Examining the Dimensions of Discrimination that Predict Sleep Health in Minoritized Racial and Ethnic College Students

by

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DISSERTATION ABSTRACT

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Title: Examining the Dimensions of Discrimination that Predict Sleep Health in Minoritized Racial and Ethnic College Students

Discrimination is a well-documented stressor that adversely impacts mental and physical health. While numerous studies have explored the relationship between discrimination and mental health, as well as between sleep and overall health, fewer studies have specifically examined how different forms of discrimination affect Sleep Health among minoritized racial and ethnic college students. This study aimed to investigate the effects of various dimensions of discrimination on Sleep Health in a diverse sample of college students. By employing a multi-method, micro-longitudinal design, this research seeks to provide a nuanced understanding of potential mechanisms associated to and contributing to overall racial and ethnic health disparities.

The study included 82 minoritized racial and ethnic college students who completed measures of discrimination, including the Everyday Discrimination Scale, Scale of Ethnic Experiences, Perceived Ethnic Discrimination Questionnaire, and Daily Racial Discrimination. Sleep Health was assessed using subjective daily dairy measures, and potential confounding effects of gender, age, race, ethnicity, parental education, and mental health were controlled for in the analyses. Results indicated, contrary to prior research, that discrimination was not a significant predictor of overall Sleep Health. When covariates were entered into the model, ethnic experiences of discrimination and average parental education emerged as significant predictors of Sleep Health. Post-hoc exploratory analyses were also conducted, and results

revealed that mental health emerged as a significant predictor of specific sleep indices, such as sleep quality and sleep efficiency.

These results suggest that while discrimination impacts certain aspects of sleep, its effects may be more nuanced and context-dependent than previously understood. The results highlight the complexity of the relationship between discrimination and sleep among minoritized racial and ethnic college students. The study underscores the need for more large-scale epidemiological research focused specifically on discrimination and Sleep Health. Additionally, interventions targeting mental health may play a crucial role in improving sleep outcomes for this population.

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DEDICATION

Todos mis esfuerzos son dedicados a mi mamá y mi papá. Gracias por todos sus sacrificios, palabras de aliento, llamadas de terapia, y su amor y apoyo incondicional. Nunca sabrán lo orgullosa que estoy de ser su hija. Me han enseñado a perseguir todos mis sueños, sin importar el tamaño. Por eso, estoy eternamente agradecida e inspirada a seguir soñando. Los amo con todo mi corazón.

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CHAPTER 1

BACKGROUND

Health disparities between racial and ethnic groups have received increasing attention across many health domains in recent years. Cardiovascular disease (CVD), diabetes, asthma, HIV/AIDS, and tuberculosis are significantly more common among minoritized racial and ethnic groups than Whites. For example, compared to non-Hispanic Whites, African Americans/Black individuals are 43% more likely to develop hypertension, 95% more likely to have a stroke, and 30% more likely to die from CVD (Kingsbury et al., 2013). Similarly, higher rates of cardiovascular risk factors, such as obesity, dyslipidemia, diabetes, and poor blood pressure, have been reported among Hispanics/Latinx compared to Whites (Adler & Rehkopf, 2008; Grandner et al., 2016). These racial and ethnic disparities persist even after adjusting for education and socioeconomic status. Several factors play a role in these inequities, including social environment, access to health care and other services, and psychosocial risk factors, including exposure to racial discrimination (Grandner et al., 2012; Williams et al., 2003). Understanding and reducing health disparities is an important public health goal that will depend on advances in identifying disease risk factors and mechanisms (Grandner et al., 2012; Williams et al., 2003).

Prevalence of Sleep Disturbance

Sleep may be a factor underlying some health disparities (Hale & Do, 2007). Sleep disturbances include various challenges such as trouble falling asleep, trouble maintaining sleep, shorter sleep than average, higher activity during sleep, several extended night awakenings, or sleep schedules that vary from night to night (Yip, 2018). Sleep is a biological requirement for

humans, and it plays a crucial role in many other physiological systems within our body. Sleep disturbances are associated with compromised physical and psychological health outcomes. Sleep disturbances are linked to severe medical conditions such as cardiovascular disease, diabetes mellitus, cancer, neurocognitive function, hypertension, and even premature death (Grandner, 2017; Grandner et al., 2012; Kachikis & Breitkopf, 2012). One epidemiological study from 2004-2007 of 110,441 US adults found that sleep duration is associated with cardiovascular disease, diabetes risk factors, depression, and mortality (Krueger & Friedman, 2009). Likewise, poor sleep can impact mental health and well-being, such as contributing to depression or depressive symptoms, anxiety (Hamilton et al., 2007), and psychological distress (Beatty et al., 2011; Yip, 2014). The American Academy of Sleep and Medicine and Sleep Research Society broadly categorized the effects of insufficient sleep as impacting general health, cardiovascular health, metabolic health, mental health, immunologic health, human performance, cancer, pain, and mortality (Grandner, 2017).

Research has found that sleep patterns in the US have significantly changed in the past few decades. One epidemiological study conducted by Knutson et al. in 2010 revealed a notable shift in sleep habits among the US population over the past 30-40 years. The findings indicated an evident increase in the prevalence of individuals who sleep for fewer than eight hours per night, commonly referred to as "short sleepers." A national study, conducted by the Behavioral Risk Factor Surveillance Systems (BRFSS) in 2006 surveyed more than 150,000 residents across 26 US states asking: “Over the last two weeks, how many days have you had trouble falling asleep or staying asleep or sleeping too much?” The results, for men, indicated a prevalence of sleep disturbance ranging from 13.7% (ages 70-74) to 18.1% (18-24), and for women, the prevalence ranged from 17.7% (ages 80 or older) to 25.1% (ages 18-24) (Grandner, 2017).

The National Sleep Foundation (2023) recommends that adults get 7-9 hours of sleep per night, but the amount of time Americans spend asleep has decreased steadily. A large cross-sectional epidemiological study found that on average, the sleep duration for American adults is only 6.9 hours per night (Patel et al., 2004). These numbers are even worse among young adults, especially college students (Doane et al., 2015; Sladek & Doane, 2015) and are disproportionately prevalent in minoritized racial and ethnic groups (Grandner et al., 2013, 2016; Kingsbury et al., 2013; Slopen & Williams, 2014). These data underscore the significance of sleep disturbances across different demographic groups and highlights the need for further research and interventions to address sleep-related problems effectively.

Sleep Health Framework

In the past, sleep characteristics were broadly described in terms of sleep duration, sleep quality, and sleep variability (Kachikis & Breitkopf, 2012). In more recent years, the study of sleep has shifted toward a multidimensional framework that promotes mental and physical health. This new Sleep Health framework emphasizes that all individuals' sleep patterns can be characterized across several domains, regardless of the presence or absence of sleep disorders. Additionally, the Sleep Health framework aims to promote overall healthy sleep as opposed to focusing on a smaller proportion of individuals with abnormal sleep or disordered sleep (Buysse, 2014a; Wallace et al., 2020a).

Sleep Health is a multidimensional pattern of sleep-wakefulness adapted to the individual and social and environmental demands to promote physical and mental well-being. Although there remains a debate on the number of relevant sleep dimensions in the literature (Buysse, 2014a; Wallace et al., 2018), the most common domains include: 1) Regularity: the consistency of sleep timing; 2) Satisfaction: the subjective assessment of "good" or "poor" sleep (collected

through self-report); 3): Alertness/Sleepiness: the ability to maintain attentive wakefulness throughout the day; 4) Timing: the placement of sleep within the 24-hour day; 5) Efficiency: the ability to achieve consolidated sleep or the proportion of the time that an individual spends asleep from the moment they fall asleep to the moment they wake up; 6) Duration: described as the total amount of sleep obtained per 24 hours (Buysse, 2014a; Wallace et al., 2018). Good Sleep Health is categorized as subjective sleep satisfaction, appropriate sleep timing, adequate sleep duration and consistency, high sleep efficiency, and sustained alertness throughout the day. These sleep dimensions are reported to be good indicators of Sleep Health. First, each one is associated with health outcomes, although with somewhat different outcomes for each one. Second, each dimension can be expressed in positive terms; however, this does not imply that all dimensions are unidirectional. For example, sleep duration and timing are "good" if they fall within a range, but "poor" if they deviate from this range. Third, most dimensions can be measured across self-report, behavioral, and physiological levels of analyses. Self-report can be obtained using retrospective measures or daily sleep diaries. Finally, each dimension has acceptable face validity (Buysse, 2014a).

Sleep Assessment

As the understanding of good Sleep Health increases, properly assessing sleep is crucial. Various research methodologies are employed to accurately evaluate each sleep dimension. Objective measurements of sleep can be obtained using equipment such as actigraphy watches and polysomnography (PSG). Actigraphy watches are worn by individuals to monitor their physical movements during the day and/or night, which can be used to assess sleep duration, efficiency, and latency. PSG records brain waves, blood oxygen levels, heart rate, breathing, eye movement, and leg movement during sleep, enabling the measurement of sleep duration,

efficiency, architecture (the organization and structure of sleep cycles), and disordered breathing (Beatty et al., 2011).

Subjective measurements of sleep can be obtained through self-reports, which come in two forms: retrospective measures and daily diaries. Retrospective measures, such as the Pittsburgh Sleep Quality Index (PSQI, (Buysse et al., 1988), measure sleep quality over the previous month. However, retrospective measures have limitations as participants may not recall sleep patterns accurately. Daily diaries, on the other hand, require individuals to report on their sleep behaviors, such as bedtime and wake time, every day, resulting in a more accurate representation of sleep patterns across multiple nights. Daily self-reports are also useful in capturing day-to-day variability in sleep.

Minoritized Racial and Ethnic Sleep Disparities

Studies examining race-related disparities in sleep consistently demonstrate that minoritized racial and ethnic groups are more likely to report disturbed sleep compared to White individuals (Grandner et al., 2016; Johnson et al., 2019; Kingsbury et al., 2013; Loredo et al., 2010; Whinnery et al., 2014). These disparities are apparent as early as infancy and continue through childhood and persist through adulthood (Caraballo et al., 2022; Gaston & Jackson, 2021). Furthermore, racial and ethnic sleep disparities are evident across subjective (self-report) and objective (polysomnography, actigraphy) measures (Yip & Cheon, 2020). Specifically, minoritized racial and ethnic individuals report having shorter sleep duration (Grandner, 2017; Johnson et al., 2019; Kingsbury et al., 2013; Whinnery et al., 2014), worse sleep quality (Grandner et al., 2016; Johnson et al., 2019), and less restorative sleep (Kingsbury et al., 2013) compared to Whites (Grandner et al., 2013; Pigeon et al., 2011). In fact, one national study of diverse individuals found that minoritized racial and ethnic groups experienced very short sleep

(< 5 hours per night) or short sleep (5-6 hours per night) at 2.5 times the rate of non-Hispanic Whites even after adjusting for various other demographic (sex, age, marital status) and socioeconomic covariates (Whinnery et al., 2014).

A meta-analysis (Johnson et al., 2019) comparing sleep patterns among different ethnic groups, found that Black, Hispanic/Latino and Chinese participants had shorter sleep durations compared to Whites, with means of 6.05, 6.56, and 6.35 hours respectively, compared to 6.85 hours for Whites. Additionally, a higher prevalence of less than 6 hours of sleep was observed among Black, Hispanic/Latino and Chinese participants (49.4 %, 43.4% and 37.1% respectively) compared to Whites (19.4%). Finally, Black, Hispanic/Latino, and Chinese participants reported poorer sleep quality compared to Whites, with prevalence rates of 8.3%, 6.7%, and 6.6% respectively, compared to 5.0% for Whites.

Other studies have reported differences in sleep architecture, or the percentage of time spent in rapid eye movement (REM) and non-REM sleep between different racial groups. For example, one study found that Latino children experience less deep sleep (slow wave sleep, SWS) than White children (Loredo et al., 2010), while other studies have found that African/Black Americans are consistently shown to have less SWS and lighter (stages 1 and 2) sleep than White Americans. Similarly, research demonstrates that minoritized racial and ethnic groups are at higher risk of being diagnosed with sleep disorders such as sleep apnea, the most common sleep-related breathing disorder, (Petrov & Lichstein, 2016) and insomnia (Bethea et al., 2020; Kaufmann et al., 2016), characterized by difficulty falling or remaining asleep despite adequate opportunities to sleep.

Sleep disparities among racial and ethnic minoritized groups can stem from various social and environmental factors. More research is demonstrating an association between

disadvantaged residential environments and poor sleep. A meta- analysis by Billings et al., (2019) described neighborhood disadvantages as the measure of the socioeconomic features of the neighborhood residents. It is often calculated using the census data such as high poverty, female-headed households, unemployment, public assistants, and low home ownership. Using the data from the Multi-Ethnic Study of Atherosclerosis, this study reported that neighborhood disadvantages have been associated with longer WASO in adults and increased sleepiness in women. This meta-analysis also revealed that an unfavorable social environment, such as stigma, safety, and violence, can contribute to sleep deprivation, insomnia symptoms, and circadian disruptions (Billings et al., 2020). Residential segregation, due to race and ethnicity and economic status, can also expose certain groups to risks and hazards that lead to disrupted sleep (Hale & Do, 2007). Studies have found that residing in neighborhoods characterized by high levels of noise and air pollution, often prevalent in low-income and minoritized communities, can disrupt sleep patterns (Jackson et al., 2020; Williams, 2012; Williams & Mohammed, 2009). Other research demonstrates that racial and ethnic minoritized children are more likely to live in environments with factors impacting sleep quality, such as a higher number of sleepers per room, proximity to room noise, and inner-city living compared to White children (Loredo et al., 2010; Pedraza et al., 2012).

Cultural beliefs and practices related to sleep, such as napping and co-sleeping, may also differ among ethnic groups and could contribute to Sleep Health disparities (Grandner et al., 2013). In fact, in some cultures, sleep is not considered to be a production of the self, but instead perceived to belong to the entire community as reflected by the African proverbial saying "Ubunti" (i.e., "I am, because we are") (Airhihenbuwa et al., 2016). Additionally, the stressors associated with being part of the minoritized group (e.g., discrimination and socioeconomic

disadvantage) can lead to chronic sleep disturbances (Slopen et al., 2016). The accumulation of stress over time can result in biological changes that disrupt the natural sleep cycle, leading to sleep problems and chronic diseases (Grandner et al., 2013).

Psychological Stress and Stress Response

To understand the effects of stress on sleep, it is important to further explore the broader implications of stress on health. The impact of stress exposure on health is widely acknowledged (Lazarus & Folkman, 1984). Stress is a known threat to homeostasis, which refers to the maintenance of vital physiological parameters required for survival (McEwen, 2000). Psychological stress occurs when an individual perceives that environmental demands tax or exceed their ability to adapt (Cohen et al., 2007). The stress and coping theory established by Lazarus and Folkman (1984) posits that the psychological and physiological effects of a particular stressor depend not only on the characteristics of the actual events or circumstances but also the individual's perception of the threat posed by the stressor and on resulting coping responses. For example, one may report experiencing very little stress but still believe it has a great impact on their health, this may be especially true among groups facing disproportionate psychosocial stressors and health inequalities. Evidence suggests that accumulated strain from daily stressors may contribute to more physiological damage than a single stressful event (McEwen, 2006). The body's response to stress involves activating physiological and behavioral central nervous systems and peripheral adaptive responses.

The stress response is comprised of two key mechanisms: the autonomic nervous system and the hypothalamic- pituitary-adrenal (HPA) axis. These two systems promote adaptation or "allostasis." (McEwen, 1999). Activation of the HPA axis during an acute stressor initiates a cascade of events with the hypothalamic release of corticotrophin-releasing factor (CRH), also

known as corticotrophin-releasing hormone (CRH). CRF binds to the receptors of the anterior pituitary gland, leading to the release of adrenocorticotropic hormone (ACTH). ACTH then binds to receptors of the adrenal cortex, prompting the secretion of cortisol. Cortisol continues to be released for several hours following the encountered stressor. Once a certain blood concentration level of cortisol is reached, negative feedback occurs. Upon the cessation of hormone release, the system returns to homeostasis (McEwen, 1998, 2000).

However, if there is an over- or under-activation of these systems, it can begin to create problems for the body. Allostatic load or "wear and tear" on the body occurs when the allostatic systems responsible for maintaining stability through change (such as the stress response), are overwhelmed, fail to shut off and return to normal functioning, or fail to respond adequately to stressors. This can ultimately lead to other bodily systems compensating and overreacting (McEwen, 1998, 1999). While moderate stress can be beneficial, if these responses become excessive and/or prolonged, they may adversely affect psychological and physical health, and increase the risk of premature mortality (Dinan, 2005; Keller et al., 2012; Lantz et al., 2005).

There are clear effects of stress on disease and well-being. Mental health is one of the primary factors impacted by stress. Research demonstrates that increased stress exposure is associated with increased risk of internalizing psychopathology, such as depression and anxiety (Laurent et al., 2015). Psychological stress can also affect cognitive function in the short and long term. For example, daily stressors may produce temporary effects on cognition by reducing the amount of attention resources available for information processing (Sliwinski et al., 2006). Over time, chronic stress may contribute to hippocampal dysfunction, impaired memory, poorer cognitive functions, accelerated cognitive decline, and increased incidence of dementia (McEwen, 1998; Scott et al., 2015). Chronic stress can also trigger a physiological chain of

events that can damage the immune system and other vital organs, resulting in a more rapid onset and progression of chronic illnesses, including cardiovascular disease, gastrointestinal disturbances, and cancer (McEwen, 1998).

Minoritized Stress

Minoritized racial and ethnic groups are disproportionately affected by various forms of stress (Slopen & Williams, 2014). The Minority Stress Model suggests that individuals who belong to stigmatized minority groups, such minoritized racial and ethnic groups, and sexual and gender minorities, are more likely to experience excessive stress (Meyer, 2003). In the development of this model, the researchers made the assumptions that minority stress was unique, chronic, and socially based. First, minority stress is considered unique, in that it is additional to general stress experienced by everyone. This implies that stigmatized individuals require additional coping and adaptation efforts beyond what is generally expected from non-stigmatized individuals. Second, minority stress is chronic, meaning that the stress experienced by marginalized individuals is consistent over time due to the ongoing presence of societal norms, prejudices, and inequalities. Finally, minority stress is socially based, driven by social processes, institutions, and structures, meaning that it goes beyond individual events, biology, or genetics (Meyer, 2003).

There is growing evidence that suggests early health deterioration among minoritized racial and ethnic groups. The “weathering” hypothesis posits that Black individuals experience premature health deterioration as a consequence of the cumulative impact of frequent exposure of social or economic diversity and political marginalization. This effect has been attributed to the increased risk for biological "wear and tear" (i.e., allostatic load) resulting from chronic stress (Guidi et al., 2021; T Geronimus, 1992)). Research demonstrates that the physiological

deterioration can be so profound that Black individuals experience health problems typically seen in much older White individuals. In fact, because Black individuals tend to experience health concerns at a younger age, and these health concerns worsen over time, resulting in the increase of racial health disparities, they often encounter additional challenges in accessing healthcare services and resources (Geronimus et al., 2006).

As a means to address health disparities holistically, researchers have turned their attention to sociodemographic and environmental factors that influence sleep disparities. The well-established relationship between stress exposure and health outcomes (Karademas et al., 2013; Lazarus & Folkman, 1984) has prompted investigations into the impact of stress on sleep disparities. Recently, researchers have paid particular attention to the effects of psychosocial stressors on Sleep Health, including perceived discrimination. Discrimination is defined as the differential treatment, usually negative and unfair, of people based on actual or perceived membership of a particular group (Slopen & Williams, 2014). Discrimination based on race and ethnicity, or other personal characteristics has been associated with both physical and mental health issues (Slopen & Williams, 2014), and investigations have commenced into the underlying mechanisms through which discrimination may impact Sleep Health on a behavioral, cognitive, and physiological level.

Discrimination as a Psychosocial Stressor

Over the years, researchers have begun to study the health effects of discrimination by conceptualizing racial and ethnic discrimination as forms of social stress within the stress and coping framework (Lazarus & Folkman, 1984). Racial and ethnic discrimination is one of the primary psychosocial stressors that minorities excessively and repeatedly experience and may be implicated in sleep disparities**.** The act of discrimination against minoritized racial and ethnic

groups is a serious public health concern because these experiences are correlated with physical and mental health consequences (Williams et al., 2003). Discrimination can be assessed using two approaches, specifying the domain or type of discrimination (e.g., racial discrimination) or general reports of unfair treatment across a wide range of possible events (general discrimination) (Gong et al., 2017; Williams et al., 1997).

Racial and ethnic discrimination may be the most prevalent form of discrimination in America (Kessler et al., 1999). Research demonstrates that self-perceived discrimination is prevalent in all racial and ethnic groups. However, perceptions of discrimination vary significantly by race and ethnicity, suggesting that different groups may experience and internalize discrimination in unique ways. For example, data collected from the Collaborative Psychiatric Epidemiology Survey between 2002 and 2003 found that self-perceived discrimination was reported by 90% of African Americans and Afro-Caribbeans, 76% of Latinx individuals, and 71% of Asian Americans (Gong et al., 2017). More research is needed to understand how various ethnicities and races perceive discrimination and how these perceptions intersect with other social variables such as socioeconomic status (SES) and gender to impact well-being and sleep.

Discrimination can encompass a wide range of acts such as exclusion, workplace discrimination, stigmatization, and physical threat or harassment (Brondolo et al., 2005b, 2009). Any of these discriminatory acts can be further classified as major or overt experiences of discrimination, or more covert and implicit in communication (Brondolo et al., 2009). Researchers have more recently began focusing on more subtle, “everyday” forms of discrimination. Everyday experiences of discrimination are described as relatively minor, more subtle microaggressions using demeaning and invalidating messages (Córdova & Cervantes,

2010; Sue et al., 2008). Everyday forms of discrimination have received more attention because they can be considered ongoing and common in daily life. As such, discrimination can be a normative experience for some, and the chronicity of discrimination suggests it may be best considered a continuous stressor (Dunbar et al., 2017).

Discrimination and Sleep

Feeling safe and socially connected psychologically can help promote good sleep (Dahl and Lewin 2002). Therefore, stressful events that increase alertness and arousal may interfere with sleep. Like other stressors, discrimination may contribute to negative sleep patterns because it activates rumination processes and vigilance against a threat, which impedes falling asleep and reinitiating sleep after awakening (Slopen et al., 2016). Several studies have explored the relationship between discrimination and sleep and have found that racial or ethnic discrimination is associated with various sleep disturbances, such as daytime fatigue (Grandner et al., 2012; Steffen & Bowden, 2006), shorter sleep duration and poor sleep quality (Slopen et al., 2016). Additionally, research indicates that these relationships are seen across several forms of discrimination (racial or general) and across various measures of sleep (actigraphy, PSG, subjective/retrospective measures; (Slopen et al., 2016). Lewis et al. (2013) conducted a significant longitudinal study examining the impact of chronic discrimination on sleep quality among middle-aged women from various ethnic backgrounds. Their research demonstrated that experiences of everyday discrimination over a four-year period were linked to poorer subjective sleep quality and increased wakefulness after sleep onset (WASO), as indicated by PSG measures. Similarly, another study focusing on mid-life adults, conducted by Beatty et al. (2011), found that unfair treatment was associated with shorter sleep duration and reduced sleep efficiency, as assessed through ten days of sleep diaries, actigraphy and polysomnography

(PSG). Lastly, using a community sample, Thomas et al. (2006) discovered that discrimination was linked to less slow-wave sleep, essential for cognitive function, in both African American and White adults. More importantly, research demonstrate that exposure to racial discrimination is associated with sleep disturbances, above the effects of race (Fuller-Rowell et al., 2017), sociodemographic characteristics and even depressed mood (Grandner, 2017).

Discrimination and Mental Health

The link between discrimination and mental health is a relatively new and expanding area of study, but strong evidence demonstrates that perceived discrimination is a risk factor for psychological problems in both adolescents and adults (El-Sheikh et al., 2016; Yip, 2014). In fact, a meta-analysis found significant associations between perceived discrimination and negative health outcomes across diverse populations (Pascoe & Richman, 2009). Similarly, through longitudinal and repeated measures methods, they have found that experiences of discrimination precede increases in poor psychological outcomes, suggesting that as perceptions of discrimination increase, so do mental health problems. Moreover, evidence suggests that repeated exposure to discrimination may cause the body to become more physically reactive in stressful social situations (Pascoe & Richman, 2009).

Studies have shown that depression is the most prevalent mental health disorder associated with discrimination (Finch et al., 2000; Steffen & Bowden, 2006). Furthermore, minoritized adolescents and adults who experience ethnic and racial discrimination report worse psychological health outcomes, lower self-esteem, and higher levels of depressive symptoms (Finch et al., 2000; Osman et al., 2012; Torres & Ong, 2010; Zeiders et al., 2013). It is worth noting that the link between discrimination and depression is not limited to specific ethnic or racial groups. For example, studies have found that perceptions of ethnic discrimination are

associated with higher levels of depressive symptoms among both Black and Latinx individuals (Beatty et al., 2011; Roane et al., 2014; Torres & Ong, 2010).

Additionally, insufficient sleep has been linked to negative emotions, emotion regulation difficulties, and mental health problems in young adults (Doane et al., 2015; Zeiders, 2017). Interestingly, research has found that the interaction between discrimination and sleep can lead to worse mental health outcomes. For instance, El-Sheik and colleagues (2016) found that adolescents who reported higher levels of discrimination and shorter sleep duration had higher levels of externalizing behaviors, such as anxiety and depression. Similarly, Yip (2015) found that the interaction between sleep and discrimination predicted depressive symptoms and self-esteem in high school students, highlighting the importance of considering both factors when examining mental health outcomes.

College Students as an At-risk Population

College may be a period of unique vulnerability to sleep difficulties and discrimination in minoritized racial and ethnic college students. On average, the sleep duration for American adults is only 6.9 hours per night (Patel et al., 2006). These numbers are even worse among young adults, especially college students. Evidence suggests that adolescents do not obtain sufficient sleep as they transition into college (Doane et al., 2015; Sladek & Doane, 2015) and that younger adults go to bed later and receive less sleep than teenagers (Tsai & Li, 2004). In addition, many university students meet the requirements for partial sleep deprivation (e.g., less than 5 hours of sleep in 24 hours (Galambos et al., 2009). Even more troubling, one study revealed that minoritized college students consistently show poorer sleep than White college students (Fuller-Rowell et al., 2017). College provides young adults with opportunities to engage in identity exploration and an opportunity to interact with ethnically diverse peers. For

minoritized ethnic college students, this new environment also increases exposure to discrimination through interactions with diverse peers and instructors (Doane et al., 2015; Sladek & Doane, 2015).

Studies of racial disparities in sleep among college students are rare. However, this gap in the literature is of particular importance because of the known stressors experienced by minoritized students attending predominantly White universities, such as covert racism and lack of support in classrooms and residence halls (Fuller-Rowell et al., 2017). Given that sleep is strongly associated with academic performance and the ability to manage stress, identifying psychosocial predictors of race-related differences in sleep among college students is necessary for reducing racial disparities. Additionally, college is an opportune time for interventions, setting the stage for long-term behavioral health(Fuller-Rowell et al., 2017).

The Current Study

The U.S. population is growing and diversifying. It is predicted that approximately 56% of the population will be non-White or of minoritized racial and ethnic background by 2060 (Colby & Ortman, 2014). Because of this, more research is needed on human sleep patterns, physiology and epidemiology using a diverse and representative sample. While more and more research demonstrates the existence of racial and ethnic Sleep Health disparities, less research exists exploring and understanding the mechanisms by which these Sleep Health disparities exist. To fully understand the mechanisms contributing to these disparities, we must consider sociodemographic and environmental factors that play a role. Our study focuses specifically on minoritized racial and ethnic college students, recognizing their unique experiences within the college environment. By focusing on this population, we can better understand the contextual

factors contributing to Sleep Health disparities and tailor interventions to address their specific needs.

Discrimination is a chronic stressor contributing to racial and ethnic disparities in mental and physical health and variations in health outcomes within minoritized racial and ethnic groups. While most studies thus far have examined Sleep Health outcomes associated with one specific form of discrimination, fewer studies have examined the outcomes of different forms of experience or exposure of discrimination on sleep outcomes. Such forms can be identified as lifetime or chronic discrimination, racial and ethnic experiences of discrimination, everyday general discrimination, and daily racial discrimination. This study aims to the examine the effects of various dimension of discrimination on Sleep Health. Evaluating the different dimensions of racial and ethnic discrimination may facilitate understanding of the mechanisms linking discrimination to Sleep Health. Additionally, a better understanding of different forms of discrimination experiences can inform ethnically sensitive interventions to reduce Sleep Health disparities.

This research employed a multi-method, micro-longitudinal design to evaluate associations between discrimination and Sleep Health in a sample of minoritized racial and ethnic college students. This study used various measures of discrimination, including the Everyday Discrimination Scale, Scale of Ethnic Experiences, Perceived Ethnic Discrimination Questionnaire, and Daily Racial Discrimination to examine which domains predict Sleep Health. These measures of discrimination were included for their frequent application in previous research, their perceived effectiveness in addressing the research question, and their ability to assess various domains of discrimination. Additionally, these measures are comprised of multiple sub-measures that allow for deeper exploration and analyses in the future.

Although there is no prediction on which measure will best predict Sleep Health, we hypothesize that greater experiences or perceptions of discrimination across measures will be associated with poor Sleep Health overall. In our study, we are controlling for gender, age, race and ethnicity, average parental education, and a composite score of mental health which have been identified as potential confounding factors in previous research(Fuller-Rowell et al., 2017; Grandner et al., 2012; Slopen & Williams, 2014). By controlling for these variables, we aim to isolate the effects of our discrimination variables on Sleep Health outcomes and minimize the influence of extraneous factors. In an attempt to extend the current literature and replicate past studies, exploratory analyses were also conducted with individual sleep indices (e.g., regularity, satisfaction, alertness/sleepiness, timing, efficiency, and duration) as the outcome variables.

CHAPTER 2

METHODS

Participants

Participants were simultaneously recruited from the University of Oregon Human Subjects Pool (HSP) and through various forms of advertisement across the university campus (non-HSP). The HSP is a group of individuals who volunteer to participate in research projects conducted at the university. Participants were recruited through an online sign-up procedure and were given class credit for their participation. Recruitment methods outside of the HSP (non-HSP) included flyer distribution via departmental and organizational email listservs across the university. Recruitment also extended to target extracurricular activities attended by minority students, as well as outreach with the Multicultural Center and the Center for Multicultural Academic Excellence. Recruitment materials included a brief description of the study, a link to the prescreen questionnaire, and contact information if they wanted additional details or were interested in participating. Research credits or compensation were provided at the completion of each part of the study. In cases where course credit was not granted (non-HSP), participants were paid $13 an hour, or $20, to participate in the study. Participants were compensated via an Amazon electronic gift card upon the completion of the sleep diaries or upon withdrawal of the study.

Prior to being enrolled in the study, both the HSP and non-HSP participants were screened to ensure they met the study requirements. Inclusion criteria for the study required participants to be enrolled college students, be proficient in English, be between the ages of 18-24, and identify themselves as racial or ethnic minorities (See Appendix A for screener). Participants were also required to have a minimum level of exposure to discrimination to be

eligible. Specifically, during the screening process, participants were asked if they had ever experienced being treated poorly or unfairly because of their race or ethnicity, to which they could answer "yes" or "no." Additionally, recruitment focused on healthy college students who did not report any sleep disorders such as obstructive sleep apnea, and narcolepsy/cataplexy, or psychosis during the screening.

Power analyses were conducted using G*Power software, version 3.1.9.2, linear multiple regression: Fixed model, R^2 deviation from zero statistical test, *a priori* (computer required sample size – given α, power, and effect size). This sample was calculated using a medium effect size of $f^2 = .20$, an α error probability of .05, a power of .80. A medium effect size of $f^2 = 0.20$ was chosen for the power analysis based on empirical findings from a large sample of meta-analytically derived correlations (Gignac & Szodorai, 2016). This approach re-evaluates Cohen's guidelines suggesting that correlations of 0.20 are typical in individual differences research, ensuring an adequately powered study. The results of the power analyses combined with an over-sampling of 10% to account for attrition, produced a total of 83 participants.

Measures

Study measures are summarized in Table 1. Most measures were completed once via an online questionnaire. Sleep behaviors and daily discrimination were completed online daily for one week.

Lifetime or Chronic Perceived Racial Discrimination

The Brief Perceived Ethnic Discrimination Questionnaire-Community Version (Brief PEDQ-CV, (Brondolo et al., 2005a), an abbreviated version of the full Perceived Ethnic Discrimination Questionnaire (PEDQ, (Contrada et al., 2001), was used to assess lifetime racial and ethnic discrimination. The Brief PEDQ-CV consists of 17-items, self- self-report, and

Table 1. Study measures and schedule of administration

Construct	Measure	Schedule	
		Intake	Daily
Sleep	▪ The Pittsburgh Sleep Quality Index ▪ The Consensus Sleep Diary	X	 X
Discrimination	▪ Lifetime Perceived Racial Discrimination (PEDQ-CV) ▪ Racial and Ethnic Experience (SEE) ▪ Everyday Discrimination (EDS) ▪ Daily Racial Discrimination	X X X	 X
Mental Health Symptomology	▪ The Perceived Stress Scale (PSS) ▪ The Depression, Anxiety, and Stress Scale (DASS-21)	X X	

measures five factors: 1) Lifetime exposure: assesses the degree of exposure to race-based maltreatment throughout the lifetime 2) Exclusion/ rejection: assesses the degree to which individuals report having been isolated, excluded, or ignored because of their race or ethnicity, 3) Stigmatization/ devaluation: assesses the degree to which individuals report having been treated in a demeaning or stigmatizing way because of their race or ethnicity, 4) Discrimination at work/school: assesses the degree to which individuals report having been mistreated at work or school because of their race or ethnicity, 5) Threat/aggression: assesses the degree to which individuals report that they (or their property) were harmed or threatened with harm because of their race or ethnicity. Scoring consists of a 5-point Likert scale ranging from 1 = "Never happened" to 5 = "Happened very often," with higher scores indicating higher perceptions of racism. The internal consistency ranged from .65 to .88 using a diverse sample of college

students (Contrada et al., 2001). In our study the Cronbach's alpha was 0.85, indicating good internal consistency.

Racial and Ethnic Experience of Discrimination

The Scale of Ethnic Experience (Malcarne et al., 2006) is a 32-item self-report questionnaire developed to measure the cognitive experience of ethnicity across four dimensions, ethnic identity, perceived discrimination, mainstream comfort, and social affiliation. Only the perceived discrimination dimension was used for this study. This scale yields a perceived discrimination scale, which assesses an individual's beliefs that members of his or her ethnic group have experienced discrimination in society. Higher scores are indicative of greater perceived discrimination. The questionnaire was developed using a college sample from diverse ethnic backgrounds. Initial studies showed the perceived discrimination scale to have good internal consistency in African American participants (Cronbach's alpha = 0.86, Malcarne et al., 2006). In our study the Cronbach's alpha for the entire measure was 0.83, and 0.75 for only the perceived discrimination sub score, indicating adequate internal consistency.

Everyday General Discrimination

The Everyday Discrimination Scale (EDS) is a 9-item scale that asks participants about experiences with various forms of interpersonal mistreatment in their daily lives over the previous 12 months (Williams et al., 1997). On a 6-point Likert scale, participants were asked to report how often they experienced unfair treatment in their everyday lives. Responses range from 1 (never) to 6 (almost every day), with higher scores signifying greater perceived discrimination. Questions include "You are treated with less respect than other people are" and "People act as if they are afraid of you." The EDS revealed good internal consistency with a Cronbach's alpha of .88 (Williams et al., 1997) and .86 in our study.

The following questions were administered through the daily diary.

Daily Racial Discrimination

Six items, developed by Wang & Yip (2019), assessed daily experiences of ethnic/racial discrimination. Questions included: "I was treated unfairly because of my race and ethnicity," "I felt stress because of my race and ethnicity," and "Others treated me poorly because of my race and ethnicity." Participants rate the extent to which each item was a problem each day on a 3-point scale ranging from 0 (did not happen/was not a problem today) to 2 (very much a problem today). A composite score was computed at the end of the seven days to make up the daily discrimination variable. The measure demonstrated satisfactory internal consistency at the within- (.90) and between-person level (.99) (Wang & Yip, 2019). However, in our study, the internal consistency was just acceptable at a Cronbach's level of 0.70.

Multidimensional Sleep Health

Sleep diaries were collected as the primary method to index multidimensional Sleep Health (Buysse, 2014b; Wallace et al., 2020b). Multidimensional Sleep Health consists of six domains of Sleep Health based on scientific and clinical rationale: (1) Regularity: the consistency of sleep timing, (2) Satisfaction: the subjective assessment of "good" or "poor" sleep (defined here by self-report only), (3) Alertness/Sleepiness: the ability to maintain attentive wakefulness during the day; (4) Timing: the placement of sleep within the 24-h day; (5) Efficiency: the ability to achieve consolidated sleep; and (6) Duration: the total amount of sleep obtained per 24 hours. Upon awakening*, the Consensus Sleep Diary* (Carney et al., 2012) was completed electronically via Qualtrics. Participants completed the daily diary for seven consecutive days and received a reminder email to complete it. The daily diaries consisted of sleep-related questions to quantify the sleep characteristics explained above.

Qualitative Sleep. The Pittsburgh Sleep Quality Index (PSQI; (Buysse et al., 1988) was used as a secondary and supplementary measure to inform and validate the information gathered from the sleep diaries. The PSQI is a measured used to assesses subjective sleep quality and sleep disturbances in the previous month. This measure consists of 19 items that evaluate seven sleep domains, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Scoring consists of a 0-3 Likert scale for each domain, where higher scores indicate higher severity impairment. The sum of the seven subscales produces a global PSQI score ranging from 0-21. A global score >5 is indicative of poor sleepers. The PSQI has acceptable reliability with a Cronbach's alpha of 0.83 (Buysse et al., 1988). This measure was completed online as part of the intake questionnaires and served to cross validate data from sleep diaries.

Covariates and Supplementary Exploratory Analyses

Symptoms of depression, anxiety, and perceived stress, and sociodemographic characteristics were measured for inclusion as covariates in sensitivity analyses.

Depression and Anxiety

The Depression, Anxiety, and Stress Scale (DASS-21) is a set of three self-report scales designed to measure the emotional states of depression (e.g., loss of self-esteem/incentives and depressed mood), anxiety (e.g., fear and anticipation of adverse events), and stress (e.g., persistent state of arousal and low frustration tolerance; (Lovibond & Lovibond, 1995). A maximum score of 42 on each scale indicated high depression, anxiety, and stress levels. Items included, "I experience trembling in the hands" (anxiety), "I felt that I have nothing to look forward to" (depression), and "I found it hard to wind down" (stress). Participants rated the frequency of each item over the past week on a four-point scale. The scores ranged from 0 ("did

not apple to me at all") to 3 ("applied to me much, or most of the time.") The DASS-21 demonstrates good overall reliability (α = .88) and good reliability within each subscale (Depression scale α= .82; Anxiety scale α = .90; and the Stress scale α = .93) (Henry & Crawford, 2005). For this study, the measure indicated excellent internal consistency with a Cronbach's alpha of 0.94.

Perceived Stress

The Perceived Stress Scale (PSS, Cronbach's α = .85, Cohen, Kamarck, & Mermelstein, 1983) was designed to measure the degree to which individuals found their lives unpredictable, uncontrollable, and overloading in the past month. The PSS is a 10-item questionnaire that yields a total possible score of 0-40 with higher scores indicating greater perceived stress. The scale ranges from 0 (*Never*) to 4 (*Very often)* and includes questions such as, "In the last month, how often have you felt that you were unable to control the important things in your life?" and "In the last month, how often have you felt nervous and "stressed"? The Cronbach's alpha for this study was 0.84.

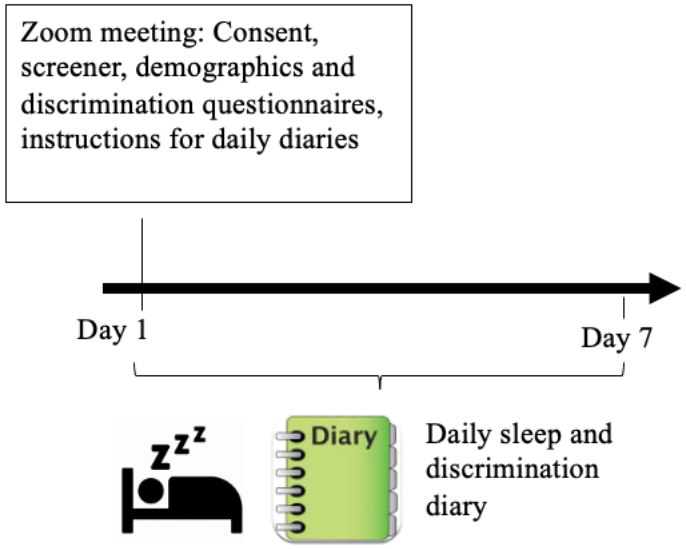
Demographics

Participants were asked to self-report demographic characteristics about race, ethnicity, socioeconomic status (SES) via family income and parent educational attainment, gender, and age. These variables were used to adjust for the effects for demographic characteristics in hypothesis tests (See Appendix B for demographic questions).

Procedure

Data collection was completed from Summer 2022 to Fall 2023. The entire study was comprised of two parts. In part one, the researcher and participant met briefly online via zoom. During this meeting, the researcher described the study, and participants completed the informed consent. Participants were given a copy of the consent form, including the study researcher's, IRB, and human subject pool's contact information, and were encouraged to reach out to the research team regarding any additional questions. Following the consent form, participants were given instructions on how to complete the daily sleep diaries online (part 2). At the end of part 1, participants were emailed a link to complete questionnaires to assess lifetime exposure to discrimination, everyday discrimination, and other experiences of discrimination. The online meeting, review of the consent form, instructions for sleep diaries, and the online questionnaires took approximately 45-50 minutes. Part 2 consisted of online sleep diaries that were to be completed by participants every morning for one week. Sleep diaries were sent out every morning at 6:00 am and participants were instructed to complete the diaries upon awakening. Participants were automatically sent a reminder email at noon and were told to disregard the email if the sleep diary has already been completed for that day. The sleep diaries asked questions regarding their

Figure 1. The timeline for the proposed study.



daytime behaviors and functioning from the previous day (e.g., napping and caffeine use), their sleep patterns from the previous night (e.g., sleep time and awakening), and daily experiences of discrimination. The diaries were expected to take about 5 minutes each morning (5 min x 7 days) for a total of approximately 35 minutes. The total study took about an hour and a half to complete (see Figure 1 for a timeline of the study). At the end of the study (completion of both parts), participants received an online debriefing form on the study that included the study researcher's, IRB, and human subject pool's contact information and provided participants with additional resources to mental health providers and discrimination-related reporting options.

Data Analyses and Assumptions

Data cleaning involved several operations to ensure the data's accuracy and consistency. This included renaming variables for clarity, recoding responses into a more usable numeric format, and calculating derived variables such as composite scores and averages. To facilitate the recoding process, we defined custom functions tailored to transform Likert scale responses into numeric values and to reverse code scale items. These functions were then applied to specific subscale items, ensuring a standardized approach to data manipulation. Next, data inconsistencies were addressed by correcting duplicate entries and resolving discrepancies in responses (e.g., using AM instead of PM when recording sleep). The sleep data needed to be transformed to minutes in order to accurately derive at key sleep metrices such as sleep onset, duration, and WASO.

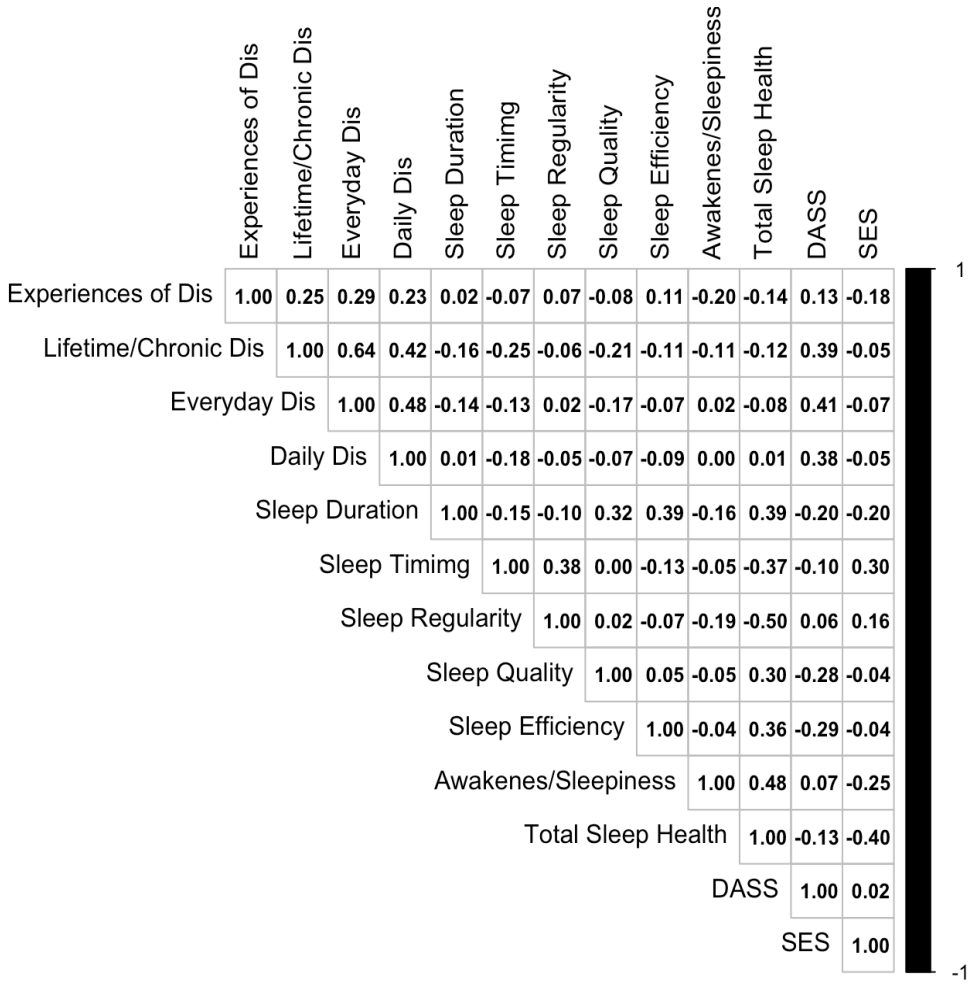
Descriptive statistics were used to evaluate the extent of missing data, skewness, kurtosis the distribution of the data. The decision to log-transform the sleep regularity variable, also known as midpoint variance, was made due to the expectation that it would not fit a normal distribution in its raw form. Log-transformation is commonly used to address skewness and to

stabilize variance, especially when dealing with variables that exhibit non-normal distributions. It was decided that data from five out of the seven days of sleep diary entries would be included for each participant. This decision was made to ensure a balance between obtaining a representative sample of participants' sleep patterns and minimizing potential biases introduced by incomplete or inconsistent data. As a result, approximately 94% of the sleep diary data remained available for analysis after applying this criterion. Missing data were addressed using hot deck imputations, a method for handing missing data where missing values are replaced with an observed response from a "similar unit" (Andridge & Little, 2010). In 57.8% of cases, wake after sleep onset (WASO) data was not collected through sleep dairies due to oversight. For these cases, participants' response from a similar item if the PSQI (Q #8) was used to replace it. No other missing data was manipulated. A total of three cases were removed due to incomplete surveys or invalid responses.

Before conducting multivariable regression analyses, several assumptions were assessed to ensure the validity of the statistical analyses. 1) Linearity was met by examining scatterplots of each predictor against Sleep Health. 2) The independence of errors assumption was assessed using the Durbin-Watson statistic, a test for autocorrelational in the residuals. The value for each model was close to two which indicates no significant autocorrelation. 3) Homoscedasticity was met using scatterplots of the residuals to detect any patterns indicative of heteroscedasticity. 4) The assumption of normality stipulates that the residuals should follow a normal distribution. Although the Shapiro-Wilk and Kolmogorov-Smirnov tests yielded significant results for Model 1, residual plots still were visually inspected. Overall, the data displayed normality except for cases near the extreme ends of discrimination. However, recognizing the clinical significance of extremely high and low values of discrimination, these data were retained in further analyses.

Models 2 and 3 met the assumption of normality. 5) Multicollinearity was evaluated using correlation matrices (see Figure 2) and variance inflation factors (VIFS), with VIF values less than 10 indicating no significant multicollinearity. Data cleaning and analyses were conducted using R (Team, 2019).

Figure 2. Correlation matrix including all variables that went into the models.



The primary analyses for this study involved multivariable regression analyses. These analyses aimed to assess the relationship between dimensions of discrimination (e.g., chronic/lifetime, racial and ethnic experiences, every day, and daily racial and ethnic discrimination) and Sleep Health. Three progressive levels of adjustment were applied in the multivariable models: Model 1 all discrimination measures without covariates, Model 2 adjusting for race, ethnicity, gender, and parental education (SES proxy), and Model 3 adjusting for mental health using a composite score of depression, anxiety, and stress. Sleep Health was assessed using a multidimensional approach incorporating sleep diaries and the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1988). Each dimension of Sleep Health (see Table 2) was categorized as "good" (1) or "poor" (0) based on thresholds reported in previous studies (Dong et al., 2019; Kuula et al., 2019; Randler & Vollmer, 2013). A slight adjustment was made to the threshold for good sleep efficiency, defining it as equal to or greater than 80% (as opposed to 85%) to ensure sufficient variability in scores within our sample (Wallace et al., 2018, 2020). An aggregate measure of Sleep Health was calculated by summing the number of dimensions with "good" Sleep Health.

Table 2. Proposed operationalization of Sleep Health in college students (M = 19.4 years) as sum of 6 dichotomized indicators below:

Sleep variable	**Sleep Health dimension**	**Measure**	**Continuous scoring with high scores indicating *poor* Sleep Health**	**Dichotomization rule (coded as "1") with high scores indicating *good* Sleep Health**
Sleep midpoint variability	Regularity[1]	*see duration for TST calculation Sleep Midpoint = Bedtime + (TST/2) Regularity = *SD* of Midpoint		< 60 min[1]
Sleep Quality	Satisfaction	Consensus Daily Dairy (daily) How would you rate the quality of your sleep?	0 = Very Poor 1 = Poor 2 = Fair 3 = Good 4 = Very good	"good or very good"
Daytime sleepiness	Alertness/ Sleepiness	PSQI Q#8 (baseline) During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	0 = Never 1 = Less than once a week 2 = Once or twice a week 3 = Three or more times each week	0
Sleep midpoint	Timing[2,3]	Sleep Midpoint = Bedtime + (TST/2)		3:00 am – 5:00 am
Sleep hours/ time in bed	Efficiency	**Time in bed (TIB)** = time they woke up – time they got into bed (includes time spent awake and asleep) **Sleep Efficiency** = TST (total sleep time)/Time in bed (TIB) * 100		>80%
Sleep hours	Duration[1]	Mean total sleep time (TST) in minutes		Young Adults (18-25): 7-9 hours

CHAPTER 3

RESULTS

Descriptive Statistics

The total sample consisted of 82 participants, the majority identified as female (79%), with 18% identifying as male and 3% as gender non-binary (See Table 3 for all descriptive information). The mean age of participants was 19.33 years (*SD* = 1.52). The family income distribution varied, with 21% of participants reporting an income of $150,000 or more, and 4% reporting an income of less than $15,000. Our sample was ethnically diverse, with the largest group being biracial/multiracial (34%), followed by Hispanic/Latinx (28%), Asian/Pacific Islander (27%), and Black/African American (11%). Regarding parental education, most parents had attained at least a high school diploma or GED (Parent 1: 32%, Parent 2: 32%), with substantial percentages holding bachelor's and master's degrees.

Contrary to expectations, the degree of reported discrimination was lower than anticipated. Participants reported a mean score of 4.17 out of 5 (SD = 0.05) for racial and ethnic experiences of discrimination, a mean score of 2.43 (SD = .57) out of 5 for chronic/lifetime discrimination, a mean score of 2.87 out of 6 (SD = 0.79) for everyday discrimination, and a mean score of 0.16 out of 3 (SD = 0.19) for daily racial discrimination.

Table 3. Sociodemographic, discrimination, mental health, and sleep outcomes.

Individual-level Variable	*N* = 82	%	Mean	SD	Range
Demographics					
Age	82		19.33	1.52	
Sex					
Female	65	79			
Male	15	18			

Table 3. (continued).

Individual-level Variable	*N* = 82	%	Mean	SD	Range
Non-Binary	2	3			
Race and ethnicity					
Asian/Pacific Islander	22	27			
Black/African American	9	11			
Hispanic/Latinx	23	28			
Biracial/Multiracial	28	34			
Annual household income					
Less than $15,000	3	4			
$15,000 - $34,000	10	12			
$35,000 - $49,000	11	14			
$50,000 - $74,000	7	9			
$75,000 - $99,000	15	18			
$100,000 - $149,000	17	21			
150,000 or more	17	21			
Unknown	2	1			
Education Parent 1					
No Schooling	1	1			
Less than Middle School	1	1			
Middle school/Jr. High: 10%	8	10			
High School/GED	25	32			
Associate's degree	3	4			
Bachelor's degree (e.g., BA, BS)	16	21			
Master's degree (e.g., MA, MS, Med)	16	21			
Doctorate (e.g., PhD, EdD):	7	9			
Unknown	1	1			
Education Parent 2					
No Schooling: 1%	1	1			
Less than Middle School	1	1			
Middle school/Jr. High	6	8			
High School/GED	25	32			
Associate's degree	2	3			
Bachelor's degree (e.g., BA, BS)	16	20			
Master's degree (e.g., MA, MS, Med)	17	22			
Doctorate (e.g., PhD, EdD)	5	6			
Unknown	6	7			
Discrimination					
Racial and ethnic experiences of discrimination	82		3.72	.05	1-5
Chronic/lifetime discrimination	82		2.43	.57	1-5
Everyday discrimination	82		2.87	0.79	1-6
Daily racial discrimination	82		0.16	0.19	0-3

Table 3. (continued).

Individual-level Variable	*N* = 82	%	Mean	SD	Range
Mental Health					
Depression	82		7.49	5.41	0-21
Anxiety	82		7.50	5.13	0-21
Stress	82		8.77	4.47	0-21
Total	82		23.76	13.44	0-63
Sleep Outcomes					
Sleep duration (mins/hrs)	80		437.47 (7:29)	64.09 (1:07)	
Sleep timing (midpoint)	80		275.86 (4:35 am)	56.54	
Sleep regularity (midpoint variance)	80		79.91 (1:33)	78.04 (1:30)	
Sleep quality/satisfaction (0-4)	82		2.35	0.54	
Sleep efficiency	80		84.32 (84%)	7.49	
Alertness/sleepiness	80		1.04	0.93	
Sleep Health Bins (0-1)	8				
Sleep duration	80		0.50	0.50	
Sleep timing	80		0.60	0.49	
Sleep regularity	80		0.56	0.50	
Sleep quality/satisfaction	82		0.68	0.47	
Sleep efficiency	80		0.75	0.44	
Alertness/sleepiness	80		0.61	0.49	
Total Sleep Health (0-5)	82		3.63	1.46	

Inferential Statistics

A linear regression analysis was conducted to explore the relationship between Sleep Health and several predictor variables, including daily racial and ethnic discrimination, everyday general discrimination, lifetime/chronic discrimination, and racial and ethnic experiences of discrimination. Model 1 included scores for each of the four discrimination scales as predictors of Sleep Health. The model's intercept was statistically significant ($\beta = 5.72$, $p < 0.001$), indicating that the predicted Sleep Health score when all predictors are zero is significantly

different from zero. However, the coefficients for daily racial and ethnic discrimination (β = 0.78, $p = 0.44$), everyday general discrimination (β = -0.03, $p = 0.92$), lifetime/chronic discrimination (β = -0.32, $p = 0.40$), and racial and ethnic experiences of discrimination (β = -0.36, $p = 0.30$) were not statistically significant. The overall model fit was poor, $F(4, 77) = 0.70$, $p = 0.59$, with an adjusted $R^2 = -0.01$, suggesting that the predicted variables explained very little of the variance in Sleep Health (See Table 4 for model results).

Table 4. Multiple Linear Regressions Models. Associations between discrimination and Sleep Health.

	Model 1		*Model 2*		*Model 3*	
Predictor Variables		*SE*		*SE*		*SE*
Daily Racial Discrimination	0.78	1.00	0.85	.088	0.90	0.91
Everyday Discrimination	-0.03	0.28	-0.01	0.25	0.01	0.26
Lifetime/Chronic Discrimination	-0.32	0.38	-0.39	0.34	-0.38	0.34
Racial and ethnic Experiences of Discrimination	-0.36	0.35	-0.76*	0.33*	-0.76*	0.34
Gender			0.06	0.35	0.04	0.35
Race and ethnicity			0.08	0.13	0.07	0.14
SES (average parent education)			-0.40**	0.10	-0.40**	0.10
Age			0.01	0.10	0.01	0.10
Mental Health					-0.004	0.01

Note: β represents the standardized regression coefficients, * $p < .05$, ** $p < .001$.

Model 2 included the original discrimination predictors as well as gender, age, ethnicity/race, and average parental income as covariates. The model's intercept was statistically significant ($\beta = 9.16$, $p < 0.001$), indicating that the predicted Sleep Health score when all predictors are zero is significantly different from zero. The model revealed that greater racial and ethnic experiences of discrimination were associated with decreased Sleep Health ($\beta = -0.76$, $p = 0.03$), but daily racial and ethnic discrimination, everyday general discrimination, lifetime/chronic discrimination did not demonstrate significant associations with Sleep Health ($ps > 0.05$). Additionally, average parental education showed a significant negative association with Sleep Health ($\beta = -0.40$, $p < 0.001$), indicating that higher levels of average parental education were associated with lower Sleep Health scores. Gender and ethnicity, when recoded into numerical variables, also did not show significant associations with Sleep Health ($p > 0.05$). The overall model fit was statistically significant, $F(8, 70) = 3.05$, $p = 0.005$, suggesting that the predictors together explain a significant portion of the variance in Sleep Health. The adjusted R^2 value was 0.174 indicating that approximately 17% of the variance in Sleep Health was accounted for by the predictors in the model.

The third level of the analyses included an aggregate mental health variable (i.e., depression, anxiety, and stress). The model's intercept was again significant ($\beta = 9.11$, $p < 0.001$). Similar to Model 2, perceived racial and ethnic experiences of discrimination and average parental education emerged as significant predictors of Sleep Health. The analysis demonstrated that perceived racial and ethnic experiences of discrimination were negatively associated with Sleep Health ($\beta = -0.76$, $p = 0.03$, see Figure 3), suggesting that individuals who reported experiencing higher perceived levels of racial and ethnic discrimination tended to have poorer Sleep Health. Daily racial and ethnic discrimination, everyday general discrimination,

lifetime/chronic discrimination did not demonstrate significant associations with Sleep Health (see Figures 4-6). Additionally, average parental education displayed a significant negative association with Sleep Health ($\beta = -0.40$, $p < 0.0001$, see Figure 7), indicating that individuals with parents who attained higher levels of education tended to have lower Sleep Health scores. Other factors including daily discrimination, average education, stress, gender, ethnicity, and total DASS score did not demonstrate significant associations with Sleep Health in this study. The overall model exhibited a statistically significant fit, $F(9, 69) = 2.69$, $p = 0.009$), explaining approximately 16% of the variance in Sleep Health ($R^2 = 0.162$).

Figure 3. Experiences of Discrimination and Sleep Health.

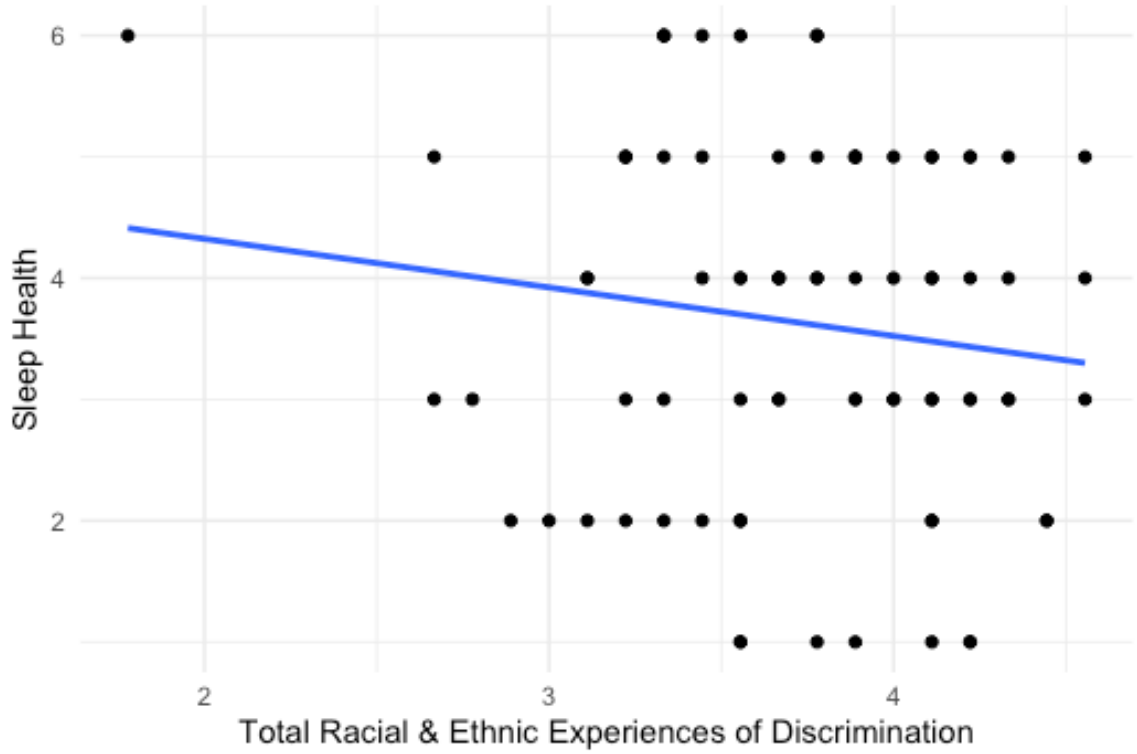


Figure 4. Daily Racial Discrimination and Sleep Health.

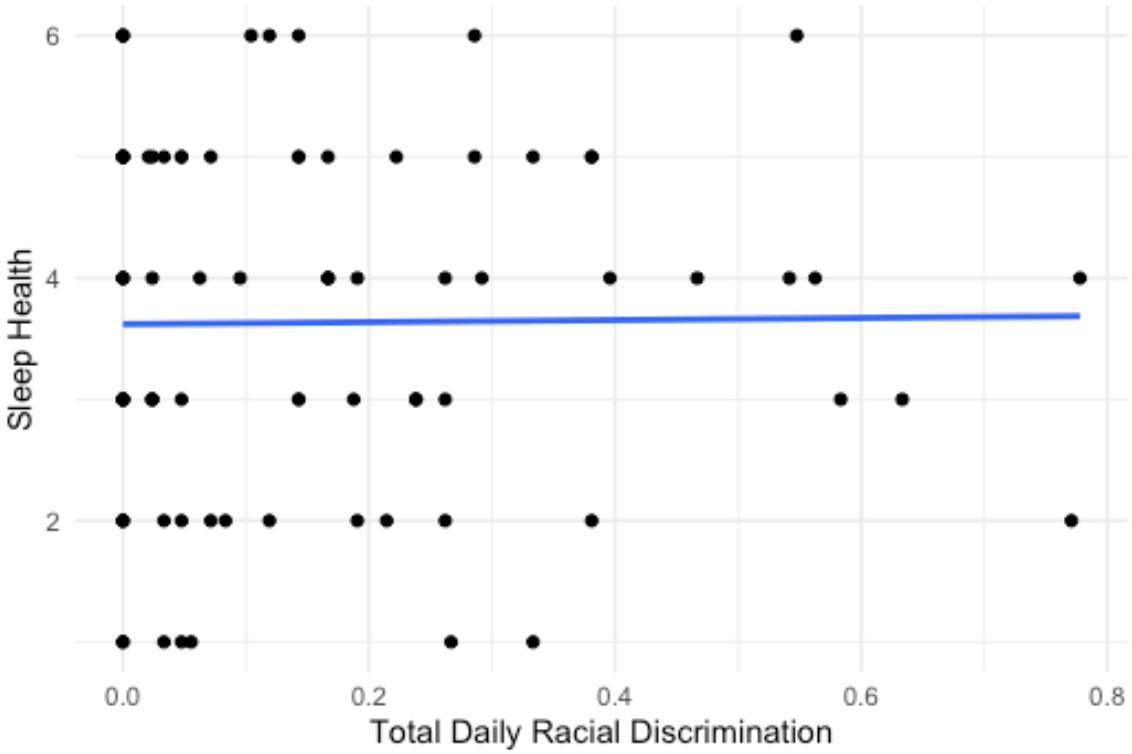


Figure 5. Everyday Discrimination and Sleep Health.

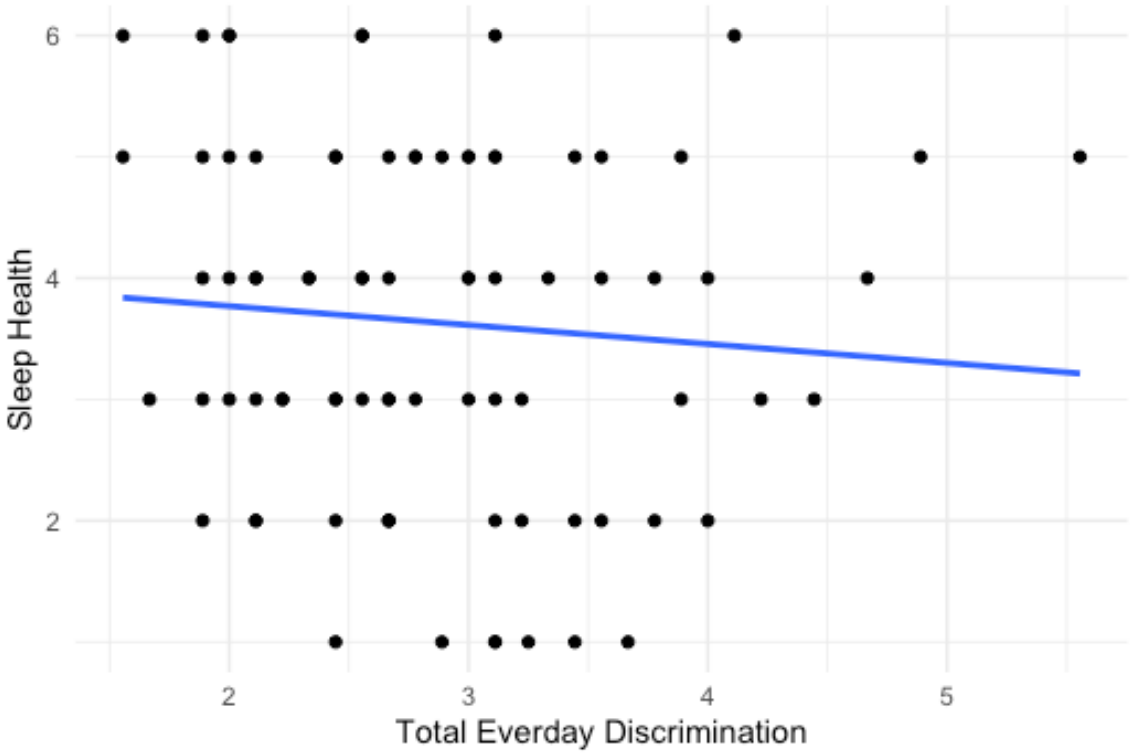


Figure 6. Chronic/Lifetime Discrimination and Sleep Health.

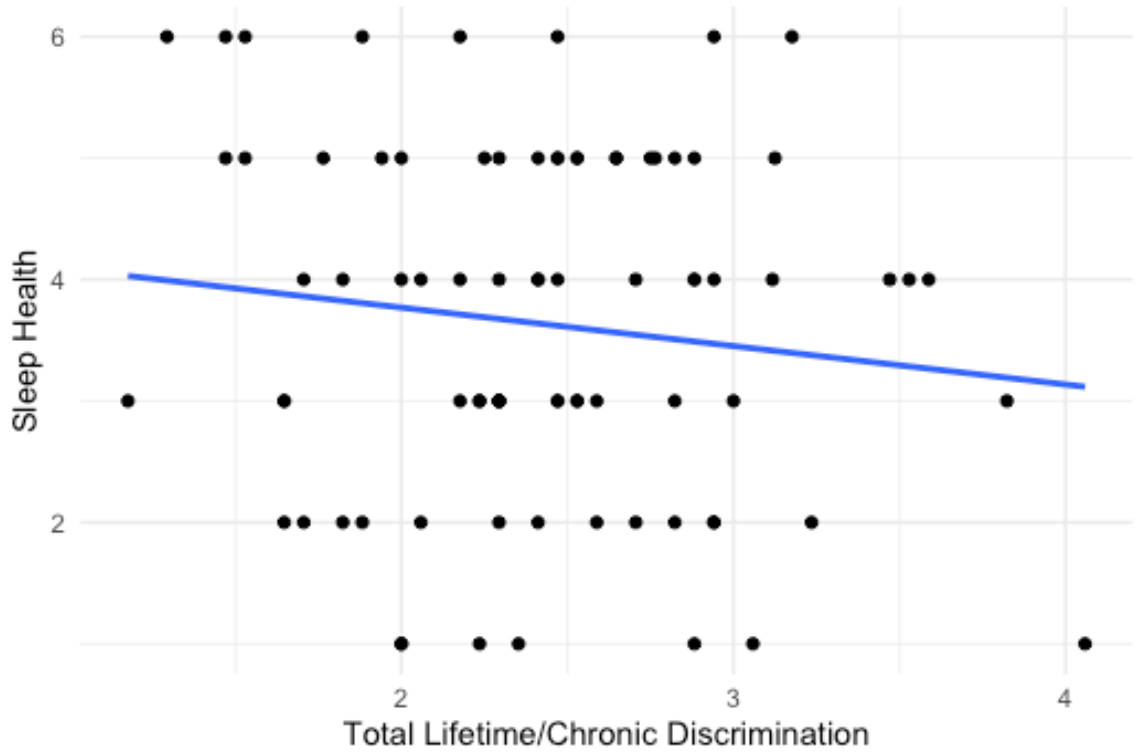
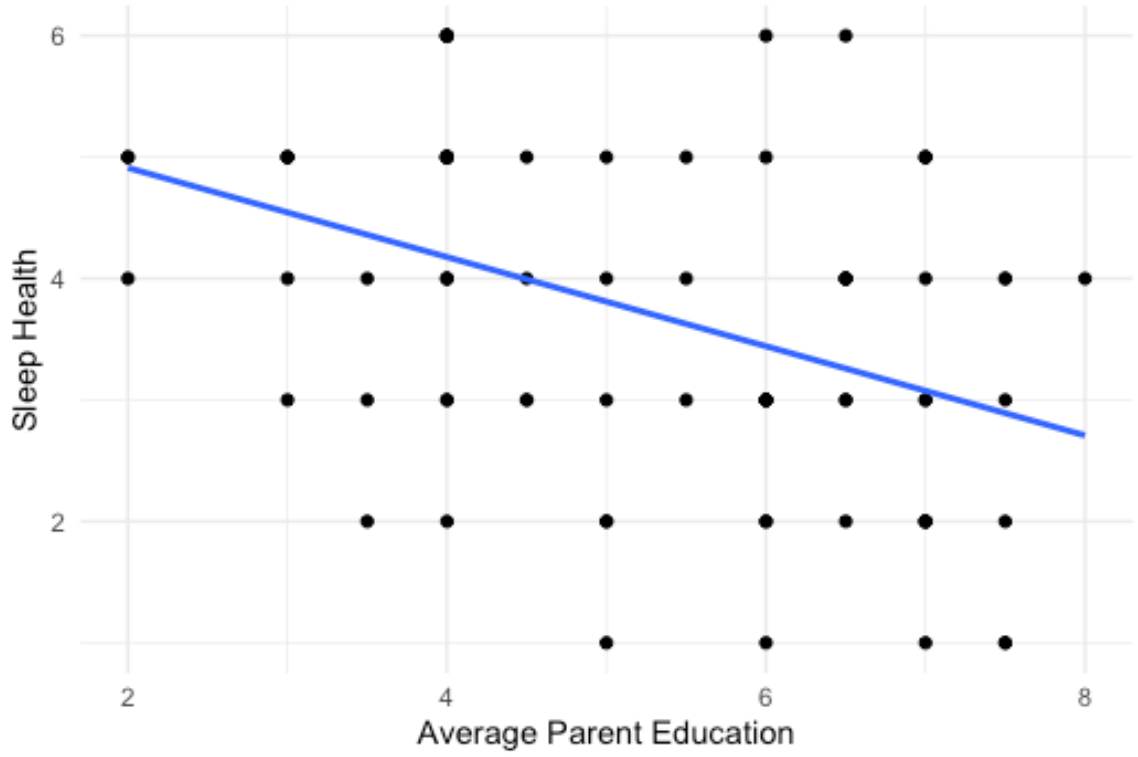


Figure 7. Average Parent Education and Sleep Health.



Post-Hoc Exploratory Analyses

Additional multivariable analyses were conducted post-hoc to examine the associates between various dimensions of discrimination and each individual index of Sleep Health (i.e., sleep regularity, quality, attention/sleepiness, timing, efficiency, and duration). Results of these models indicate that our discrimination variables, including daily racial and ethnic discrimination, everyday general discrimination, lifetime/chronic discrimination, and racial and ethnic experiences of discrimination were not significant predictors for any of the individual Sleep Health indices.

When all covariates (i.e., age, race and ethnicity, SES, gender, mental health) were included in the analyses, average parental education (β = 10.85, p = 0.005) and age (β = -11.41, p = 0.004) emerged as significant predictors for Sleep Timing (average midpoint), revealing a significant model, $F(8, 70) = 3.302$, $p = 0.003$. These results suggest higher average parental education is associated with later sleep timing (See Figure 8). Additionally, the older participants tended to have earlier sleep timing (See Figure 9). The overall model explained approximately 19% of the variance in Sleep Timing ($R^2 = 0.19$). Mental health, measured via the DASS, also emerged as a significant predictor of sleep quality (β = -0.01, p = 0.04). The model was not significant $F(9, 69) = 1.051$, $p = 0.41$ and reveled a poor fit accounting for less than 1% of the variance (See Figure 9). Mental health was also a significant predictor of sleep efficiency (β = -0.16, p = 0.03); however, this model was also not significant $F(9, 69) = 1.007$, $p = 0.44$), accounting for less than 1% of the variance (See Figure 10). See table 5 for complete results.

Figure 8. Sleep Timing and Age.

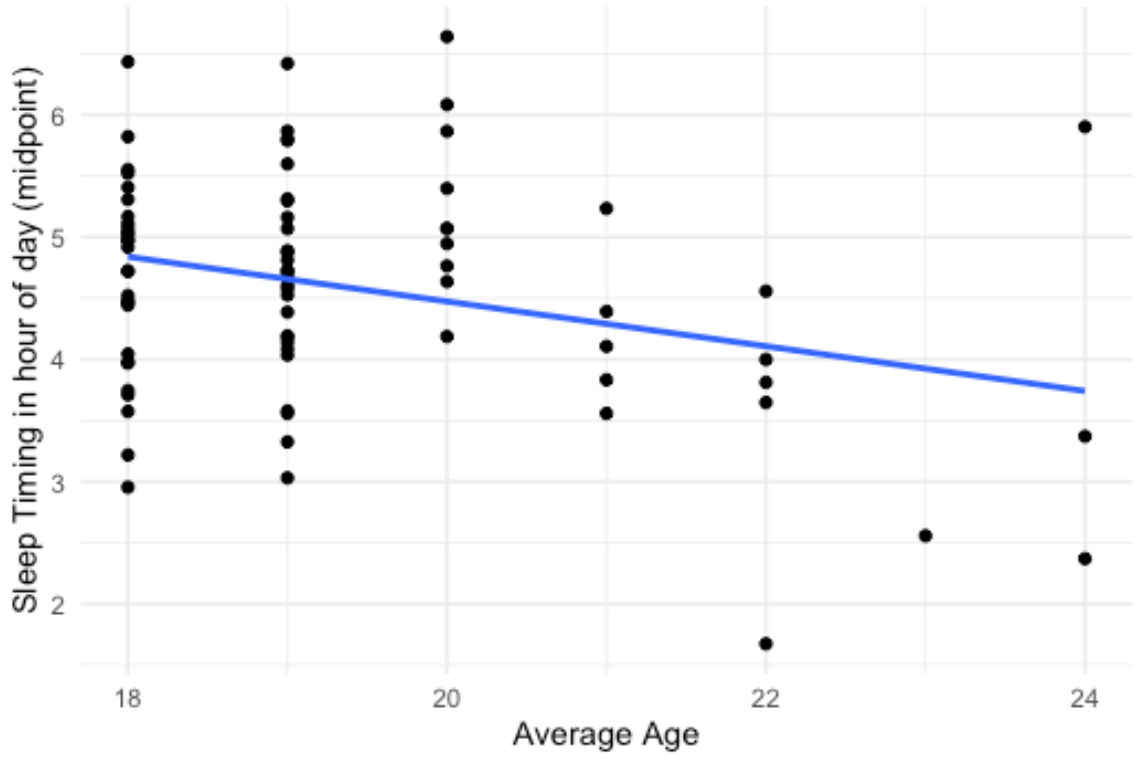


Figure 9. Sleep Quality and Mental Health.

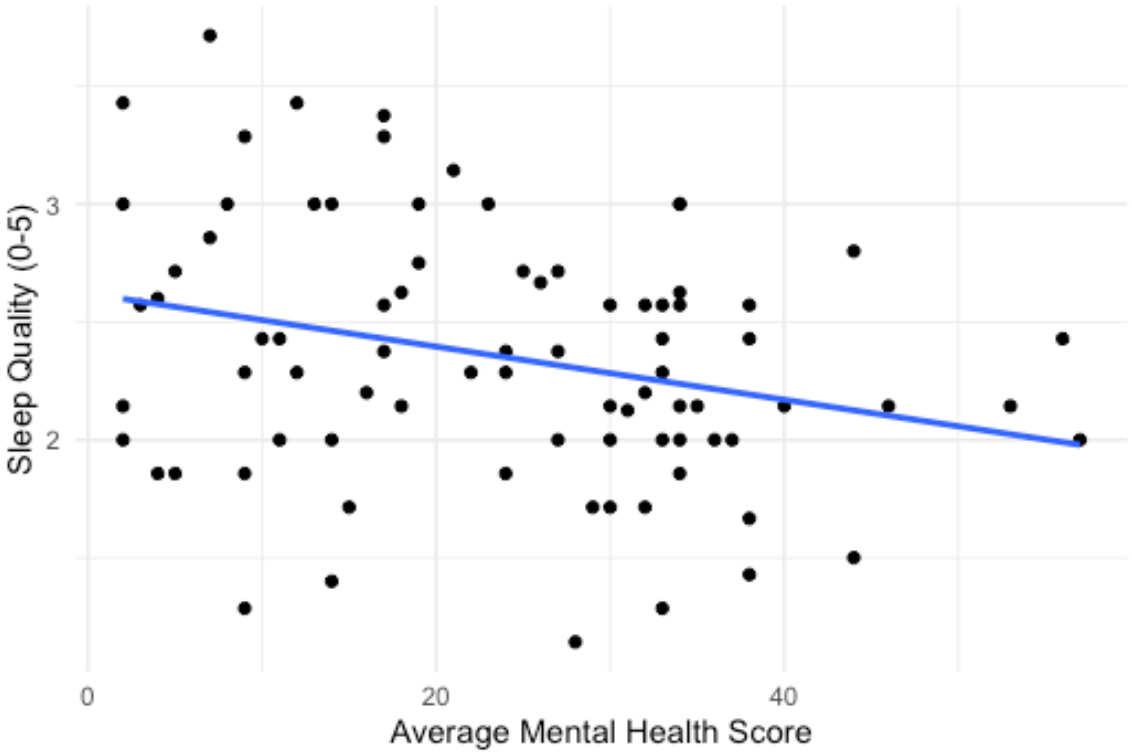


Figure 10. Sleep Efficiency and Mental Health.

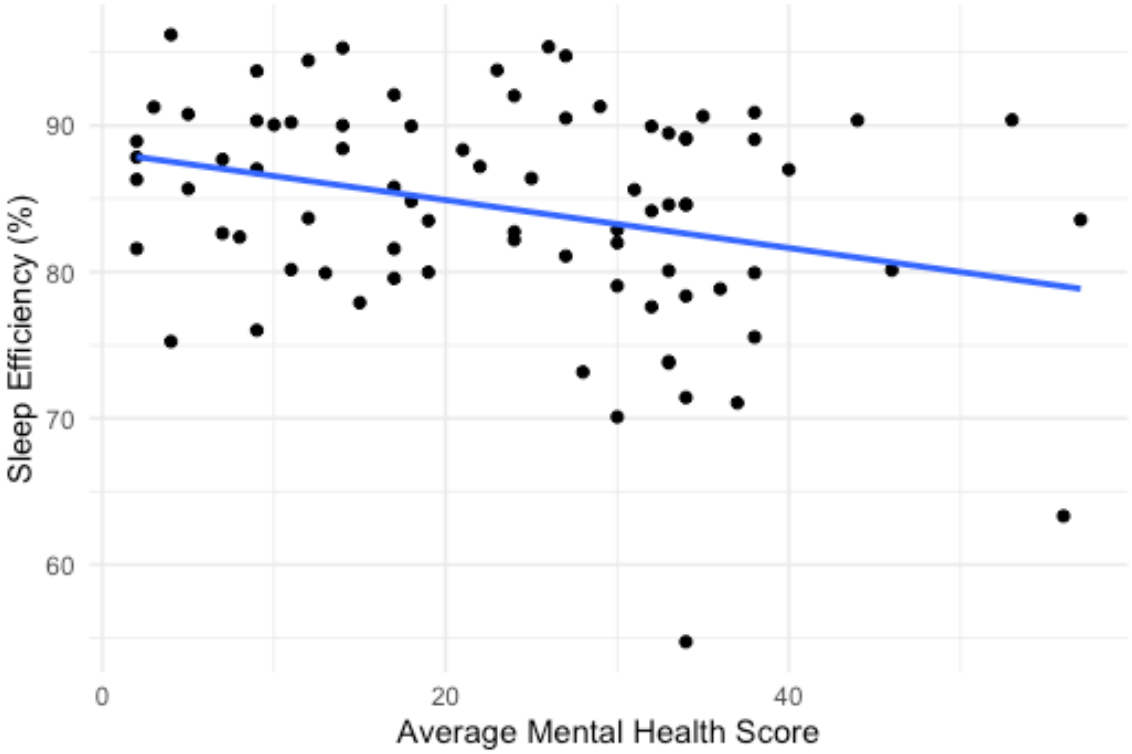


Table 5. Exploratory post-hoc multiple linear regression analyses using individual Sleep Health indices as the outcome variable.

	Sleep Regularity		*Sleep Satisfaction*		*Alternes/ Sleepiness*		*Sleep Timing*		*Sleep Efficiency*		*Sleep Duration*	
Predictor Variables	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Daily Racial Discrimination	-0.26	0.45	0.29	0.38	0.07	0.62	-41.63	35.86	-0.46	5.27	51.61	44.76
Everyday Discrimination	0.07	0.13	-0.02	0.11	0.18	0.18	4.30	10.07	0.27	1.48	-7.89	12.57
Lifetime/Chronic Discrimination	-0.15	0.17	-0.11	0.14	-0.33	0.23	-21.76	13.49	-0.38	1.98	-14.68	16.84
Racial and ethnic Experiences of Discrimination	0.07	0.16	-0.07	0.14	-0.64	0.23	3.14	13.24	1.91	1.95	4.81	16.52
Gender	-0.06	0.17	-0.09	0.15	-0.05	0.24	24.55	13.99	0.72	2.06	23.72	17.46
Race and ethnicity	0.05	0.07	0.02	0.06	0.07	0.09	1.14	5.37	0.29	0.79	3.25	6.70
SES (average parent education)	0.07	0.05	-0.02	0.04	-0.18	0.07	10.77 **	3.83	0.003	0.56	-7.77	4.78
Age	0.03	0.05	0.03	0.04	-0.03	0.07	-11.59 **	3.87	-0.53	0.57	3.02	3.02
Mental Health	0.004	0.01	-0.01*	0.01	0.01	0.01	0.26	0.50	-0.16*	0.07	-0.70	-0.70

Note: β represents the standardized regression coefficients, * $p < .05$, ** $p < .001$.

CHAPTER 4

DISCUSSION

This study aimed to examine the impacts of various forms or dimensions of discrimination on Sleep Health in healthy racial and ethnically diverse college students. To our knowledge, this is the first study to examine various dimensions of discrimination outside the typical general everyday discrimination and lifetime or chronic discrimination. Similarly to past studies, this study was able to incorporate a daily measure of racial and ethnic discrimination through the use of daily dairies, as well as a measure examining the individual's perception of racial and ethnic experiences of discrimination among their racial and ethnic group. However, this study is amongst the few to transition into examining the impact of discrimination onto Sleep Health, a construct that is comprised of various sleep measures. This approach allows for a more comprehensive examination of sleep instead of examining its parts. In this study, it was predicted that greater experiences of discrimination would be associated with worse Sleep Health. Due to the novelty of the research method, there were no predictions as to which measure would be the most predictive or strongly associated with Sleep Health.

The results of Model 1 (only including the discrimination variables), suggests there is limited evidence to support a significant relationship between discrimination and Sleep Health. Because the intercept of the model was significant, it suggests that other factors, not included, may still contribute to Sleep Health. The overall fit suggests that the model does not adequately explain the variance in Sleep Health. These results are inconsistent from prior research, which have consistently identified discrimination as a significant predictor of various sleep outcomes in both cross-sectional and longitudinal studies. A cross-sectional study conducted by Beatty et al., (2011) found that in middle-aged African Americans and Whites, greater unfair treatment was

associated with reports of poorer self-reported sleep quality and greater daytime sleepiness, shorter sleep duration, low sleep efficiency as measured via actigraphy and PSG, and shorter time spent in rapid eye movement (REM) sleep. Similar effects can be seen in a longitudinal study by Lewis et al., (2013). Researchers found that chronic everyday discrimination (across four years) was predictive of subjective sleep complaints and WASO measured via PSG. Lastly, a meta-analysis by Slopen and Williams (2014) observed associations between both racial and nonracial everyday discrimination, as well as racial and nonracial major experiences of discrimination, and increased sleep difficulties.

While further examining the data it can be noted that experiences of discrimination were not endorsed as frequently or as strongly as we would have expected. This suggests that one possible explanation for our poor model fit can be attributed to overall lows mean levels of reported discrimination. For example, daily experiences of racial and ethnic discrimination, measured via daily diaries, had an average score of .16 across seven days, with a range of 0 (did not happen/was not a problem today) to 2 (very much a problem today). These findings align with Wang and Yip (2019), who reported that daily racial discrimination occurrences were infrequent (M = 1.12, SD = 2.90 over two weeks). Although their study had different objectives from the current one, they demonstrated that the daily frequency of ethnic/racial discrimination significantly affected adolescent well-being beyond the impact of general stress. Specifically, when adolescents had longer and higher quality sleep the previous night, they were more likely to engage in active coping strategies (e.g., problem-solving, seeking peer support) on days when they experienced higher levels of discrimination.

The results from Model 2 shed light on the relationship between discrimination, socioeconomic factors, and Sleep Health. Specifically, while various forms of discrimination

were included as predictors, only racial and ethnic experiences of discrimination showed a significant association with Sleep Health ($\beta = -0.76$, $p = 0.02$). Other predictor variables such as daily racial and ethnic discrimination, everyday general discrimination, and lifetime/chronic discrimination did not demonstrate significant associations with Sleep Health ($p > 0.05$). These findings suggest that the association of discrimination with Sleep Health may be more strongly influenced by the perception of racial and ethnic group experiences rather than personal experiences of discrimination. In further examining the data, it became evident that perceptions of racial and ethnic experiences of discrimination, as captured by the SEE measure, held particular importance. This measure reflects individuals' feelings about how their ethnic group is treated unfairly in society at large. Remarkably, the data reveal that the SEE had the highest mean across all discrimination measures (See Table 3). This suggests that a larger proportion of participants endorsed a greater response to their perception of discrimination against their ethnic group as a whole versus personal experiences.

When differentiating between assessing personal experiences of discrimination versus the discernments of how individuals perceive the treatment of their racial or ethnic group in society, there are two distinct yet interconnected constructs. Personal experiences of discrimination pertain to direct encounters with prejudice or unfair treatment based on one's racial or ethnic identity (Williams & Mohammed, 2009). On the other hand, perceptions of group-based discrimination explore individuals' beliefs and opinions regarding the treatment of their racial or ethnic group as a whole within society (Pascoe & Richman, 2009). For example, items from the SEE measure may prompt respondents to reflect on societal attitudes towards their ethnic group, such as, "My ethnic group is often criticized in this country" or "In America, the opinions of people from my ethnic group are treated as less important than those of other ethnic groups."

These items capture individuals' perceptions of broader societal dynamics and systemic inequalities that affect their ethnic group, rather than isolated incidents of personal discrimination. Thus, understanding individuals' perceptions of group-based discrimination provides valuable insights into the collective experiences and social realities faced by marginalized communities within society.

Model 2 also revealed that SES, measured by average parental education, emerged as a significant negative predictor of Sleep Health ($\beta = -0.40$, $p < 0.001$). The results indicate that higher levels of parental education were associated with lower Sleep Health scores. The findings were unexpected and contradictory with previous studies that have demonstrated lower SES, both parent education attainment and income, predicting poor sleep. Specifically, lower SES has been related to less sleep efficiency, longer latency, greater WASO, difficulties initiating sleep and staying asleep, and worse sleep quality (Bøe et al., 2012; Mezick et al., 2008; Tomfohr et al., 2012).

Past research that has identified SES as a significant predictor of Sleep Health has either collected information on the three core SES measures – parental educational attainment, parental occupation, and household income (Diemer et al., 2013) – or have created an aggregate score including at least two of those variables (Mezick et al., 2008; Tomfohr et al., 2012). In our study, when income was added to the model for exploratory analytical purposes, it did not account for additional variance and was a not a significant predictor of Sleep Health ($p > .05$). It is unclear why these results are contradictory to the existing literature. It could be hypothesized that higher parental education can be associated with Sleep Health through a mediating or moderating variable such as stress or parental expectation. However, our current model did not find stress (measured through the DASS) as a significant predictor of Sleep Health. Further exploration of

the literature demonstrated that greater parental education was a significant predictor of greater child academic achievement, parental involvement, less child perceived stress, and greater social and academic support for the child (Azhar et al., 2014; Finkelstein et al., 2007). Additionally, only students with low parental education reported greater perceived stress and pressure from their parents for better academic performance (Deb et al., 2015; Finkelstein et al., 2007).

Associations between race and sleep may be moderated by social economic status. For example, one epidemiological study (Jackson et al., 2013) examined how short sleep duration differs between Black and White individuals in various job industries. Using data from over 41,000 US adults, it was found that Black individuals were more likely to experience short sleep than white individuals in (37% versus 28%). This disparity was more pronounced in professional occupations. For example, in specific industries like finances, real estate, education, public services, health care, and manufacturing, Black individuals reported significantly higher rates of short sleep compared to their White counterparts. These findings suggest that high social economic status among Black individuals does not appear to be a protective factor against short sleep as it does for White individuals. Additional research could provide more insights into the long-term effects of occupational stress and SES on Sleep Health and overall well-being in parents and their children.

Level 3 of the model indicated that when mental health was included into the model, as measured by the Depression, Anxiety, and Stress scale, it did not explain any additional variance in Sleep Health beyond what was explained by Model 2. In other words, mental health was not a significant predictor of Sleep Health. These results are inconsistent with the literature. Sleep disturbances, such as sleep deprivation and poor sleep quality, have demonstrated to play a pivotal role in mental health, particularly among individuals grappling with anxiety and

depressive symptoms. In fact, epidemiological studies indicate that disturbed sleep is amongst the most prevalent symptoms of depression (Krueger & Friedman, 2009; Patel et al., 2006), with a significant number of individuals (60%-90%) experiencing disruptions in their sleep patterns (Patel et al., 2006). Similarly, various cross-sectional studies have identified associations between sleep disturbances, notably insomnia, and anxiety disorders (Breslau et al., 1996; Kachikis & Breitkopf, 2012). Individuals with anxiety disorders often exhibit heightened arousal, or excessive worrying, making it challenging to initiate or maintain sleep, further exacerbating sleep difficulties (Kelly, 2003). It is possible that this study was unable to observe a significant relationship between mental health and Sleep Health in our sample due to the relatively low mean scores for each subscale (depression = 7.49, anxiety = 7.50, and stress = 8.77), which fall within the none to mild range (Crawford et al., 2009).

Sleep Health Considerations and Exploratory Analyses

To our knowledge, this study represents the first exploration of the impact of discrimination on sleep utilizing a comprehensive, multidimensional measure of Sleep Health. The utilization of this measure is inspired by the framework established by Buysse (2014), which emphasizes the significance of a thorough comprehension of sleep. Incorporating a multidimensional measure of sleep continues to support the progression of sleep research, recognizing sleep as a multifaceted phenomenon affected by numerous elements. By integrating diverse dimensions such as sleep quality, efficiency, and daytime functioning, we attain a more comprehensive understanding of an individual's Sleep Health. However, while our study represents an innovative exploration of the impact of discrimination on sleep utilizing a comprehensive, multidimensional measure of Sleep Health, it is also essential to acknowledge the potential limitations in this approach.

One significant challenge is the difficulty in defining optimal Sleep Health cut-offs, particularly in understudied populations. This difficulty is heightened by the lack of standardized validation for each Sleep Health scoring rule. The formulas used in the calculations of the scores varied across studies, from adolescents (Dong et al., 2019) to young adulthood (mean age = 24.87, Kuula et al., 2019), with only one study using college students (mean age 23.8, Randler & Vollmer, 2013). It should be noted that sleep tends to deteriorate from adolescence transitioning to college, influenced by both biological and psychosocial factors (Doane et al., 2015); therefore, unique considerations should be taken into account when defining Sleep Health boundaries for college students. Additionally, two studies (Dong et al., 2019; Randler & Vollmer, 2013) did not appear to consider race and ethnicity or cultural factors when establishing these cutoffs for Sleep Health, potentially leading to variations in interpretation, particularly in diverse and understudied populations. Another challenge faced when using the Sleep Health framework is dichotomization of the sleep variables. Dichotomized measures of Sleep Health, as used in our study, may sacrifice sensitivity, and fail to capture the nuances of sleep variability within individuals.

In an attempt to address this limitation, better understand our data, and replicate past methods of sleep variables, we decided to use individual indices of sleep as outcome variables. The additional multivariable analyses aimed to explore the relationships between various dimensions of discrimination and specific aspects of Sleep Health, including sleep duration, efficiency, quality, regularity, timing, and sleepiness. However, to our surprise, the results revealed that none of the discrimination variables, such as daily racial and ethnic discrimination or lifetime/chronic discrimination, were significant predictors for any of these individual aspects of sleep. When all covariates (age, race and ethnicity, average parental education, gender, and mental health) were included in the analyses, parental education and age emerged as significant

predictors for sleep timing (average midpoint). Specifically, higher average parental education was associated with later sleep timing, while older participants tended to have earlier sleep timing.

As mentioned above, there is no clear indication as to why greater parental education was associated with later sleep times. However, research does support our finding that older age is predictive of earlier sleep time. Studies show that sleep patterns undergo significant changes throughout life. Primary school children typically have early bedtime and wakes. With the onset of puberty, both biological and social obligation create a delay in preferred sleep timing, resulting in later bedtimes. However, upon the transition to early adulthood, typically in the early 20s, the trend reverses, and drifts back to earlier sleep timing (Dijk & Duffy, 1999; Roenneberg et al., 2004; Skeldon et al., 2016). These shifts in sleep timing are notable in college students as well. For example, once study found that first-year college students were more likely to report poor sleep than second-years students (Suen et al., 2008). Similarly, research by Lund et al., (2010) found that first-year students had significantly later bedtimes and rise times than juniors and seniors during the weekends, but not during the weekdays.

The results of our study also provided intriguing insights into the relationship between mental health and Sleep Health. Notably, while our mental health and stress variable, did not emerge as a significant predictor of overall Sleep Health, it did significantly predict specific sleep indices, namely sleep quality and sleep efficiency. These findings may indicate that while mental health issues, such as those captured by the DASS, are related to particular aspects of sleep (specifically quality and efficiency), they do not robustly predict overall Sleep Health. Our results are consistent with existing literature that highlights the nuanced ways in which mental health impacts specific sleep outcomes. For example, a meta-analysis found that anxiety can

disrupt sleep architecture, leading to poorer sleep quality and efficiency without necessarily affecting overall sleep duration or other aspects of Sleep Health (Cox & Olatunji, 2016).

The lack of significant predictive power for overall Sleep Health might also be attributed to the comprehensive nature of the Sleep Health construct, which encompasses multiple dimensions such as duration, timing, and regularity, in addition to quality and efficiency. Mental health may predominantly influence only certain dimensions of sleep rather than all aspects equally, which could explain the limited variance explained in our models. Future research should continue to explore these relationships using larger and more diverse samples to better understand the complex interactions between mental health and different dimensions of sleep. Additionally, longitudinal studies would be valuable in examining how changes in mental health over time impact various sleep outcomes.

Strengths and Limitations

This study was intended to capture the experiences and impacts of discrimination on Sleep Health in healthy college students. This study is unique in that only students who have experienced any form of discrimination and identified as a racial or ethnic minority were recruited. This recruitment was intentional to accurately represent racial and ethnic minorities and capture their diverse and unique experiences. Additionally, the discrimination measures that were selected were amongst the most popular and well researched amongst college students to examine the nuances of the social stressor (e.g., chronic vs daily, overt vs covert, general vs race specific, and personal vs group perception). By including four discrimination measures, we were able to examine the unique characteristics and attributions of each measure and their impact on Sleep Health.

The utilization of daily diaries in this study enhances its robustness by documenting participants' sleep patterns across seven days, thus avoiding reducing errors associated with retrospective recall found in questionnaires. Moreover, the study's incorporation of six distinct sleep indices, including midpoint and midpoint variance, expand our understanding of participants' overall sleep characteristics and patterns. However, it is important to note that these measures rely on subjective reporting, which may introduce bias. The inclusion of objective sleep measures such as actigraphy watches offers greater reliability and accuracy.

There are some limitations to consider as well. First, this study did not track weekdays and weekends separately. Sleep was collected across one week (7 days) and included one weekend that was not distinguished. This information would have been informative given that weekends are typically used to catch up on sleep debt accumulated during the school/work week (Gaston et al., 2020). Previous research has shown that students tend to sleep on average two hours more on weekends compared to weekdays (Galambos et al., 2009; Lund et al., 2010). Similar patterns were observed in our data, with participants sleeping 4-7 hours on some days (presumed to be weekdays) and 7-12 hours on others (presumed to be weekends). This weekend catch-up sleep may have elevated the overall sleep duration average of the participants.

Another limitation is the lack of geographic diversity. Due to the convenience of sampling and access to the university’s human subject pool, we restricted recruitment to students from a single institution. It would be interesting to examine the effects of discrimination, including day to day experiences, in regions that may be less progressive or minority-friendly. It is possible that students in our sample had limited exposure to instances of discrimination compared to those in different environments. Therefore, examining a more geographically

diverse population could provide further insights into the relationship between discrimination and Sleep Health.

Summary and Future Directions

The overall results from our study were unexpected and inconsistent with prior research, which has consistently identified discrimination as a significant predictor of various sleep outcomes in both cross-sectional and longitudinal studies. There are several factors that may explain these discrepancies. First, our study employed a multi-method, micro-longitudinal design, which differs from the larger epidemiological studies that have traditionally been used to explore the relationship between discrimination and mental health and sleep and mental health. While large-scale epidemiological studies provide valuable insights into broad trends and associations, our approach allows for a more detailed and nuanced examination of the daily experiences and sleep patterns of racial and ethnic minority college students.

Second, our sample population of college students represents a unique demographic that may experience discrimination differently compared to the general population. College students often face specific stressors related to academic performance, social integration, and identity exploration, which could interact with experiences of discrimination in complex ways. Additionally, the college environment may offer resources and support systems that mitigate the impact of discrimination on sleep, leading to different outcomes compared to studies involving broader or more varied populations.

Third, our study includes a comprehensive set of sleep measures, encompassing not only sleep duration and quality but also regularity, satisfaction, alertness/sleepiness, timing, and efficiency. This multidimensional approach to assessing Sleep Health may reveal different patterns than studies that focus on a narrower range of sleep outcomes. It is possible that

discrimination impacts some aspects of Sleep Health more than others, and our broader measures may capture a more complex relationship.

Fourth, it is important to consider the potential role of unmeasured confounding variables. While we have controlled for factors such as gender, age, race, ethnicity, average parental education, and a composite score of mental health, other unmeasured variables may influence the relationship between discrimination and Sleep Health. Future research should aim to identify and account for these potential confounders to clarify the relationship further.

Lastly, longitudinal research on the relationship between discrimination and Sleep Health is crucial for understanding the complex interplay between these factors over time. Past studies have highlighted the negative impacts of discrimination, on both Sleep Health and mental well-being. However, examining this relationship at one time point may not provide sufficient insight into the manifestation of consequential patterns or behaviors over time. Overall, longitudinal studies examining the chronic effects of discrimination on Sleep Health are essential for developing targeted interventions and promoting better sleep outcomes among diverse populations.

Moving forward, there is a need to delve deeper into the nuances of discrimination and its intricate relationship with Sleep Health. To advance our understanding, future research should continue to explore various forms and dimensions of discrimination, including chronic, covert, personal experiences, group perception, and everyday discrimination. It is also crucial to consider various factors such as frequency, intensity, duration, setting, and the presence of betrayal or violation expectations to uncover the mechanisms through which discrimination impacts sleep. By examining different dimensions of discrimination, we can gain a more nuanced understanding of the complex relationship between discrimination and Sleep Health.

This approach offers several potential implications for research and practice. First, it underscores the importance of recognizing discrimination and Sleep Health as multifaceted constructs. By acknowledging the diverse manifestations of discrimination and the multidimensional nature of Sleep Health, researchers can adopt a more comprehensive approach to studying these phenomena. Exploring different dimensions of discrimination allows for a deeper investigation of the mechanisms through which discrimination impacts Sleep Health. Understanding how chronic experiences of discrimination over time versus daily instances of discrimination affect sleep patterns and quality can provide valuable insights into the long-term and immediate effects of discrimination on sleep.

Future research should delve deeper into how discrimination uniquely impacts racial and ethnic minorities. Epidemiological studies indicate that self-perceived discrimination is widespread among all racial and ethnic groups. In fact, perceptions of discrimination vary significantly by race and ethnicity, suggesting that different groups may experience and internalize discrimination in unique ways (Gong et al., 2017). A large meta-analysis has found significant associations between perceived discrimination and negative health outcomes across diverse populations (Pascoe & Richman, 2009). Therefore, further research is necessary to understand these variations in perception among different ethnicities and races, and how these perceptions intersect with other social variables such as SES and gender to influence well-being and sleep.

Moreover, understanding the nuanced relationship between discrimination and Sleep Health can inform the development of targeted interventions and support strategies for racial and ethnic minority students. By identifying specific types and contexts of discrimination that are most detrimental to Sleep Health, interventions can be tailored to effectively address these

factors. This deeper understanding can lead to the development of more effective strategies to promote Sleep Health and well-being among racial and ethnic minority students. Ultimately, this research has the potential to contribute to broader efforts aimed at addressing health disparities and promoting equity in Sleep Health outcomes.

APPENDIX A

SCREENING FOR SLEEPER STUDY

Instructions. Please read each question and mark the appropriate answer.

1. Have you ever experienced being treated poorly or unfairly because of your race or ethnicity?

2. Are you currently enrolled in college or university? _____Yes _____ No

3. Do you identify as an ethnic or racial minority? _____Yes _____ No

4. Are you between the ages of 18-24?

_____Yes _____No

5. Do you have any of the following conditions?
_____Yes _____No

    a. Sleep apnea
    b. Narcolepsy/cataplexy
    c. Psychosis

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

Participant ID _____

Thank you for taking the time to participate in our study! Your accurate and honest responses are important to us, so please take your time and read all instructions and items carefully.

What is your age? (less than 18, please discontinue the survey).

_____

Gender? _____

Are you Hispanic, Latina, or of Spanish origin? (1 or more Latina categories may be selected)
☐ No
☐ Yes

Which of the following best describes you?
☐ Asian or Pacific Islander
☐ Black or African American
☐ Hispanic or Latino
☐ Native American or Alaskan Native
☐ White or Caucasian
☐ Multiracial or Biracial
☐ A race/ethnicity not listed here _____

What is your family's total, pre-tax annual household income?
☐ Less than $15,000
☐ $15,000 - $34,000
☐ $35,000 - $49,000
☐ $50,000 - $74,000
☐ $75,000 - $99,000
☐ $100,000 - $149,000
☐ $150,000 or more

What is the highest degree of level of school completed by Parent 1
☐ Middle school/Jr. High
☐ High School/GED
☐ Bachelor’s degree (e.g., BA, BS)

APPENDIX B

(continued)

☐ Master's degree (e.g., MA, MS, Med)
☐ Doctorate (e.g., PhD, EdD)
☐ Other (please specify) _____
☐ Unknown

What is the highest degree of level of school completed by Parent 2
☐ Middle school/Jr. High
☐ High School/GED
☐ Bachelor's degree (e.g., BA, BS)
☐ Master's degree (e.g., MA, MS, Med)
☐ Doctorate (e.g., PhD, EdD)
☐ Other (please specify) _____
☐ Unknown

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