self-Kindness subscales; Neff, 2003b). Thus, rather than using global scale scores, future research could benefit from including scores on the facets of dispositional mindfulness and subscales of the SCS in their analyses.

Study's Strengths

This study has several strengths. First, it is the first in the literature to examine the interaction between dispositional mindfulness and trait self-compassion as buffers against the effects of perceived stress on sleep quality. Other studies have mainly examined self-compassion or dispositional mindfulness separately as protective factors against the deleterious effects of stress on sleep. However, given the theoretical and empirical support for the complementary relationship between self-compassion and mindfulness (Baer et al., 2012; Hollis-Walker & Colosimo, 2011; Keng et al., 2012), it is important to examine both variables in conjunction. Additionally, the COVID-19 pandemic has resulted in significant disruption to daily life. The pandemic has led to increased stress,

distress, anxiety, worry, and depression in college students (Halliburton et al., 2021; Lee, 2020). This may be due in part to ongoing uncertainty about modes of instruction, potential cancellation of anticipated milestones (e.g., graduation ceremonies or foreign exchange programs), possible loss of employment (e.g., with local businesses closing or letting go of employees), and unpredictability of the job market that students may soon enter. Further, college students may be worried about the health of their friends and family or may have lost loved ones due to the virus. Considering that data collection for the present study occurred during the pandemic, it was important to include a measure to assess perceived stress due to the pandemic. Thus, for the purpose of the present study, a brief six-item measure was developed to measure perceived stress related to the pandemic. This is another strength of the current study because although several measures have been developed to measure stress related to the pandemic (e.g., the COVID Stress Scales [Taylor et al., 2020] and the Pandemic Stress Index [Harkness et al., 2020]), they are relatively lengthy. Thus, a brief measure may be particularly useful in reducing response burden. Furthermore, existing measures of COVID-19-related perceived stress were not developed to examine pandemic-related stress that may be more specific to college students' needs (e.g., concerns about the pandemic's adverse effects on their higher education experiences). This is a limitation that is addressed by the brief measure used here, as it includes an item assessing for perceived stress due to disruption in college experiences.

Conclusions

In summary, using a nonclinical sample of 108 undergraduates between the ages of 18 to 25 years old, this study investigated the possible relationship between

dispositional mindfulness and sleep quality. It also explored the relationship between trait self-compassion and sleep quality. Finally, it aimed to examine whether there would be an interaction effect between dispositional mindfulness and trait self-compassion as buffers against the adverse effects of perceived stress on sleep quality. Results showed that there was a significant moderate and negative association between dispositional mindfulness and sleep quality, as well as between trait self-compassion and sleep quality. Taken together, these findings indicate that in this sample of college students, higher levels of dispositional mindfulness and trait self-compassion respectively were associated with better sleep quality.

On the other hand, the hypothesized three-way interaction among perceived stress, dispositional mindfulness, and trait self-compassion was not supported. The moderated moderation analysis revealed that there was no significant interaction among these three variables. This indicates that the association between perceived stress and sleep quality did not vary based on participants' levels of dispositional mindfulness *and* trait self-compassion. Consistent with principles of the goodness-of-fit hypothesis (Forsyth & Compas, 1987; Zakowski et al., 2001), it is possible that other protective factors apart from dispositional mindfulness and trait self-compassion may have been more relevant to the sample's perceived stress and sleep quality. Additionally, it is possible that other methodological and theoretical limitations may have contributed to the null findings related to Hypotheses 3a and 3b, including the restricted range of the study's main variables (i.e., PSS, FFMQ, and SCS), the collecting of data only during the end of the semester, limited power, exclusion of theoretically relevant variables in the study's

main model (e.g., rumination, worry, and pre-sleep arousal), and use of global FFMQ and SCS scores (vs. FFMQ facet scores and SCS subscale scores).

Overall, it has been estimated that between 40 to 88% of college students suffer from poor sleep quality (Buboltz et al., 2001; Lund et al., 2010; Vail-Smith, Felts, & Becker, 2009). A major risk factor for poor sleep quality is perceived stress (Galambos et al., 2013; Lund et al., 2010; Verlander et al., 1999). Given the prevalence of poor sleep quality and its associated negative health, psychological, and emotional outcomes (Jean-Louis, Kripke, & Ancoli-Israel, 2000; Pilcher et al., 1997), it is important to identify protective factors that buffer the stress-sleep relationship. This study adds to the body of literature supporting the positive associations between dispositional mindfulness and trait self-compassion respectively with better sleep quality. Future studies should continue to explore the ways dispositional mindfulness and trait self-compassion can contribute to improved sleep quality outcomes.

REFERENCES

Âkerstedt, T. (2006). Psychosocial stress and impaired sleep. *Scandinavian Journal of Work, Environment & Health, 32*(6), 493-501.

Alapin, I., Fichten, C. S., & Libman, E. (2000). How is good and poor sleep in older adults and college students related to daytime sleepiness, fatigue and ability to concentration? *Journal of Psychosomatic Research, 49*, 381-390.

American College Health Association. (2012). *American College Health Association–National College Health Assessment II: Reference Group Executive Summary Spring 2012. Hanover, MD: American College Health Association*. Retrieved September 2, 2020 from https://www.acha.org/documents/ncha/ACHA-NCHA-II_ReferenceGroup_ExecutiveSummary_Spring2012.pdf

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

American Psychological Association. (2015). *Stress in America: Paying with our health*. Retrieved September 2, 2020 from https://www.apa.org/news/press/releases/stress/2014/stress-report.pdf

Ayas, N. T., White, D. P., Manson, J. E., Stampfer, M. J., Speizer, F. E., Malhotra, A., & Hu, F. B. (2003). A prospective study of sleep duration and coronary heart disease in women. *Archives of Internal Medicine, 163*(2), 205-209. DOI:10.1001/archinte.163.2.205

Baer, R. A. (2011). Measuring mindfulness. *Contemporary Buddhism, 12*, 241-261.

Baer, R. A., Lykins, E. L., & Peters, J. R. (2012). Mindfulness and self-compassion as predictors of psychological wellbeing in long-term meditators and matched nonmeditators. *Journal of Positive Psychology, 7*(3), 230-238.

Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. *Assessment, 11*(3), 191-206. https://doi.org/10.1177/1073191104268029

Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*(1), 27-45.

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., ... & Williams, J. M. G. (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. *Assessment, 15*(3), 329-342.

Bajaj, B., Gupta, R., & Pande, N. (2016). Self-esteem mediates the relationship between mindfulness and well-being. *Personality and Individual Differences, 94*, 96-100.

Barnes, C. M., & Drake, C. L. (2015). Prioritizing sleep health: Public health policy recommendations. *Perspectives on Psychological Science, 10*(6), 733-737. https://doi.org/10.1177/1745691615598509

Barnhofer, T., Duggan, D. S., & Griffith, J. W. (2011). Dispositional mindfulness moderates the relation between neuroticism and depressive symptoms. *Personality and Individual Differences, 51*(8), 958-962.

Bassett, S. M., Lupis, S. B., Gianferante, D., Rohleder, N., & Wolf, J. M. (2015). Sleep quality but not sleep quantity effects on cortisol responses to acute psychosocial stress. *Stress, 18*(6), 638-644. https://doi.org/10.3109/10253890.2015.1087503

Bastien, C. H., Vallières, A., & Morin, C. M. (2001). Validation of the Insomnia Severity Index as an outcome measure for insomnia research. *Sleep Medicine, 2*(4), 297-307. https://doi.org/10.1016/s1389-9457(00)00065-4

Becker, S. P., Jarrett, M. A., Luebbe, A. M., Garner, A. A., Burns, G. L., & Kofler, M. J. (2018). Sleep in a large, multi-university sample of college students: Sleep problem prevalence, sex differences, and mental health correlates. *Sleep Health, 4*(2), 174-181.

Bergin, A. J., & Pakenham, K. I. (2016). The stress-buffering role of mindfulness in the relationship between perceived stress and psychological adjustment. *Mindfulness, 7*(4), 928-939.

Blume, C., Schmidt, M. H., & Cajochen, C. (2020). Effects of the COVID-19 lockdown on human sleep and rest-activity rhythms. *Current Biology, 30*(14), R795-R797.

Bluth, K., & Blanton, P. W. (2014). Mindfulness and self-compassion: Exploring pathways to adolescent emotional well-being. *Journal of Child and Family Studies, 23*(7), 1298-1309. https://doi.org/10.1007/s10826-013-9830-2

Bogusch, L. M., Fekete, E. M., & Skinta, M. D. (2016). Anxiety and depressive symptoms as mediators of trait mindfulness and sleep quality in emerging adults. *Mindfulness, 7*(4), 962-970.

Bonnet, M. H., & Arand, D. L. (1998). Heart rate variability in insomniacs and matched normal sleepers. *Psychosomatic Medicine, 60*(5), 610–615. https://doi.org/10.1097/00006842-199809000-00017

Brantley, P. J., Waggoner, C. D., Jones, G. N., & Rappaport, N. B. (1987). A daily stress inventory: Development, reliability, and validity. *Journal of Behavioral Medicine, 10*, 61–74. https://doi.org/10.1007/BF00845128

Brenner, R. E., Heath, P. J., Vogel, D. L., & Credé, M. (2017). Two is more valid than one: Examining the factor structure of the Self-Compassion Scale (SCS). *Journal of Counseling Psychology, 64*(6), 696.

Brown, K. W., Goodman, R. J., & Inzlicht, M. (2013). Dispositional mindfulness and the attenuation of neural responses to emotional stimuli. *Social Cognitive and Affective Neuroscience, 8*(1), 93–99. https://doi.org/10.1093/scan/nss004

Brown, L., Houston, E. E., Amonoo, H. L., & Bryant, C. (2021). Is self-compassion associated with sleep quality? A meta-analysis. *Mindfulness, 12*(1), 82-91.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*(4), 822-848.

Brown, K. W., Weinstein, N., & Creswell, J. D. (2012). Trait mindfulness modulates neuroendocrine and affective responses to social evaluative threat. *Psychoneuroendocrinology, 37*, 2037–2041.

Brown, K. W., West, A. M., Loverich, T. M., & Biegel, G. M. (2011). Assessing adolescent mindfulness: Validation of an adapted Mindful Attention Awareness Scale in adolescent normative and psychiatric populations. *Psychological Assessment, 23*(4), 1023–1033. https://doi.org/10.1037/a0021338.

Buboltz Jr., W. C., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: A preliminary study. *Journal of American College Health, 50*(3), 131-135.

Buchheld, N., Grossman, P., & Walach, H. (2001). Measuring mindfulness in insight meditation (vipassana) and meditation-based psychotherapy: The development of the Freiburg Mindfulness Inventory (FMI). *Journal for Meditation and Meditation Research, 1*, 11–34.

Bustamante, C. M., Coombs, G., 3rd, Rahimi-Eichi, H., Mair, P., Onnela, J. P., Baker, J. T., & Buckner, R. L. (2022). Fluctuations in behavior and affect in college students measured using deep phenotyping. *Scientific Reports, 12*(1), 1932. https://doi.org/10.1038/s41598-022-05331-7

Butz, S., & Stahlberg, D. (2018). Can self-compassion improve sleep quality via reduced rumination? *Self and Identity, 17*(6), 666-686.

Buxton, O. M., Pavlova, M., Reid, E. W., Wang, W., Simonson, D. C., & Adler, G. K. (2010). Sleep restriction for 1 week reduces insulin sensitivity in healthy men. *Diabetes, 59*(9), 2126-2133. https://doi.org/10.2337/db09-0699

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*(2), 193-213. https://doi.org/10.1016/0165-1781(89)90047-4

Carney, C. E., Buysse, D. J., Ancoli-Israel, S., Edinger, J. D., Lichstein, K. L., & Morin, C. M. (2012). The Consensus Sleep Diary: Standardizing prospective sleep self-monitoring. *Sleep, 35*, 287–302. https://doi.org/10.5665/sleep.1642

Cellini, N., Canale, N., Mioni, G., & Costa, S. (2020). Changes in sleep pattern, sense of time and digital media use during COVID-19 lockdown in Italy. *Journal of Sleep Research, 29*(4), e13074. https://doi.org/10.1111/jsr.13074

Centers for Disease Control and Prevention. (2020a). *Sleep and sleep disorders.* Retrieved September 10, 2020 from https://www.cdc.gov/sleep/index.html

Centers for Disease Control and Prevention. (2020b). *Sleep and chronic disease.* Retrieved September 10, 2020 from https://www.cdc.gov/sleep/about_sleep/chronic_disease.html

Centers for Disease Control and Prevention. (2020c). *Circadian rhythms and circadian clock.* Retrieved September 10, 2020 from https://www.cdc.gov/niosh/emres/longhourstraining/clock.html

Chadwick, P., Hember, M., Symes, J., Peters, E., Kuipers, E., & Dagnan, D. (2008). Responding mindfully to unpleasant thoughts and images: Reliability and validity of the Southampton Mindfulness questionnaire (SMQ). *British Journal of Clinical Psychology, 47*(4), 451-455. Doi: 10.1348/014466508X314891.

Chaput, J. P., Després, J. P., Bouchard, C., & Tremblay, A. (2008). The association between sleep duration and weight gain in adults: A 6-year prospective study from the Quebec Family Study. *Sleep, 31*(4), 517-523. https://doi.org/10.1093/sleep/31.4.517

Cheng, S. H., Shih, C. C., Lee, I. H., Hou, Y. W., Chen, K. C., Chen, K. T., ... & Yang, Y. C. (2012). A study on the sleep quality of incoming university students. *Psychiatry Research, 197*(3), 270-274.

Cohen, S., Doyle, W. J., Alper, C. M., Janicki-Deverts, D., & Turner, R. B. (2009). Sleep habits and susceptibility to the common cold. *Archives of Internal Medicine, 169*(1), 62-67. https://doi.org/10.1001/archinternmed.2008.505

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Consensus Conference Panel, Watson, N. F., Badr, M. S., Belenky, G., Bliwise, D. L., Buxton, O. M., ... & Kushida, C. (2015). Recommended amount of sleep for a healthy adult: A joint consensus statement of the American Academy of Sleep Medicine and Sleep Research Society. *Journal of Clinical Sleep Medicine, 11*(6), 591-592.

Cox, R. C., & Olatunji, B. O. (2021). Sleep in a pandemic: Implications of COVID-19 for sleep through the lens of the 3P model of insomnia. *American Psychologist, 76*(7), 1159–1171. https://doi.org/10.1037/amp0000850

Creswell, J. D., & Lindsay, E. K. (2014). How does mindfulness training affect health? A mindfulness stress buffering account. *Current Directions in Psychological Science, 23*(6), 401-407.

Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine, 69,* 560–565.

Czeisler, C. A. (2011). Impact of sleepiness and sleep deficiency on public health—utility of biomarkers. *Journal of Clinical Sleep Medicine, 7*(5 Suppl), S6-S8. Doi:10.5664/JCSM.1340

Derogatis, L. R. (1987). The Derogatis Stress Profile (DSP): Quantification of psychological stress. In G. A. Fava & T. N. Wise (Eds.), *Advances in psychosomatic medicine* (Vol. 17, pp. 30-54). Basel, Switzerland: Karger.

Domino, G., Blair, G., & Bridges, A. (1984). Subjective assessment of sleep by Sleep Questionnaire. *Perceptual and Motor Skills, 59,* 163-170.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment, 29*(3), 177-190. Doi: 10.1007/s10862-006-9035-8.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39,* 175-191.

Forsythe, C. J., & Compas, B. E. (1987). Interaction of cognitive appraisals of stressful events and coping: Testing the goodness of fit hypothesis. *Cognitive Therapy and Research, 11*(4), 473–485. https://doi.org/10.1007/BF01175357

Fossati, A., Feeney, J., Maffei, C., & Borroni, S. (2011). Does mindfulness mediate the association between attachment dimensions and borderline personality disorder features? A study of Italian non-clinical adolescents. *Attachment & Human Development, 13*(6), 563-578.

Friedman, E. M. (2016). Self-reported sleep problems prospectively increase risk of disability: Findings from the survey of midlife development in the United States. *Journal of the American Geriatrics Society*, *64*(11), 2235-2241. https://doi.org/10.1111/jgs.14347

Galambos, N. L., Vargas Lascano, D. I., Howard, A. L., & Maggs, J. L. (2013). Who sleeps best? Longitudinal patterns and covariates of change in sleep quantity, quality, and timing across four university years. *Behavioral Sleep Medicine, 11*(1), 8-22.

Gangwisch, J. E., Heymsfield, S. B., Boden-Albala, B., Buijs, R. M., Kreier, F., Pickering, T. G., ... & Malaspina, D. (2007). Sleep duration as a risk factor for diabetes incidence in a large US sample. *Sleep*, *30*(12), 1667-1673. https://doi.sorg/10.1093/sleep/30.12.1667

Gao, C., & Scullin, M. K. (2020). Sleep health early in the coronavirus disease 2019 (COVID-19) outbreak in the United States: Integrating longitudinal, cross-sectional, and retrospective recall data. *Sleep Medicine, 73*, 1-10.

Garland, S. N., Campbell, T., Samuels, C., & Carlson, L. E. (2013). Dispositional mindfulness, insomnia, sleep quality and dysfunctional sleep beliefs in post-treatment cancer patients. *Personality and Individual Differences, 55*(3), 306-311.

Gaultney, J. F. (2010). The prevalence of sleep disorders in college students: Impact on academic performance. *Journal of American College Health, 59*, 91-97.

Gaultney, J. F. (2016). Risk for sleep disorder measured during students' first college semester may predict institutional retention and grade point average over a 3-year period, with indirect effects through self-efficacy. *Journal of College Student Retention, 18*(3), 333-359. https://doi.org/10.1177/1521025115622784

Germain, A., Hall, M., Krakow, B., Katherine Shear, M., & Buysse, D. J. (2005). A brief sleep scale for posttraumatic stress disorder: Pittsburgh Sleep Quality Index Addendum for PTSD. *Journal of Anxiety Disorders, 19*, 233–244. http://dx.doi.org/10.1016/j.janxdis.2004.02.001

Gómez-Odriozola, J., & Calvete, E. (2021). The role of dispositional mindfulness profiles as predictors of sleep problems through rumination in adolescents over time. *Personality and Individual Differences, 180*, Article 110966. https://doi.org/10.1016/j.paid.2021.110966

Gradisar, M., Wolfson, A. R., Harvey, A. G., Hale, L., Rosenberg, R., & Czeisler, C. A. (2013). The sleep and technology use of Americans: Findings from the National Sleep Foundations' 2011 Sleep in America poll. *Journal of Clinical Sleep Medicine, 9*, 1291-1299.

Grossman, P. (2010). Mindfulness for psychologists: Paying kind attention to the perceptible. *Mindfulness, 1*(2), 87-97. https://doi.org/10.1007/s12671-010-0012-7

Gruber, J., Prinstein, M. J., Clark, L. A., Rottenberg, J., Abramowitz, J. S., Albano, A. M., ... & Weinstock, L. M. (2021). Mental health and clinical psychological science in the time of COVID-19: Challenges, opportunities, and a call to action. *American Psychologist, 76*(3), 409-426. http://dx.doi.org/10.1037/amp0000707

Halliburton, A. E., Hill, M. B., Dawson, B. L., Hightower, J. M., & Rueden, H. (2021). Increased stress, declining mental health: Emerging adults' experiences in college during COVID-19. *Emerging Adulthood, 9*(5), 433–448. https://doi.org/10.1177/21676968211025348

Han, K. S., Kim, L., & Shim, I. (2012). Stress and sleep disorder. *Experimental Neurobiology, 21*(4), 141–150. https://doi.org/10.5607/en.2012.21.4.141

Harkness, A., Weinstein, E. R., Mayo, D., Rodriguez-Diaz, C., & Safren, S. A. (2021). Latinx sexual minority men's behavioral, psychosocial, and medical experiences during COVID-19: Differences across immigration statuses. *Annals of LGBTQ Public and Population Health, 2*(2), 104-115.

Hayes, A. H. (2017). *Introduction to Mediation, Moderation, and Conditional Process Analysis* (2nd ed.). New York, NY: Guilford Press.

Hicks, A., Siwik, C., Phillips, K., Zimmaro, L. A., Salmon, P., Burke, N., Albert, C., Fields, O., Dorsel, D., & Sephton, S. E. (2020). Dispositional mindfulness is associated with lower basal sympathetic arousal and less psychological stress. *International Journal of Stress Management, 27*(1), 88–92. https://doi.org/10.1037/str0000124

Hollis-Walker, L., & Colosimo, K. (2011). Mindfulness, self-compassion, and happiness in non-meditators: A theoretical and empirical examination. *Personality and Individual Differences, 50*(2), 222–227. https://doi.org/10.1016/j.paid.2010.09.033

Howell, A. J., Digdon, N. L., Buro, K., & Sheptycki, A. R. (2008). Relations among mindfulness, well-being, and sleep. *Personality and Individual Differences, 45*(8), 773-777.

Howell, A. J., Digdon, N. L., & Buro, K. (2010). Mindfulness predicts sleep-related self-regulation and well-being. *Personality and Individual Differences, 48*(4), 419-424.

Hoyt, L. T., Cohen, A. K., Dull, B., Castro, E. M., & Yazdani, N. (2021). "Constant stress has become the new normal": Stress and anxiety inequalities among US college students in the time of COVID-19. *Journal of Adolescent Health, 68*(2), 270-276.

Hu, Y., Wang, Y., Sun, Y., Arteta-Garcia, J., & Purol, S. (2018). Diary study: The protective role of self-compassion on stress-related poor sleep quality. *Mindfulness, 9*(6), 1931-1940. Doi:10.1007/s12671-018-0939-7

IBM Corp. Released 2021. IBM SPSS Statistics for Macintosh, Version 28.0. Armonk, NY: IBM Corp

Ikehara, S., Iso, H., Date, C., Kikuchi, S., Watanabe, Y., Wada, Y., ... & JACC Study Group. (2009). Association of sleep duration with mortality from cardiovascular disease and other causes for Japanese men and women: The JACC study. *Sleep, 32*(3), 295-301. https://doi.org/10.1093/sleep/32.3.295

Jackson, M. L., Sztendur, E. M., Diamond, N. T., Byles, J. E., & Bruck, D. (2014). Sleep difficulties and the development of depression and anxiety: A longitudinal study of young Australian women. *Archives of Women's Mental Health, 17*(3), 189-198. https://doi.org/10.1007/s00737-014-0417-8

Jahrami, H., BaHammam, A. S., Bragazzi, N. L., Saif, Z., Faris, M., & Vitiello, M. V. (2021). Sleep problems during the COVID-19 pandemic by population: A systematic review and meta-analysis. *Journal of Clinical Sleep Medicine, 17*(2), 299-313.

Jean-Louis, G., Kripke, D. F., & Ancoli-Israel, S. (2000). Sleep and quality of well-being. *Sleep, 23*(8), 1115-1157. Doi:10.1093/sleep/23.8.1k

Jenkins, C. D., Stanton, B.-A., Niemcryk, S. J., & Rose, R. M. (1988). A scale for the estimation of sleep problems in clinical research. *Journal of Clinical Epidemiology, 41*(4), 313–321. https://doi.org/ 10.1016/0895-4356(88)90138-2.

Jensen, D. R. (2003). Understanding sleep disorders in a college student population. *Journal of College Counseling*, *6*(1), 25-34. https://doi.org/10.1002/j.2161-1882.2003.tb00224.x

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry, 4*(1), 33-47. https://doi.org/10.1016/0163-8343(82)90026-3

Kabat-Zinn, J. (1994). *Wherever you go, there you are: Mindfulness meditation in everyday life*. New York, NY: Hyperion.

Kaplan, R. M., Sieber, W. J., & Ganiats, T. G. (1997). The Quality of Well-Being scale: Comparison of the interviewer-administered version with a self-administered questionnaire. *Psychology and Health, 12*(6), 783-791. https://doi.org/10.1080/08870449708406739

Keel, P. K., Gomez, M. M., Harris, L., Kennedy, G. A., Ribeiro, J., & Joiner, T. E. (2020). Gaining "The Quarantine 15:" Perceived versus observed weight changes in college students in the wake of COVID-19. *International Journal of Eating Disorders*, 1– 8. https://doi.org/10.1002/eat.23375

Kemper, K. J., Mo, X., & Khayat, R. (2015). Are mindfulness and self-compassion associated with sleep and resilience in health professionals? *The Journal of Alternative and Complementary Medicine, 21*(8), 496-503.

Keng, S., Smoski, M. J., Robins, C. J., Ekblad, A. G., & Brantley, J. G. (2012). Mechanisms of change in mindfulness-based stress reduction: Self-compassion and mindfulness as mediators of intervention outcomes. *Journal of Cognitive Psychotherapy, 26*(3), 270-280. https://doi.org/10.1891/0889-8391.26.3.270

Kim, J. J., Cunnington, R., & Kirby, J. N. (2020a). The neurophysiological basis of compassion: An fMRI meta-analysis of compassion and its related neural processes. *Neuroscience & Biobehavioral Reviews, 108*, 112-123. https://doi.org/10.1016/j.neubiorev.2019.10.023

Kim, J. J., Parker, S. L., Doty, J. R., Cunnington, R., Gilbert, P., & Kirby, J. N. (2020b). Neurophysiological and behavioural markers of compassion. *Scientific Reports, 10*(1), 1-9. https://doi.org/10.1038/s41598-020-63846-3

Kirschbaum, C., Wüst, S., & Hellhammer, D. (1992). Consistent sex differences in cortisol responses to psychological stress. *Psychosomatic Medicine, 54*(6), 648–657. https://doi.org/10.1097/00006842-199211000-00004

Knutson, K. L., Van Cauter, E., Rathouz, P. J., Yan, L. L., Hulley, S. B., Liu, K., & Lauderdale, D. S. (2009). Association between sleep and blood pressure in midlife: The CARDIA sleep study. *Archives of Internal Medicine, 169*(11), 1055-1061. https://doi.org/10.1001/archinternmed.2009.119

Kolla, B. P., Mansukhani, S., & Mansukhani, M. P. (2016). Consumer sleep tracking devices: A review of mechanisms, validity and utility. *Expert Review of Medical Devices, 13*(5), 497–506. https://doi.org/10.1586/17434440.2016.1171708

Krieger, T., Hermann, H., Zimmermann, J., & grosse Holtforth, M. (2015). Associations of self-compassion and global self-esteem with positive and negative affect and stress reactivity in daily life: Findings from a smart phone study. *Personality and Individual Differences*, *87*, 288-292.

Krueger, J. M., Frank, M. G., Wisor, J. P., & Roy, S. (2016). Sleep function: Toward elucidating an enigma. *Sleep Medicine Reviews*, *28*, 46-54. https://doi.org/10.1016/j.smrv.2015.08.005

Krystal, A. D., & Edinger, J. D. (2008). Measuring sleep quality. *Sleep Medicine, 9*, S10-S17.

Lathren, C., Bluth, K., & Park, J. (2019). Adolescent self-compassion moderates the relationship between perceived stress and internalizing symptoms. *Personality and Individual Differences, 143*, 36-41.

Lau, W. K., Leung, M. K., Wing, Y. K., & Lee, T. M. (2018). Potential mechanisms of mindfulness in improving sleep and distress. *Mindfulness, 9*(2), 547-555.

Lauderdale, D. S., Knutson, K. L., Yan, L. L., Liu, K., & Rathouz, P. J. (2008). Sleep duration: How well do self-reports reflect objective measures? The CARDIA sleep study. *Epidemiology, 19*(6), 838-845. https://doi.org/10.1097/ede.0b013e318187a7b0

Lazarus, R. (1999). *Stress and emotion: A new synthesis*. New York, NY: Springer Publishing Company.

Lazarus, R. S. (2000). Toward better research on stress and coping. *American Psychologist, 55*(6), 665-673. https://doi.org/10.1037/0003-066x.55.6.665

Lazarus, R. S., DeLongis, A., Folkman, S., & Gruen, R. (1985). Stress and adaptational outcomes: The problem of confounded measures. *American Psychologist, 40*(7), 770-779. https://doi.org/10.1037/0003-066X.40.7.770

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.

Leary, M. R., Tate, E. B., Adams, C. E., Batts Allen, A., & Hancock, J. (2007). Self-compassion and reactions to unpleasant self-relevant events: The implications of treating oneself kindly. *Journal of Personality and Social Psychology, 92*(5), 887.

Lee, J. (2020). Mental health effects of school closures during COVID-19. *The Lancet Child & Adolescent Health, 4*(6), 421.

Levenson, J. C., Kay, D. B., & Buysse, D. J. (2015). The pathophysiology of insomnia. *Chest, 147*(4), 1179-1192.

Li, Y., Gu, S., Wang, Z., Li, H., Xu, X., Zhu, H., Deng, S., Ma, X., Feng, G., Wang, F., & Huang, J. H. (2019). Relationship between stressful life events and sleep quality: Rumination as a mediator and resilience as a moderator. *Frontiers in Psychiatry, 10*, 348. https://doi.org/10.3389/fpsyt.2019.00348

Lichstein, K. L., & Fanning, J. (1990). Cognitive anxiety in insomnia: An analogue test. *Stress Medicine, 6*(1), 47–51. https://doi.org/10.1002/smi.2460060110

Lichstein, K. L., Stone, K. C., Donaldson, J., Nau, S. D., Soeffing, J. P., Murray, D., ... & Aguillard, R. N. (2006). Actigraphy validation with insomnia. *Sleep, 29*(2), 232-239.

Lindsay, E. K., & Creswell, J. D. (2017). Mechanisms of mindfulness training: Monitor and acceptance theory (MAT). *Clinical Psychology Review, 51*, 48-59. Doi: 10.1016/j.cpr.2016.10.011

Liu, D., Kahathuduwa, C., & Vazsonyi, A. T. (2021). The Pittsburgh Sleep Quality Index (PSQI): Psychometric and clinical risk score applications among college students. *Psychological Assessment, 33*(9), 816–826. https://doi.org/10.1037/pas0001027

Liu, X., Liu, L., Yang, J., Chai, F., Wang, A., Sun, L., Zhao, G., & Ma, D. (1997). The Adolescent Self-Rating Life Events Checklist and its reliability and validity. *Chinese Journal of Clinical Psychology, 5*(1), 34–36.

Loucks, E. B., Britton, W. B., Howe, C. J., Eaton, C. B., & Buka, S. L. (2015). Positive associations of dispositional mindfulness with cardiovascular health: The New England Family Study. *International Journal of Behavioral Medicine, 22*(4), 540-550.

Loucks, E. B., Britton, W. B., Howe, C. J., Gutman, R., Gilman, S. E., Brewer, J., ... & Buka, S. L. (2016). Associations of dispositional mindfulness with obesity and central adiposity: The New England Family Study. *International Journal of Behavioral Medicine, 23*(2), 224-233.

Lundh, L. G. (2005). The role of acceptance and mindfulness in the treatment of insomnia. *Journal of Cognitive Psychotherapy, 19*(1), 29–39. https://doi.org/10.1891/ jcop.19.1.29.66331.

Lund, H. G., Reider, B. D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. *Journal of Adolescent Health, 46*(2), 124-132. Doi: 10.1016/j.jadohealth.2009.06.016

Luyster, F. S., Strollo, P. J., Zee, P. C., & Walsh, J. K. (2012). Sleep: A health imperative. *Sleep, 35*(6), 727-734. https://doi.org/10.5665/sleep.1846

MacBeth, A., & Gumley, A. (2012). Exploring compassion: A meta-analysis of the association between self-compassion and psychopathology. *Clinical Psychology Review, 32*(6), 545-552. https://doi.org/10.1016/j.cpr.2012.06.003

Masuda, A., Price, M., & Latzman, R. D. (2012). Mindfulness moderates the relationship between disordered eating cognitions and disordered eating behaviors in a non-clinical college sample. *Journal of Psychopathology and Behavioral Assessment, 34*(1), 107-115.

Masuda, A., & Wendell, J. W. (2010). Mindfulness mediates the relation between disordered eating-related cognitions and psychological distress. *Eating Behaviors, 11*(4), 293-296.

Matthews, K. A., Patel, S. R., Pantesco, E. J., Buysse, D. J., Kamarck, T. W., Lee, L., & Hall, M. H. (2018). Similarities and differences in estimates of sleep duration by polysomnography, actigraphy, diary, and self-reported habitual sleep in a community sample. *Sleep Health, 4*(1), 96-103. https://doi.org/10.1016/j.sleh.2017.10.011

McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine, 338*(3), 171-179.

McEwen, B. S., & Akil, H. (2020). Revisiting the stress concept: Implications for affective disorders. *Journal of Neuroscience, 40*(1), 12-21.

Medic, G., Wille, M., & Hemels, M. E. (2017). Short-and long-term health consequences of sleep disruption. *Nature and Science of Sleep, 9*, 151.

Melton, B. F., Langdon, J., & McDaniel, T. (2013). Sleep trends and college students: Does it connect to obesity? *College Student Journal, 47*, 429-436.

Marelli, S., Castelnuovo, A., Somma, A., Castronovo, V., Mombelli, S., Bottoni, D., ... & Ferini-Strambi, L. (2021). Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *Journal of Neurology, 268*(1), 8-15.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy, 28*, 487–495. https://doi.org/10.1016/0005-7967(90)90135-6

Milojevich, H. M., & Lukowski, A. F. (2016). Sleep and mental health in undergraduate students with generally healthy sleep habits. *PloS one, 11*(6), e0156372.

Modinos, G., Ormel, J., & Aleman, A. (2010). Individual differences in dispositional mindfulness and brain activity involved in reappraisal of emotion. *Social Cognitive and Affective Neuroscience, 5*, 369–377.

Mollayeva, T., Thurairajah, P., Burton, K., Mollayeva, S., Shapiro, C. M., & Colantonio, A. (2016). The Pittsburgh Sleep Quality Index as a screening tool for sleep dysfunction in clinical and non-clinical samples: A systematic review and meta-analysis. *Sleep Medicine Reviews, 25*, 52–73. https://doi.org/10.1016/j.smrv.2015.01.009

Montoya, A. K. (2019). Moderation analysis in two-instance repeated measures designs: Probing methods and multiple moderator models. *Behavior Research Methods, 51*(1), 61-82.

Morin, C. M., Rodrigue, S., & Ivers, H. (2003). Role of stress, arousal, and coping skills in primary insomnia. *Psychosomatic Medicine, 65*, 259–267. https://doi.org/10.1097/01.PSY.0000030391.09558.A3

Murphy, M. J., Mermelstein, L. C., Edwards, K. M., & Gidycz, C. A. (2012). The benefits of dispositional mindfulness in physical health: A longitudinal study of female college students. *Journal of American College Health, 60*(5), 341-348.

Nagy, S. M., Pickett, S. M., & Hunsanger, J. A. (2020). The relationship between mindfulness, PTSD-related sleep disturbance, and sleep quality: Contributions beyond emotion regulation difficulties. *Psychological Trauma: Theory, Research, Practice, and Policy.* Advance online publication. https://doi.org/10.1037/tra0000572

National Institute of Neurological Disorders and Stroke. (2019). *Brain basics: Understanding sleep.* Retrieved September 10, 2020 from https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Understanding-Sleep#:~:text=Sleep%20is%20important%20to%20a,up%20while%20you%20are%20awake

Neely, M. E., Schallert, D. L., Mohammed, S. S., Roberts, R. M., & Chen, Y. J. (2009). Self-kindness when facing stress: The role of self-compassion, goal regulation, and support in college students' well-being. *Motivation and Emotion, 33*(1), 88-97.

Neff, K. D. (2003a). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and Identity, 2*(2), 85–101. https://doi.org/10.1080/15298860309032.

Neff, K. D. (2003b). The development and validation of a scale to measure self-compassion. *Self and Identity, 2*(3), 223-250. https://doi.org/10.1080/15298860309027

Neff, K. D., & Dahm, K. A. (2015). *Self-compassion: What it is, what it does, and how it relates to mindfulness*. In Ostafin, B., Robinson, M., & Meier, B. (eds.) Handbook of Mindfulness and Self-Regulation. New York, NY: Springer.

Neff, K. D., Hsieh, Y.-P., & Dejitterat, K. (2005). Self-compassion, achievement goals, and coping with academic failure. *Self and Identity, 4*(3), 263–287. https://doi.org/10.1080/13576500444000317

Neff, K. D., Kirkpatrick, K. L., & Rude, S. S. (2007). Self-compassion and adaptive psychological functioning. *Journal of Research in Personality, 41*(1), 139-154.

Neff, K. D., & Pommier, E. (2013). The relationship between self-compassion and other-focused concern among college undergraduates, community adults, and practicing meditators. *Self and Identity, 12*, 160–176.

Nicassio, P. M., Mendlowitz, D. R., Fussell, J. J., & Petras, L. (1985). The phenomenology of the pre-sleep state: The development of the Pre-Sleep Arousal Scale. *Behaviour Research and Therapy, 23*, 263–271. https://doi.org/10.1016/0005-7967(85)90004-X

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressed mood. *Journal of Abnormal Psychology, 100*, 569–582. https://doi.org/10.1037/0021-843X.100.4.569

Nordin, M., Åkerstedt, T., & Nordin, S. (2013). Psychometric evaluation and normative data for the Karolinska Sleep Questionnaire. *Sleep and Biological Rhythms*, *11*(4), 216-226. https://doi.org/10.1111/sbr.12024

O'Connor, D. B., Thayer, J. F., & Vedhara, K. (2021). Stress and Health: A Review of Psychobiological Processes. *Annual Review of Psychology, 72*, 663–688. https://doi.org/10.1146/annurev-psych-062520-122331

Ohayon, M., Wickwire, E. M., Hirshkowitz, M., Albert, S. M., Avidan, A., Daly, F. J., ... & Hazen, N. (2017). National Sleep Foundation's sleep quality recommendations: First report. *Sleep Health, 3*(1), 6-19. https://doi.org/10.1016/j.sleh.2016.11.006

Ong, J. C., Cardé, N. B., Gross, J. J., & Manber, R. (2011). A two-dimensional approach to assessing affective states in good and poor sleepers. *Journal of Sleep Research, 20*(4), 606-610. https://doi.org/10.1111/j.1365-2869.2011.00907.x

Patel, S. R., Ayas, N. T., Malhotra, M. R., White, D. P., Schernhammer, E. S., Speizer, F. E., ... & Hu, F. B. (2004). A prospective study of sleep duration and mortality risk in women. *Sleep, 27*(3), 440-444. https://doi.org/10.1093/sleep/27.3.440

Petrov, M. E., Lichstein, K. L., & Baldwin, C. M. (2014). Prevalence of sleep disorders by sex and ethnicity among older adolescents and emerging adults: Relations to daytime functioning, working memory and mental health. *Journal of Adolescence, 37*(5), 587-597.

Phillips, W. J., & Hine, D. W. (2019). Self-compassion, physical health, and health behavior: A meta-analysis. *Health Psychology Review, 22*(1), 1-27. https://doi.org/10.1080/17437199.2019.1705872

Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity: Relationships between sleep and measures of health, well-being and sleepiness in college students. *Journal of Psychosomatic Research*, *42*(6), 583-596. https://doi.org/10.1016/s0022-3999(97)00004-4

Porkka-Heiskanen, T., Zitting, K. M., & Wigren, H. K. (2013). Sleep, its regulation and possible mechanisms of sleep disturbances. *Acta Physiologica, 208*(4), 311-328. https://doi.org/10.1111/apha.12134

Roth, T., Jaeger, S., Jin, R., Kalsekar, A., Stang, P. E., & Kessler, R. C. (2006). Sleep problems, comorbid mental disorders, and role functioning in the National Comorbidity Survey Replication. *Biological Psychiatry, 60*(12), 1364-1371. Doi: 10.1016/j.biopsych.2006.05.039

Ryff, C. (1989). Happiness is everything, or is it? Explorations of the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*, 1069–1081.

Sawyer, A. M., & Weaver, T. E. (2010). Sleep medicine. In *Handbook of Health Psychology and Behavioral Medicine,* J. M. Suls, K. W. Davidson, & R. M. Kaplan (pp. 442-461). New York, NY: The Guilford Press.

Segerstrom, S. C., & O'Connor, D. B. (2012). Stress, health and illness: Four challenges for the future. *Psychology & Health, 27*(2), 128–140. https://doi.org/10.1080/08870446.2012.659516

Senders, A., Borgatti, A., Hanes, D., & Shinto, L. (2018). Association between pain and mindfulness in multiple sclerosis: A cross-sectional survey. *International Journal of MS Care*, *20*(1), 28-34.

Seow, L., Tan, X. W., Chong, S. A., Vaingankar, J. A., Abdin, E., Shafie, S., Chua, B. Y., Heng, D., & Subramaniam, M. (2020). Independent and combined associations of sleep duration and sleep quality with common physical and mental disorders: Results from a multi-ethnic population-based study. *PloS one, 15*(7), e0235816. https://doi.org/10.1371/journal.pone.0235816

Shapiro, S. L. (2009). The integration of mindfulness and psychology. *Journal of Clinical Psychology*, *65*(6), 555-560.

Shapiro, S. L., Carlson, L. E., Astin, J. A., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*(3), 373-386.

Shockey, T. M., & Wheaton, A. G. (2017). Short sleep duration by occupation group — 29 states, 2013-2014. Retrieved September 2, 2020 from https://www.cdc.gov/mmwr/volumes/66/wr/mm6608a2.htm

Sirois, F. M., Molnar, D. S., & Hirsch, J. K. (2015). Self-compassion, stress, and coping in the context of chronic illness. *Self and Identity, 14*(3), 334-347. https://doi.org/10.1080/15298868.2014.996249

Smith, B. W., Ortiz, J. A., Steffen, L. E., Tooley, E. M., Wiggins, K. T., Yeater, E. A., ... & Bernard, M. L. (2011). Mindfulness is associated with fewer PTSD symptoms, depressive symptoms, physical symptoms, and alcohol problems in urban firefighters. *Journal of Consulting and Clinical Psychology*, *79*(5), 613-617.

Sotelo, M. I., Tyan, J., Dzera, J., & Eban-Rothschild, A. (2020). Sleep and motivated behaviors, from physiology to pathology. *Current Opinion in Physiology, 15*, 159-166. Doi:10.1016/j.cophys.2020.01.006

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. *PloS Medicine, 1*(3), e62. Doi:10.1371/journal.pmed.0010062

Taren, A. A., Creswell, J. D., & Gianaros, P. J. (2013). Dispositional mindfulness co-varies with smaller amygdala and caudate volumes in community adults. *PloS one, 8*(5), e64574.

Taylor, D. J., Bramoweth, A. D., Grieser, E. A., Tatum, J. I., & Roane, B. M. (2013). Epidemiology of insomnia in college students: Relationship with mental health, quality of life, and substance use difficulties. *Behavior Therapy, 44*(3), 339-348.

Taylor, S., Landry, C. A., Paluszek, M. M., Fergus, T. A., McKay, D., & Asmundson, G. J. (2020). Development and initial validation of the COVID Stress Scales. *Journal of Anxiety Disorders, 72*, 102232. https://doi.org/10.1016/j.janxdis.2020.102232

Thacher, P. V. (2008). University students and "the all-nighter": Correlates and patterns of students' engagement in a single night of total sleep deprivation. *Behavioral Sleep Medicine, 6*, 16-31.

Tomlinson, E. R., Yousaf, O., Vittersø, A. D., & Jones, L. (2018). Dispositional mindfulness and psychological health: A systematic review. *Mindfulness, 9*(1), 23–43. https://doi.org/10.1007/s12671-017-0762-6

Tousignant, O. H., Taylor, N. D., Suvak, M. K., & Fireman, G. D. (2019). Effects of rumination and worry on sleep. *Behavior Therapy, 50*(3), 558–570. https://doi.org/10.1016/j.beth.2018.09.005

Trockel, M. T., Barnes, M. D., & Egget, D. L. (2000). Health-related variables and academic performance among first-year college students: Implications for sleep and other behaviors. *Journal of American College Health, 49*, 125-131.

Vail-Smith, K., Felts, W. M., & Becker, C. (2009). Relationship between sleep quality and health risk behaviors in undergraduate college students. *College Student Journal, 43*(3), 924-930.

Van Dam, N. T., Van Vugt, M. K., Vago, D. R., Schmalzl, L., Saron, C. D., Olendzki, A., ... & Fox, K. C. (2018). Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation. *Perspectives on Psychological Science, 13*(1), 36-61.

Vandekerckhove, M., & Cluydts, R. (2010). The emotional brain and sleep: An intimate relationship. *Sleep Medicine Reviews, 14*, 219-226.

Vargas, P. A., Flores, M., & Robles, E. (2014). Sleep quality and body mass index in college students: The role of sleep disturbances. *Journal of American College Health, 62*, 534-541.

Verlander, L. A., Benedict, J. O., & Hanson, D. P. (1999). Stress and sleep patterns of college students. *Perceptual and Motor Skills, 88*(3), 893-898.

Vyazovskiy, V. V. (2015). Sleep, recovery, and metaregulation: Explaining the benefits of sleep. *Nature and Science of Sleep, 7*, 171-184. https://doi.org/10.2147/nss.s54036

Wallace, D. D., Boynton, M. H., & Lytle, L. A. (2017). Multilevel analysis exploring the links between stress, depression, and sleep problems among two-year college students. *Journal of American College Health, 65*(3), 187-196.

Way, B. M., Creswell, J. D., Eisenberger, N. I., & Lieberman, M. D. (2010). Dispositional mindfulness and depressive symptomatology: Correlations with limbic and self-referential neural activity during rest. *Emotion, 10*, 12–24.

Weinstein, N., Brown, K. W., & Ryan, R. M. (2009). A multi-method examination of the effects of mindfulness on stress attribution, coping, and emotional well-being. *Journal of Research in Personality, 43*(3), 374–385. https://doi.org/10.1016/j.jrp.2008.12.008

Winzeler, K., Voellmin, A., Schafer, V., Meyer, A. H., Cajochen, C., Wilhelm, F. H., & Bader, K. (2014). Daily stress, presleep arousal, and sleep in healthy young women: A daily life computerized sleep diary and actigraphy study. *Sleep Medicine, 15,* 359–366. https://doi.org/10.1016/j.sleep.2013.09.027

Wisener, M., & Khoury, B. (2022). Which emotion-regulation strategies explain the relationship between dispositional mindfulness, self-compassion, and eating to cope? *Appetite, 172,* 105912. https://doi.org/10.1016/j.appet.2022.105912

Yi, H., Shin, K., & Shin, C. (2006). Development of the Sleep Quality Scale. *Journal of Sleep Research, 15*(3), 309–316. https://doi.org/10.1111/j.1365-2869.2006.00544.x

Yu, L., Buysse, D. J., Germain, A., Moul, D. E., Stover, A., Dodds, N. E., ... & Pilkonis, P. A. (2012). Development of short forms from the PROMIS™ sleep disturbance and sleep-related impairment item banks. *Behavioral Sleep Medicine, 10*(1), 6-24. https://doi.org/10.1080/15402002.2012.636266

Zakowski, S. G., Hall, M. H., Cousino Klein, L., & Baum, A. (2001). Appraised control, coping, and stress in a community sample: A test of the goodness-of-fit hypothesis. *Annals of Behavioral Medicine, 23*(3), 158–165. https://doi.org/10.1207/S15324796ABM2303_3

Zessin, U., Dickhauser, O., & Garbade, S. (2015). The relationship between self-compassion and well-being: A meta-analysis. *Applied Psychology: Health and Well-Being, 7*(3), 340–364.

Zinkhan, M., Berger, K., Hense, S., Nagel, M., Obst, A., Koch, B., . . . Stang, A. (2014). Agreement of different methods for assessing sleep characteristics: A comparison of two actigraphs, wrist and hip placement, and self-report with polysomnography. *Sleep Medicine, 15*(9), 1107-1114. Doi:10.1016/j.sleep.2014.04.015

Zisapel, N. (2007). Sleep and sleep disturbances: Biological basis and clinical implications. *Cellular and Molecular Life Sciences*, *64*(10), 1174-1186. https://doi.org/10.1007/s00018-007-6529-9

Zohar, D., Tzischinsky, O., Epstein, R., & Lavie, P. (2005). The effects of sleep loss on medical residents' emotional reactions to work events: A cognitive-energy model. *Sleep, 28*(1), 47-54. Doi:10.1093/sleep/28.1.4

Table 1

Study sample demographic characteristics (N = 108)

Demographic Variables	Frequency	Percentage
Age	*M* = 19.92	*SD* = 1.61
Gender		
Male	24	22.2
Female	79	73.1
Non-binary	4	3.7
Trans	1	0.9
BMI	*M* = 24.96	*SD* = 5.47
Race/ethnicity[a]		
Asian	7	6.5
Biracial/Multiethnic	3	2.8
Black/African American	16	14.8
Caucasian/White	82	75.9
Hispanic or Latino/a	11	10.2
Multiracial/ethnic	1	0.9
International (i.e., not native to the United States and U.S. culture)	1	0.9
Relationship status		
Married/civil union	2	1.9
Single	93	86.1
Live-in partner	10	9.3
Different relationship status	3	2.8
Employment status		
Part-time	58	53.7
Full-time	10	9.3
Unemployed	37	34.3
Another employment status	3	2.8
Shift work status[b]		
Morning (5am-12pm)	8	11.4
Afternoon (12-6pm)	13	18.6
Evening (6-11pm)	15	21.4
Rotating variable	34	48.6
Living arrangement status		
In an apartment, dorm, or house on campus	47	43.5
In an apartment or house off-campus	25	23.1
With parents or family	36	33.3
Roommate status		
No roommate	46	42.6
Has a roommate	62	57.4
Average number of roommates	*M* = 2.03	*SD* = 2.13

[a]Participants were able to select more than one racial/ethnic group to represent their own racial/ethnic identity. Thus, the total frequency of responses for this category (n = 121) exceeded the actual sample size of 108.

[b]A total of 71 participants indicated that they were employed to some extent. Seventy participants responded to the item querying for shift work status, indicating that this item was missing data (n = 1).

Table 2

Study sample academic characteristics (N = 108)

Academic Variables	Frequency	Percentage
Current academic class standing		
Freshman	47	43.5
Sophomore	30	27.8
Junior	18	16.7
Senior	13	12.0
Enrollment status		
Part-time	5	4.6
Full-time	103	95.4
Grade point average (GPA)[a]		
1.00-1.49	1	1.0
1.50-1.99	2	1.9
2.00-2.49	2	1.9
2.50-2.99	17	16.2
3.00-3.49	38	36.2
3.50-3.99	37	35.2
4.00-4.00+	8	7.6
College major status		
Declared	100	92.6
Undeclared	8	7.4

[a]One participant was excluded from the final reporting of the sample's grade point averages as they had stated that their GPA was 77.36, which was considered to be invalid given that GPA at the University of Louisville ranges from 0 to 4.0+. Additionally, there were three missing data for this variable. Further, participants' GPA were recoded into seven categories (i.e., 1.00-1.49; 1.50-1.99; 2.00-2.49; 2.50-2.99; 3.00-3.49; 3.50-3.99; and 4.00-4.0+) for ease of reporting.

Table 3

Bivariate correlations, means, and standard deviations for total scale scores of the PSS, PSQI, SCS, and FFMQ (N = 108)

Variables	PSS	PSQI	SCS	FFMQ
PSS	—			
PSQI	.54*	—		
SCS	-.61*	-.38*	—	
FFMQ	-.52*	-.48*	.65*	—
Mean	30.08	7.88	2.69	115.77
Standard deviation	6.86	3.48	.63	15.85

Note. PSS = Perceived Stress Scale; PSQI = Pittsburgh Sleep Quality Index; SCS = Self-Compassion Scale; and FFMQ = Five-Facet Mindfulness Questionnaire.

*$p < .01$, two-tailed.

Table 4

Bivariate correlations between the PSS and subscales of the PSQI, SCS, and FFMQ (N = 108)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. PSS	—																		
PSQI Components																			
2. Sleep duration	**.32****	—																	
3. Sleep disturbances	**.26****	.05	—																
4. Sleep latency	**.25****	**.29****	**.31****	—															
5. Daytime dysfunction	**.59****	**.26****	**.27****	**.45****	—														
6. Sleep efficiency	**.35****	**.39****	.16	**.36****	**.31****	—													
7. Subjective sleep quality	**.43****	**.45****	**.41****	**.43****	**.43****	**.34****	—												
8. Sleep medication use	.19	.03	**.28****	**.24***	.17	.02	**.27****	—											
SCS Subscales																			
9. Self-kindness	**-.39****	**-.35****	-.10	-.19	**-.35****	-.11	**-.30****	-.15	—										
10. Common humanity	**-.25****	-.10	-.03	-.04	-.15	-.07	**-.27****	.01	**.47****	—									
11. Mindfulness	**-.40****	**-.23***	-.14	-.10	**-.25****	-.12	**-.31****	-.17	**.67****	**.56****	—								
12. Self-judgment[a]	**-.54****	-.14	**-.22***	-.14	**-.40****	**-.25***	**-.28****	**-.21***	**.53****	**.28****	**.42****	—							
13. Isolation[a]	**-.57****	-.04	**-.22***	**-.20***	**-.38****	-.16	**-.19***	-.17	**.34****	**.25***	**.40****	**.76****	—						
14. Over-identification[a]	**-.50****	-.04	**-.22***	-.03	**-.27****	-.18	**-.20***	-.15	**.30****	.18	**.41****	**.74****	**.72****	—					
FFMQ Subscales																			
15. Observing	.01	-.01	.09	-.04	.09	-.02	**-.21***	-.02	.15	**.34****	**.32****	-.15	-.10	-.17	—				
16. Describing	.17	**-.22***	-.04	-.18	-.17	**-.19***	**-.29****	-.10	**.24***	.13	**.36****	.11	-.04	.08	**.24***	—			
17. Acting with Awareness	**-.46****	-.16	-.09	**-.28****	**-.53****	**-.27****	**-.22***	-.01	**.19***	.17	.18	**.45****	**.39****	**.43****	**-.21***	.10	—		
18. Nonjudging of inner experience	**-.45****	**-.19***	**-.20***	**-.19****	**-.45****	**-.24***	**-.36****	**-.26****	**.41****	.14	**.37****	**.70****	**.63****	**.62****	**-.20***	.09	**.50****	—	
19. Nonreactivity to inner experience	**-.37****	-.13	.02	-.05	**-.29****	.02	**-.25****	**-.19***	**.50****	**.45****	**.57****	**.26****	**.28****	**.25***	**.44****	**.25****	.06	**.24***	—

Note. PSS = Perceived Stress Scale; SCS = Self-Compassion Scale; and FFMQ = Five-Facet Mindfulness Questionnaire.

[a]The items on these subscales were reverse-scored. Therefore, on these subscales, higher scores indicate higher levels of self-compassion.

*$p < .05$, two-tailed. **$p < .01$, two-tailed. Significant correlations are bolded.

Table 5

Sample's sleep quality characteristics based on component scores on the Pittsburgh Sleep Quality Index (N = 108)

Variable	% (*N*)
Total sleep quality	
Good sleep	27.8 (30)
Poor sleep	72.2 (78)
Sleep duration	
>7 hours	50.9 (55)
6-7 hours	28.7 (31)
5-6 hours	13.9 (15)
< 5 hours	6.5 (7)
Sleep latency	
≤15 minutes	32.4 (35)
16-30 minutes	36.1 (39)
31-60 minutes	23.1 (25)
>60 minutes	8.3 (9)
Sleep efficiency	
≥ 85%	54.6 (59)
75-84%	25.9 (28)
65-74%	13.0 (14)
< 65%	6.5 (7)
Use of sleep medications	
Not during the past month	65.7 (71)
Less than once a week	16.7 (18)
Once or twice a week	8.3 (9)
Three or more times a week	9.3 (10)
Subjective sleep quality	
Very good	6.5 (7)
Fairly good	59.3 (64)
Fairly bad	31.5 (34)
Very bad	2.8 (3)
Sleep disturbances[a]	
0	2.8 (3)
1	64.8 (70)
2	32.4 (35)
3	0 (0)
Daytime dysfunction[a]	
0	6.5 (7)
1	47.2 (51)
2	37.0 (40)
3	9.3 (10)

[a]Minimum score = 0 (better), maximum score = 3 (worse).

Table 6

Pittsburgh Sleep Quality Index descriptive statistics (N = 108)

Variable	*M* (*SD*)
Sleep onset latency (minutes)	33.06 (26.26)
Total sleep time (hours)	6.74 (1.34)
PSQI total score	7.88 (3.48)
PSQI component scores[a]	
Sleep duration	.76 (.93)
Sleep disturbances	1.30 (.52)
Sleep latency	1.70 (.91)
Sleep efficiency	.71 (.93)
Sleep quality	1.31 (.63)
Daytime dysfunction	1.49 (.75)
Sleep medication use	.61 (.98)

Note. PSQI = Pittsburgh Sleep Quality Index. For all PSQI variables, higher scores indicate worse sleep.

[a]Minimum score = 0 (better), maximum score = 3 (worse).

Table 7

Descriptive statistics of the COVID-19 Perceived Stress Scale (N = 108)

Variable	*M* (*SD*)	Range
Scale Items		
1. In the last month, I have felt nervous and stressed about the COVID-19 pandemic.	1.14 (1.063)	4
2. In the last month, I have felt that the difficulties related to the COVID-19 pandemic are increasing and I feel unable to overcome them.	.95 (1.06)	4
3. In the last month, I have felt that I am unable to control the important things in my life because of the COVID-19 pandemic.	1.02 (1.09)	4
4. In the last month, I have felt worried about catching the COVID-19 virus.	1.22 (1.13)	4
5. In the last month, I have felt worried about my friends or family catching the COVID-19 virus.	1.83 (1.23)	4
6. In the last month, I have felt upset that the COVID-19 pandemic has disrupted my college experience (e.g., classes; socializing opportunities).	2.14 (1.37)	4
Total score	8.31 (5.55)	24

Note. For all items on the COVID-19 Perceived Stress Scale, higher scores reflect higher levels of perceived stress.

Table 8

Skewness and kurtosis statistics for total scale scores of the PSS, PSQI, SCS, and FFMQ (N = 108)

Variables	Skewness (SE)	Kurtosis (SE)
PSS	-.47 (.23)	.49 (.46)
PSQI	.44 (.23)	-.43 (.46)
SCS	.47 (.23)	.83 (.46)
FFMQ	.39 (.23)	.11 (.46)

Table 9

Moderated moderation analyses (N = 108)

Predictor	PSQI Scores				
	b	*t*(100)	*p*	*F*(1, 100)	ΔR^2
PSS	.22	4.13	.0001		
FFMQ	-.07	-2.88	.005		
SCS	.41	.63	.53		
PSS*FFMQ	.002	.45	.65		
PSS*SCS	.06	.66	.51		
FFMQ*SCS	.03	.91	.36		
PSS*FFMQ*SCS	-.001	-.53	.60	.28	.002

Note. PSQI = Pittsburgh Sleep Quality Index; PSS = Perceived Stress Scale; FFMQ = Five-Facet Mindfulness Questionnaire; and SCS = Self-Compassion Scale.

APPENDIX A

Attention Check Questions

1. This item is here to be sure you are paying attention as you respond. If you have read this, please choose the "*Very Often*" response option. (This item was embedded in the Perceived Stress Scale, which consists of the following response options: "Never"; "Almost Never"; "Sometimes"; "Fairly Often"; and "Very Often.")

2. This item is here to be sure you are paying attention as you respond. If you have read this, please choose the "*About Half of the Time*" response option. (This item was embedded in the Self-Compassion Scale, which consists of the following response options: "Almost Never"; "Occasionally"; "About Half of the Time"; "Fairly Often"; and "Almost Always.")

3. This item is here to be sure you are paying attention as you respond. If you have read this, please choose the "*Rarely true*" response option. (This item was embedded in the Five-Facet Mindfulness Questionnaire, which consists of the following response options: "Never or Very Rarely True"; "Rarely True"; "Sometimes True"; "Often True"; and "Very Often or Always True.")

4. This item is here to be sure you are paying attention as you respond. If you have read this, please enter the number "*5*." (This item was embedded in the International Physical Activity Questionnaire Short-Form (IPAQ-SF), which consists of open-ended questions wherein participants have to provide numerical responses.)

5. This item is here to be sure you are paying attention as you respond. If you have read this, please choose the "*Very Often*" response option. (This item was embedded in the COVID-19 Perceived Stress Scale, which consists of the following response options: "Never"; "Almost Never"; "Sometimes"; "Fairly Often"; and "Very Often.")

APPENDIX B

Demographic Questionnaire

1. Indicate your age: _____ years _____ months

2. What is your gender?
   a. Male
   b. Female
   c. Non-binary
   d. Trans+
   e. If not listed, please specify: _____

3. Which of the following ethnic/racial group(s) do you consider yourself a member of? You can check multiple groups.
   a. Asian
   b. Biracial/Multiethnic
   c. Black/African American
   d. Caucasian/White
   e. Hispanic/Latino/a
   f. Multiracial/ethnic
   g. Native American/American Indian
   h. International (i.e., not native to the United States and U.S. culture)
   i. If not listed, please specify: _____

4. What is your current relationship status?
   a. Married/civil union
   b. Single
   c. Divorced
   d. Live-in partner
   e. If not listed, please specify: _____

5. What is your current academic class standing (based on number of credit hours attained)?
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior

6. Are you enrolled as a full-time or part-time student?
    a. Part-time (i.e., 11 credit hours or less per semester)
    b. Full-time (i.e., 12 credit hours or more per semester)

7. What is your current grade point average? _____

8. What is your current major in college? _____
    a. Check here if undeclared ____
9. How many years of education have you obtained? _____

10. What is your current employment status?
    a. Part-time employed
    b. Full-time employed
    c. Unemployed/not working
    d. Other (please describe): _____
    e. If employed, what is your job title? _____

11. If you are currently employed, when do you work?
    a. Morning (5am-12pm)
    b. Afternoon (12-6pm)
    c. Evening (6-11pm)
    d. Rotating/variable

12. What is your current living arrangement?
    a. In an apartment, dorm, or house on campus?
    b. In an apartment or house off campus?
    c. With your parents or family?
    d. Other (please specify): _____

13. Are you currently living with roommates?
    a. None
    b. Yes
    c. If so, how many?: _____

14. What is your height? _____ feet _____ inches

15. What is your weight? _____ lbs

APPENDIX C

Perceived Stress Scale (PSS; Cohen et al., 1983)

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. There are no right or wrong answers.

	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
4[R]. In the last month, how often have you dealt successfully with irritating life hassles?	0	1	2	3	4
5[R]. In the last month, how often have you felt that you were effectively coping with important changes that were occurring in your life?	0	1	2	3	4
6[R]. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
7[R]. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
8. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
9[R]. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4

	Never	Almost Never	Sometimes	Fairly Often	Very Often
10[R]. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
11. In the last month, how often have you been angered because of things that happened that were outside of your control?	0	1	2	3	4
12. In the last month, how often have you found yourself thinking about things that you have to accomplish?	0	1	2	3	4
13[R]. In the last month, how often have you been able to control the way you spend your time?	0	1	2	3	4
14. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

[R]Scored in the reverse direction.

APPENDIX D

The Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989)

Instructions: The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.				
1. During the past month, what time have you usually gone to bed at night?				[String variable]
2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?				[String variable]
3. During the past month, what time have you usually gotten up in the morning?				[String variable]
4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spend in bed.)				[String variable]
Instructions: For each of the remaining questions, select the best response. Please answer all questions.				
5. During the past month, how often have you had trouble sleeping because you…				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Cannot get to sleep within 30 minutes	0	1	2	3
b. Wake up in the middle of the night or early morning	0	1	2	3
c. Have to get up to use the bathroom	0	1	2	3
d. Cannot breathe comfortably	0	1	2	3
e. Cough or snore loudly	0	1	2	3
f. Feel too cold	0	1	2	3
g. Feel too hot	0	1	2	3
h. Had bad dreams	0	1	2	3
i. Have pain	0	1	2	3
j. Other reason(s), please describe and indicate how often you have had trouble sleeping because of each reason: [String variable]	0	1	2	3
6. During the past month, how would you rate your sleep quality overall?	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?	0	1	2	3
8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	0	1	2	3

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?	No problem at all (0)	Only a very slight problem (1)	Somewhat of a problem (2)	A very big problem (3)
10. Do you have a partner or roommate?	No bed partner or roommate (0)	Partner/room mate in other room (1)	Partner in same room, but not same bed (2)	Partner in same bed (3)
If you have a roommate or bed partner, ask them how often in the past month you have had…	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
a. Loud snoring	0	1	2	3
b. Long pauses between breaths while asleep	0	1	2	3
c. Legs twitching or jerking while you sleep	0	1	2	3
d. Episodes of disorientation or confusion during sleep	0	1	2	3
e. Other restlessness while you sleep; please describe	0	1	2	3

APPENDIX E

Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006)

Instructions: Please rate each of the following statements using the scale provided. Select the rating that best describes your own opinion of what is generally true for you.

	Never or Very Rarely True	Rarely True	Sometimes True	Often True	Very Often or Always True
1. When I'm walking, I deliberately notice the sensations of my body moving.	1	2	3	4	5
2. I'm good at finding words to describe my feelings.	1	2	3	4	5
3[R]. I criticize myself for having irrational or inappropriate emotions.	1	2	3	4	5
4. I perceive my feelings and emotions without having to react to them.	1	2	3	4	5
5[R]. When I do things, my mind wanders off and I'm easily distracted.	1	2	3	4	5
6. When I take a shower or bath, I stay alert to the sensations of water on my body.	1	2	3	4	5
7. I can easily put my beliefs, opinions, and expectations into words.	1	2	3	4	5
8[R]. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.	1	2	3	4	5
9. I watch my feelings without getting lost in them.	1	2	3	4	5
10[R]. I tell myself I shouldn't be feeling the way I'm feeling.	1	2	3	4	5

	Never or Very Rarely True	Rarely True	Sometimes True	Often True	Very Often or Always True
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.	1	2	3	4	5
12[R]. It's hard for me to find the words to describe what I'm thinking.	1	2	3	4	5
13[R]. I am easily distracted.	1	2	3	4	5
14[R]. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.	1	2	3	4	5
15. I pay attention to sensations, such as the wind in my hair or sun on my face.	1	2	3	4	5
16[R]. I have trouble thinking of the right words to express how I feel about things.	1	2	3	4	5
17[R]. I make judgments about whether my thoughts are good or bad.	1	2	3	4	5
18[R]. I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5
19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.	1	2	3	4	5
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.	1	2	3	4	5
21. In difficult situations, I can pause without immediately reacting.	1	2	3	4	5
22[R]. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.	1	2	3	4	5

	Never or Very Rarely True	Rarely True	Sometimes True	Often True	Very Often or Always True
23[R]. It seems I am "running on automatic" without much awareness of what I'm doing.	1	2	3	4	5
24. When I have distressing thoughts or images, I feel calm soon after.	1	2	3	4	5
25[R]. I tell myself that I shouldn't be thinking the way I'm thinking.	1	2	3	4	5
26. I notice the smells and aromas of things.	1	2	3	4	5
27. Even when I'm feeling terribly upset, I can find a way to put it into words.	1	2	3	4	5
28[R]. I rush through activities without being really attentive to them.	1	2	3	4	5
29. When I have distressing thoughts or images I am able just to notice them without reacting.	1	2	3	4	5
30[R]. I think some of my emotions are bad or inappropriate and I shouldn't feel them.	1	2	3	4	5
31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.	1	2	3	4	5
32. My natural tendency is to put my experiences into words.	1	2	3	4	5
33. When I have distressing thoughts or images, I just notice them and let them go.	1	2	3	4	5
34[R]. I do jobs or tasks automatically without being aware of what I'm doing.	1	2	3	4	5

	Never or Very Rarely True	Rarely True	Sometimes True	Often True	Very Often or Always True
35[R]. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.	1	2	3	4	5
36. I pay attention to how my emotions affect my thoughts and behavior.	1	2	3	4	5
37. I can usually describe how I feel at the moment in considerable detail.	1	2	3	4	5
38[R]. I find myself doing things without paying attention.	1	2	3	4	5
39[R]. I disapprove of myself when I have irrational ideas.	1	2	3	4	5

[R]Scored in the reverse direction.

APPENDIX F

Self-Compassion Scale (SCS; Neff, 2003)

Instructions: Please read each statement carefully before answering and indicate how often you behave in the stated manner, using the following scale: 1 = “almost never”; and 5 = “almost always.”

	Almost Never	Occasionally	About Half of the Time	Fairly Often	Almost Always
1[R]. I’m disapproving and judgmental about my own flaws and inadequacies.	1	2	3	4	5
2[R]. When I’m feeling down I tend to obsess and fixate on everything that’s wrong.	1	2	3	4	5
3. When things are going badly for me, I see the difficulties as part of life that everyone goes through.	1	2	3	4	5
4[R]. When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world.	1	2	3	4	5
5. I try to be loving towards myself when I’m feeling emotional pain.	1	2	3	4	5
6[R]. When I fail at something important to me I become consumed by feelings of inadequacy.	1	2	3	4	5
7. When I'm down and out, I remind myself that there are lots of other people in the world feeling like I am.	1	2	3	4	5
8[R]. When times are really difficult, I tend to be tough on myself.	1	2	3	4	5
9. When something upsets me I try to keep my emotions in balance.	1	2	3	4	5

	Almost Never	Occasionally	About Half of the Time	Fairly Often	Almost Always
10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.	1	2	3	4	5
11[R]. I'm intolerant and impatient towards those aspects of my personality I don't like.	1	2	3	4	5
12. When I'm going through a very hard time, I give myself the caring and tenderness I need.	1	2	3	4	5
13[R]. When I'm feeling down, I tend to feel like most other people are probably happier than I am.	1	2	3	4	5
14. When something painful happens I try to take a balanced view of the situation.	1	2	3	4	5
15. I try to see my failings as part of the human condition.	1	2	3	4	5
16[R]. When I see aspects of myself that I don't like, I get down on myself.	1	2	3	4	5
17. When I fail at something important to me I try to keep things in perspective.	1	2	3	4	5
18[R]. When I'm really struggling, I tend to feel like other people must be having an easier time of it.	1	2	3	4	5
19. I'm kind to myself when I'm experiencing suffering.	1	2	3	4	5
20[R]. When something upsets me I get carried away with my feelings.	1	2	3	4	5
21[R]. I can be a bit cold-hearted towards myself when I'm experiencing suffering.	1	2	3	4	5

	Almost Never	Occasionally	About Half of the Time	Fairly Often	Almost Always
22. When I'm feeling down I try to approach my feelings with curiosity and openness.	1	2	3	4	5
23. I'm tolerant of my own flaws and inadequacies.	1	2	3	4	5
24[R]. When something painful happens I tend to blow the incident out of proportion.	1	2	3	4	5
25[R]. When I fail at something that's important to me, I tend to feel alone in my failure.	1	2	3	4	5
26. I try to be understanding and patient towards those aspects of my personality I don't like.	1	2	3	4	5

[R]Scored in the reverse direction.

APPENDIX G

COVID-19 Pandemic Perceived Stress Measure

Instructions: The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. There are no right or wrong answers.

	Never	Almost Never	Sometimes	Fairly Often	Very Often
1. In the last month, I have felt nervous and stressed about the COVID-19 pandemic.	0	1	2	3	4
2. In the last month, I have felt that the difficulties related to the COVID-19 pandemic are increasing and I feel unable to overcome them.	0	1	2	3	4
3. In the last month, I have felt that I am unable to control the important things in my life because of the COVID-19 pandemic.	0	1	2	3	4
4. In the last month, I have felt worried about catching the COVID-19 virus.	0	1	2	3	4
5. In the last month, I have felt worried about my friends or family catching the COVID-19 virus.	0	1	2	3	4
6. In the last month, I have felt upset that the COVID-19 pandemic has disrupted my college experience (e.g., classes; socializing opportunities).	0	1	2	3	4

CURRICULUM VITAE

Jackie Ma, M.S.

Clinical Psychology Doctoral Intern

Indiana University School of Medicine
Department of Psychiatry | Indianapolis, IN

E-mail address: jm148@iu.edu

EDUCATION

University of Louisville *Louisville, KY*	**Ph.D. in Clinical Psychology** Advisor: Paul Salmon, Ph.D. GPA: 3.95 Dissertation (Defended): *The Combined Benefits of Dispositional Mindfulness and Trait Self-Compassion as Potential Buffers of the Effects of Perceived Stress on Sleep Quality in College-Aged Young Adults*	July 2017-June 2022 (anticipated)
Flinders University *Adelaide, South Australia*	**Bachelor of Arts (Honors) in Psychology**	Feb-Nov 2015
James Cook University *Singapore*	**Bachelor of Arts in Psychology**	Feb 2012-June 2014

CLINICAL EXPERIENCE

Indiana University School of Medicine	**Clinical Psychology Doctoral Intern,** *Adult Health Track*	July 2021-June 2022 (anticipated)

Department of Psychiatry

Current Rotations (Jan-June 2022):

1. **Advanced Pain Therapies Clinic** *(In-Person)*
   Supervisor: Dr. Danielle Henderson, HSPP
   - Conduct pre-surgical evaluations for pain pumps and spinal cord stimulators in patients with chronic pain
   - Provide cognitive behavioral therapy and mindfulness- and acceptance-based therapies to patients with chronic pain

2. **Adult Outpatient Clinic** (*Hybrid*)
   Supervisor: Dr. Danielle Henderson, HSPP
   - Conduct semi-structured clinical interviews, diagnostic assessments, and individual psychotherapy for patients presenting with mood, anxiety, and posttraumatic stress disorders

3. **Integrated Care** (*Telehealth*)
   Supervisors: Dr. Danielle Henderson, HSPP; and Dr. Sarah Landsberger, HSPP
   - Conduct diagnostic evaluations for patients referred by primary care providers with psychiatric concerns such as depression and anxiety and/or health behavior change concerns
   - Provide brief individual psychotherapy and behavioral health interventions for patients with psychiatric and/or health behavior change concerns
   - Consult with medical team members

4. **Weight Management Clinic** (*In-Person*)
   Supervisor: Dr. Elaine Gilbert, HSPP
   - Conduct semi-structured biopsychosocial interviews with interdisciplinary medical team (e.g., pediatric gastroenterologist; dietitian) for children and adolescents presenting with weight management concerns and co-morbid medical and mental health concerns
   - Provide brief behavioral interventions to promote healthy eating and physical activity habits in children and adolescents with weight management concerns

Past Rotations (July-Dec 2021):

1. **Advanced Heart and Lung Care Clinic** (*In-Person*)
   Supervisor: Dr. Yelena Chernyak, HSPP
   - Conducted pre-lung and heart transplant evaluations in adult patients with end-stage pulmonary or cardiac disease
   - Provided brief mindfulness-based and cognitive behavioral therapies within an inpatient setting to patients who recently received a lung or heart transplant and are presenting with acute adjustment difficulties
   - Provided outpatient mindfulness-based interventions and cognitive behavioral therapy to posttransplant patients presenting with adjustment and mood difficulties

2. **Adult Behavioral Sleep Medicine Clinic** (*Telehealth*)
   Supervisor: Dr. Yelena Chernyak, HSPP
   - Conducted semi-structured intakes for adults presenting with sleep difficulties including chronic insomnia, circadian rhythm sleep disorders, obstructive sleep apnea, and hypersomnia
   - Provided *Cognitive Behavioral Therapy for Insomnia* (CBT-I) to adult patients presenting with chronic insomnia and/or comorbid obstructive sleep apnea, circadian rhythm sleep disorders, chronic health conditions, and mood disorders
   - Served as a co-facilitator for two virtual CBT-I groups. This was a four-week group that had an average of 5-6 participants per group.

3. **IU Simon Cancer Clinic** (*Telehealth*)
   Supervisors: Dr. Yelena Chernyak, HSPP (Jul-Oct '21); and Dr. Lezlie Blackford, HSPP (Oct-Dec '21)
   - Conducted semi-structured intakes for adults with comorbid cancer history and mood or adjustment difficulties
   - Provided mindfulness- and acceptance-based interventions and cognitive behavioral therapy to adult patients presenting with coping and adjustment difficulties with their cancer diagnoses

4. **Traumatic Stress Clinic** (*Telehealth*)
   Supervisor: Dr. Michelle Miller, HSPP
   - Conducted semi-structured intakes for adults presenting with posttraumatic stress disorder (PTSD), including individuals with complex childhood trauma histories and traumatic perinatal and/or postpartum experiences
   - Received training by supervisor in empirically supported treatments for PTSD, including *Prolonged Exposure*, *Cognitive Processing Therapy*, and *Narrative Exposure Therapy*
   - Provided empirically supported treatments for PTSD to adults with a history of complex childhood trauma, sexual assault, and/or traumatic perinatal and/or postpartum experiences

5. **Simon-Skjodt Behavioral Health Center** *(In-Person)*
   Supervisor: Dr. Melissa Butler, HSPP
   - Co-facilitated a *Dialectical Behavioral Therapy* Skills group for adolescents who are undergoing a brief inpatient stay due to suicidality or risk concerns
   - Attended rounds conducted by an interdisciplinary medical team

University of Louisville
Noble H. Kelley Psychological Services Center

Graduate Student Therapist

Aug 2017-June 2021

1. **Integrative Intervention Team** (*Aug 2020-Jun 2021*)
   Supervisor: Richard Lewine, Ph.D., HSPP
   - Provided mindfulness-based interventions and cognitive behavioral therapy via telehealth to clients presenting with anxiety- and mood disorders

2. **Mindfulness in Health Team** (*Aug 2018-Aug 2020*)
   Supervisor: Paul Salmon, Ph.D., HSPP
   - Conducted semi-structured psychotherapy intake interviews for adolescents and adults presenting with comorbid medical and anxiety- and/or mood disorders
   - Provided mindfulness-based interventions and cognitive behavioral therapy in-person and via telephone to clients presenting with comorbid medical and anxiety- and/or mood disorders

3. **Child & Adult Assessment Clinic** *(Jun 2018-Jun 2021)*
   Supervisors: Bernadette Walter, Ph.D., HSPP; and David Winsch, Ph.D., HSPP
   - Conducted semi-structured intake interviews for incoming child and adult clients seeking psychological assessments
   - Conducted assessments for adult clients with questions of ADHD, anxiety, and depression
   - Conducted gifted and talented assessments for child clients to aid Jefferson County Public Schools in determining their eligibility for Advanced Placement programs
   - Administered and scored relevant psychological assessments to child and adult clients, including the Wechsler Intelligence Scale for Children Fifth Edition (*WISC-V*) and Wechsler Adult Intelligence Scale Fourth Edition (*WAIS-IV*)
   - Prepared integrative reports detailing client's history, presenting problem(s), key symptoms, diagnosis, treatment suggestions, and relevant accommodations under the supervision of licensed clinical psychologists

4. **Eating Disorder Specialty Team** (*Aug 2017-Aug 2018*)
   Supervisor: Cheri Levinson, Ph.D., HSPP
   - Conducted semi-structured intakes for adolescents and adults presenting with eating disorders including anorexia nervosa and binge eating disorder as well as comorbid anxiety- and mood disorders
   - Provided cognitive behavioral therapy to clients presenting with eating-, anxiety-, and mood disorders, and related comorbidities
   - Facilitated bi-monthly eating disorder recovery support group for individuals in the community

Sleep Health Center *Louisville, KY*	**Graduate Student Therapist** Supervisor: Ryan Wetzler, Psy.D., HSPP • Conducted structured psychotherapy intake interviews for adult clients • Provided biofeedback services (i.e., thermal, electromyography, and skin conductance) to adult clients presenting with anxiety, chronic pain, and stress management concerns • Provided *Cognitive Behavioral Therapy for Insomnia* in person and via telehealth to adult clients presenting with sleep disorders including chronic insomnia, sleep apnea, and circadian rhythm sleep disorders and comorbid medical-, mood-, and personality disorders	July 2019-July 2020
University of Louisville Hospital *Depression Center*	**Graduate Student Therapist** Supervisor: Paul Salmon, Ph.D., HSPP • Assisted with facilitating the "Mindfulness: An Eight-Week Plan for Finding Peace in a Frantic World" program for patients at the Depression Center presenting with mood- and anxiety disorders	Feb-June 2018

PEER-REVIEWED PUBLICATIONS

Levinson, C. A., Sala, M. Murray, S., **Ma, J**., Rodebaugh, T. L., & Lenze, E. C. (2019). Diagnostic, clinical, and personality correlates of food anxiety during a food exposure in patients diagnosed with an eating disorder. *Eating and Weight Disorders, 24*(6), 1079-1088.

Wu, L., Farquhar, J., **Ma, J.**, & Vidyarthi, A. R. (2018). Understanding Singaporean medical students' stress and coping. *Singapore Medical Journal, 59*(4), 172-176.

Sung, S. C., **Ma, J.**, Earnest, A., Rush, A. J., Lim, L. E. C., & Ong, M. E. H. (2018). Screening for panic-related anxiety in emergency department patients with cardiopulmonary complaints: A comparison of two self-report instruments. *Psychiatry Research, 263*, 7-14.

Levinson, C. A., Brosof, L. C., **Ma, J.**, Fewell, L., & Lenze, E. J. (2017). Fear of food prospectively predicts drive for thinness in an eating disorder sample recently discharged from intensive treatment. *Eating Behaviors, 27*, 45-51.

MANUSCRIPTS IN PREPARATION

Hicks, A., **Ma. J**., Salmon, P., Phillips, K., Siwik, C., & Sephton, S.E. (In preparation, 2021). *The Role of Self-Compassion in a Stress-Health Pathway*.

Siwik, C., Phillips, K., Hicks, A., Salmon, P., Jablonski, M., van der Gryp, K., **Ma, J.**, Moore, L., & Sephton, S. (In preparation, 2021). *An MBSR Intervention for Parkinson's Disease Patients and Caregiving-Partners: Effects on Distress, Social Support, Cortisol, and Inflammation*.

CONFERENCE PRESENTATIONS

Wong, J. C. M., Wan, J. S. M., Goth, K., **Ma, J.**, Chan, M. Y. K., Chan, C. S. M., & Nur d/o Mohd Abdullah, F. (2018, July 25). *A pilot study of AIDA in a Singaporean Adolescent Sample*. Poster presented at the 23rd World Congress of the International Association for Child and Adolescent Psychiatry and Allied Professions, Prague, Czech Republic.

Ma, J., Levinson, C.A. (2018, April 21). *The effect of manipulating the theoretical framing of exposure therapy for eating disorders on clinicians' treatment preferences*. Poster presented at the 25th International Conference on Eating Disorders, Chicago, Illinois.

Ma, J., Sala, M., Rodebaugh, T., Lenze, E.C., Levinson, C.A. (2018, April 21). *Correlates of food anxiety during a meal in patients diagnosed with an eating disorder.* Poster presented at the 25th International Conference on Eating Disorders, Chicago, Illinois.

Wong, J. C. M., **Ma, J. W.**, & Nyein, N. (2016, October 29). *Comparison of stressors experienced between Asian adolescent suicide attempters and matched controls in Singapore across age groups*. Poster presented at the 63rd annual meeting of the American Academy of Child and Adolescent Psychiatry, New York, New York.

Ma, J., Ng, M., Sung, S. C., & Ong, M. (2015, March 26). *Sociodemographic correlates of recurrent emergency medicine 149tilization by patients with panic-like anxiety: An exploratory study.* Individual oral presentation presented at the 5th ASEAN Regional Union of Psychological Societies Congress, Singapore.

GRADUATE RESEARCH EXPERIENCE

University of Louisville
Mindfulness and Biobehavioral Health Research Laboratory

Graduate Research Assistant — Feb 2018-June 2021

Supervisor: Paul Salmon, Ph.D.

1. Project: **Mindfulness-based Move/Stretch/Strengthen Program**
   - Assisted with developing and implementing the program at the Kentucky Air National Guard for Air National Guard personnel with marginal performance on their annual fitness test
   - Participated in weekly program development meetings

2. Project: **A Brief iPod-based Mindfulness Intervention for Undergraduates**
   - Assisted as a co-author with a manuscript examining the potential buffering effect of self-compassion on stress-related psychological variables (e.g., negative affect, anxiety, and depression) and neurophysiological (i.e., HPA) reactivity as measured by salivary cortisol in undergraduates across three time points within an academic semester

3. Project: **Mindfulness-based Stress Reduction for Patients with Parkinson's Disease and their Caregivers**
   - Assisted as a co-author with a manuscript examining the effects of an eight-session MBSR intervention on disease-specific distress, appraisal of social support, HPA-axis function, and immune function in patients with Parkinson's Disease and their caregivers

University of Louisville
Eating Anxiety Treatment Laboratory

Graduate Research Assistant — July 2017-Jan 2018

Supervisor: Dr. Cheri Levinson

- Collaborated with Dr. Levinson to design an experimental study investigating the effects of manipulating the theoretical framing of exposure therapy for eating disorders on clinicians' treatment preferences. Presented findings at the 25th International Conference on Eating Disorders.
- Assisted with writing publications
- Facilitated lab meetings to discuss current eating disorder literature and project tasks with undergraduate research assistants
- Supervised and trained undergraduate research assistants in data entry and lab-related tasks

CLINICAL TEACHING EXPERIENCE

University of Louisville
Noble H. Kelley Psychological Services Center

Clinical Graduate Teaching Assistant — July 2019-June 2021

1. Course: **Clinical Psychology Practicum** (Spring 2021)
   Supervisor: Alison McLeish, Ph.D.
   - Served as one of four clinical graduate teaching assistants to teach first year graduate students foundational therapy skills via online, synchronous instruction on a weekly basis
   - Observed students' weekly in-class roleplays and provided feedback via online, synchronous instruction
   - Provided peer supervision to first year graduate student therapists including rendering assistance with psychotherapy intakes and addressing their questions about providing clinical services within the Psychological Services Center

2. Course: **Interviewing Skills Practicum** (Summer 2020)
   Supervisor: Barbara Stetson, Ph.D.
   - Served as one of four clinical graduate teaching assistants to teach incoming first year graduate students fundamental clinical interviewing skills via online, synchronous instruction
   - Facilitated students' weekly in-class seminar-style discussions on their readings and roleplay experiences via online, synchronous instruction
   - Graded students' weekly reflections and provide feedback
   - Observed students' weekly in-class roleplays and provided feedback via online, synchronous instruction

3. Course: **Intellectual and Cognitive Assessment** (Spring 2020)
   Supervisor: Bernadette Walter, Ph.D.
   - Served as one of four clinical graduate teaching assistants to teach the administration of the Wechsler Adult Intelligence Scale Fourth Edition (*WAIS-IV*) and the Wechsler Intelligence Scale for Children Fifth Edition (*WISC-V*) to first year graduate students
   - Demonstrated the administration of the *WAIS* and *WISC-V* to students during weekly lessons
   - Facilitated and observed students' weekly in-class roleplays and provided feedback

4. Course: **Interviewing Skills Practicum** (Summer 2019)
   Supervisor: Barbara Stetson, Ph.D.
   - Served as one of four clinical graduate teaching assistants to teach incoming first year graduate students fundamental clinical interviewing techniques
   - Facilitated students' weekly in-class seminar-style discussions on their readings and roleplay experiences
   - Graded students' weekly reflections and provided feedback
   - Observed students' weekly in-class roleplays and provided feedback
   - Designed one of seven classes on multicultural considerations in interviewing, including recruiting volunteers of diverse cultural backgrounds to serve as volunteer roleplay clients for the first-year students and facilitating a panel wherein the volunteers shared their perspectives on multicultural considerations in interviewing

PEER SUPERVISORY EXPERIENCE

University of Louisville
Noble H. Kelley Psychological Services Center

Peer Supervisor — Aug 2020-June 2021

Rotation: Integrative Intervention Team
Supervisor: Richard Lewine, Ph.D.
- Provided biweekly peer supervision to junior graduate student therapists on the team

University of Louisville
Noble H. Kelley Psychological Services Center

Clinical Graduate Teaching Assistant

May 2019-June 2021

Supervisor: Bernadette Walter, Ph.D.

- Provided peer supervision to graduate student therapists working in the Psychological Services Center including rendering assistance with psychotherapy intakes as well as addressing their questions about providing therapy services and assessments
- Served as first-line contact for management of crisis situations within the Psychological Services Center
- Facilitated fellow graduate students' adherence to clinic operating procedures

ADMINISTRATIVE EXPERIENCE

University of Louisville
Noble H. Kelley Psychological Services Center

Clinical Graduate Teaching Assistant

May 2019-June 2021

Supervisor: Bernadette Walter, Ph.D.

- Coordinated via phone the initiation of treatment and asssessment services for individuals contacting the clinic by conducting phone intakes and/or providing referrals to community resources and other service providers
- Collaborated with external agencies to provide referrals, outreach, and client case management
- Aided with management of clinic operations, including scheduling, payment records, and chart audits

COMMUNITY OUTREACH

University of Louisville
Noble H. Kelley Psychological Services Center

- Organized and coordinated the clinic's annual **Depression Screening Day**, a free service offered to the community as part of Depression Awareness Month
- Promoted awareness of the event on the University of Louisville campus
- Supervised fellow graduate students assisting with the screenings

Oct 17 2019

University of Louisville

Presentation Title: **Stress and Coping**

June 4 2019

- Co-facilitated an interactive hour-long presentation on the application of mindfulness for stress management to rising sophomore and junior undergraduate students who are interested in health professions
- Taught and led attendees through informal and formal mindfulness practices

TEACHING EXPERIENCE

University of Louisville *Department of Psychological and Brain Sciences*	**Graduate Teaching Assistant** Undergraduate courses: 1. **Quantitative Methods in Psychology** (Fall 2018; Spring 2019) Supervisor: Maria Kondaurova, Ph.D. 2. **Psychology of Diversity** (Spring 2018) Supervisor: Keith Lyle, Ph.D. 3. **Personality** (Fall 2017) Supervisor: Alison McLeish, Ph.D.	Aug 2017- April 2019

ADDITIONAL CLINICAL TRAINING

University of Miami	**Mindful Self-Compassion Core Skills Workshop** Instructors: Drs. Chris Germer and Kristin Neff Total hours: 16	Oct 12-13 2018
University of Louisville	**The Body Project Eating Disorder Prevention Program—Peer Facilitator Two-Day Training (University Version)** Instructor: Alan Duffy, M.S. Total hours: 14.5	Jan 2018

PROFESSIONAL DEVELOPMENT

University of Louisville, *LGBT Center*	Workshop: **Working with Parents/Guardians of LGBTQ+ Youth in the Clinical Setting** (*virtual*) Total hour: 1	9 Feb 2021
Asian Americans Advancing Justice—Chicago and Hollaback!	Workshop: **Bystander Intervention to Stop Anti-Asian/American and Xenophobic Harassment** (*virtual*) Total hour: 1	30 Nov 2020
University of Louisville, *LGBT Center*	Workshop: **Intersectionality and Trans/Nonbinary Affirming Practices** (*virtual*) Total hour: 1	16 Sep 2020
Kentucky Psychological Association Annual Convention	Workshop: **Bringing Psychologists to the Fight Against Deep Poverty** (*in-person*) Presenter: Rosie Davis, Ph.D. Total hours: 3	16 Nov 2019

University of Louisville	Workshop: **PLAN Workshop – The Teaching Toolbox** (*in-person)* Presenter: Michelle Rodems, Ph.D. Total hour: 5	17 Aug 2018

AWARD

May 2019	**University of Louisville**	Departmental Award: **Excellence in Clinical Practice for Junior Students**

MEMBERSHIPS IN PROFESSIONAL ORGANIZATIONS

Asian American Psychological Association, *student member*	2021-present
Society for a Science of Clinical Psychology, *student member*	2020-present

REFEREES

Paul Salmon, Ph.D.
E-mail: paul.salmon@louisville.edu
Associate Professor
Department of Psychological and Brain Sciences
University of Louisville

Bernadette Walter, Ph.D.
E-mail: bernadette.walter@louisville.edu
Professor (Term)
Department of Psychological and Brain Sciences
University of Louisville

Michelle Miller, Ph.D.
E-mail: mlm41@iu.edu
Assistant Professor
Department of Psychiatry
Indiana University School of Medicine