Examining Mediators of the Association Between Child Maltreatment and Sleep Disturbance in College Students

A Dissertation
SUBMITTED TO THE FACULTY OF THE
UNIVERSITY OF MINNESOTA
BY

McKenzie Kaubrys

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Advisor: Patricia A. Frazier, PhD

September 2022

Acknowledgements

I would first like to acknowledge my advisor, Dr. Patricia Frazier. Her dedication, mentorship, and knowledge are truly unmatched, and it is her support that helped me cross this finish line. Pat, thank you for believing in me. I am so lucky to have you as my advisor and, now, mentor for life.

I extend my gratitude to my committee members for their guidance and support of my project: Dr. Richard Lee, Dr. Susan Mason, and Dr. Samantha Anders. I also want to acknowledge and thank the research participants who volunteered their time for this study: without them, this project would not have been possible. To the undergraduate students whom I had the joy of teaching and learning from during my years as a graduate instructor: thank you for your energy, insight, and curiosity, which inspired me and gave me purpose in my program of research.

I also greatly appreciate my colleagues in the Counseling Psychology area at the University of Minnesota, including, but not limited to: my kind and brilliant cohort mates, Stress and Trauma Lab collaborators, and our wonderful program specialist, Amy Kranz. My graduate school journey was made infinitely better because of the supportive community you all helped to create. Special thanks to Dr. Viann Nguyen-Feng and Dr. Majel Baker for sharing their wisdom, data, and statistical expertise throughout the years. I am also particularly grateful to Emily Mischel for providing support, collaboration, and accountability throughout the dissertation process.

Last, but certainly not least, I am deeply grateful to my family and friends, whose love and support sustained me throughout six years of graduate school. To my friends near and far: thank you for your never-ending encouragement, understanding, and patience. Your friendships have kept me grounded and brought me joy during difficult times. To my family: thank you for providing a foundation that allowed me the freedom, curiosity, and bravery to pursue this path. Mom and Dad, I cannot thank you enough for your many forms of support, ranging from the inexhaustible supply of Post-it notes to your (multiple!) cross-country roadtrips. You made this possible and worthwhile, and I am eternally grateful.

Dedication

This dissertation is dedicated in loving memory of my grandparents: John and Jean Clifford and Ty and Alfreda Kaubris. For teaching me the values of hard work, knowledge, humor, and, above all, compassion.

Table of Contents

List of Tables

List of Figures

Examining Mediators of the Association Between Child Maltreatment and Sleep Disturbance in College Students

A significant portion of students entering college have a history of childhood maltreatment. Defined as experiences of abuse (physical, emotional, and sexual) and neglect (physical and emotional; Bernstein & Fink, 1998), child maltreatment is a significant problem within the United States. In 2020, the U.S. Department of Health and Human Services (DHHS) reported that there were eight victims of child abuse and neglect for every 1,000 children in the population (U.S. DHHS, 2022). Unfortunately, these statistics are likely an underestimate of the true prevalence of maltreatment (Maples et al., 2014), as many cases of abuse and neglect go unreported. By the time young adults enter college, a significant portion have experienced at least one form of maltreatment, and many have experienced multiple forms (e.g., Arata et al., 2005; Clemmons et al., 2007).

Experiences of maltreatment in childhood are associated with greater risk for negative mental and physical health outcomes across the lifespan, including disrupted sleep (e.g., Kalmakis & Chandler, 2015). Indeed, a growing body of research suggests that disrupted sleep is one pathway through which early adversities affect later health (e.g., Fuligni et al., 2021). The link between child maltreatment and adult sleep disturbance has been well-established in retrospective and prospective studies (see Brown et al., 2022 and Kajeepeta et al., 2015 for systematic reviews). Overall, reviews suggest a robust association between child maltreatment and poorer adult sleep with an effect size in the small-to-medium range across heterogeneous samples, measures and methodologies.

There have been fewer investigations of the relation between child maltreatment and sleep among college student samples, though these have demonstrated similar results to adult samples. Most studies have found small-to-moderate associations between child maltreatment and adversity and poorer self-reported sleep (e.g., John-Henderson et al., 2018; Rojo-Wissar et al., 2019; Kaubrys et al., 2021). For example, in one large sample of college students from seven universities in Georgia, higher adverse childhood experience (ACE) scores were associated with shorter self-reported average sleep duration (Windle et al., 2018). In one cross-sectional study with undergraduates from two U.S. universities, researchers found a large association between a history of child adversity and insomnia symptoms (Gress-Smith et al., 2015). Understanding the relation between child maltreatment and sleep in college students is of high importance given the central role of sleep in students' functioning, paired with evidence to suggest that many college students struggle to obtain sufficient, quality sleep. In a large sample of undergraduates, nearly 10% met criteria for chronic insomnia and another 27% reported significant sleep disturbances (Taylor et al., 2013). Problems with sleep have been linked to negative outcomes for college students, including poorer academic performance (e.g., Hartmann & Pritchard, 2018), greater risk of alcohol-related consequences (e.g., Kenney et al., 2014), and poorer mental health, including depression and anxiety (e.g., Fernandez-Mendoza et al., 2009; Taylor et al., 2013). In data from a large national sample of students, sleep problems were as or more strongly related to academic success than many other health problems typically addressed on campus (e.g., binge drinking), leading the authors to conclude that sleep problems had the greatest impact that received the least attention (Hartmann & Pritchard, 2018).

Theoretical Framework of Mechanisms Linking Maltreatment to Sleep

Theoretical models explaining the onset and perpetuation of sleep disturbance, such as the hyperarousal model of insomnia (Riemann et al., 2010), can be used as a lens through which to understand the link between maltreatment in childhood and sleep disturbance later in life (Pfaff et al., 2021). The normative process of sleep requires reduced arousal and responsiveness to environmental stimuli (e.g., Joiner 2018). Maltreatment experiences typically increase threats of harm or unpredictability, resulting in states of increased vigilance and hyperarousal that can impede sleep (e.g., Noll et al., 2006). Thus, children exposed to maltreatment may be at greater risk for persistent sleep disturbance in adulthood as a result of living under potentially threatening conditions for sustained periods of development. The hyperarousal model of insomnia posits an interplay between psychological, physiological, and behavioral factors in the maintenance of chronic sleep disturbance (Riemann et al., 2010).

On the cognitive level, theoretical models suggest that ruminative response styles increase hyperarousal and distress, contributing to difficulties falling asleep and maintaining restful sleep (e.g., Carney et al., 2010; Harvey et al., 2005). Indeed, studies have demonstrated that individuals who engage in more rumination following stress have longer sleep onset latency (Zoccola et al., 2009), poorer sleep quality (Guastella & Moulds, 2007; Van Laethem et al., 2016), and more sleep difficulties (Amaral et al., 2018; Van Laethem et al., 2016). Several studies suggest that, compared to those without histories of maltreatment, adults with a history of childhood abuse are more likely to engage in rumination (Raes & Hermans, 2008; Sarin & Nolen-Hoeksema, 2010; Szabo et al., 2020).

Furthermore, early maltreatment experiences are typically not controllable, which may influence individuals' perceptions of control over stressful events across their lifespan (e.g., Irving & Ferraro, 2006; Pfaff & Schlarb, 2022). Therefore, the present study proposes that perceptions of control could be included among the cognitive considerations of the hyperarousal model of insomnia. Perceived control has been conceptualized in terms of general control beliefs (Rotter, 1966), which reflect the degree to which individuals believe events in their life are independent of their actions (external locus of control) or dependent upon their behavior (internal locus of control), and event-specific control beliefs (Frazier et al., 2011), which refer to perceptions about the controllability of a specific event. There is evidence to suggest that event-specific measures of perceived control are more related to adjustment (i.e., lower distress, fewer depressive symptoms) than general control beliefs (Frazier et al., 2011). Of the different temporal aspects of event-specific control (i.e., past, present, future control; Frazier et al., 2001) only present control has shown consistent associations with less distress (Frazier et al., 2011). In a pilot study, we found that college students with a history of greater maltreatment experienced less present control over their daily stressors with a small-to-moderate negative association (e.g., Person et al., 2020). Although several studies have investigated sleep-specific control beliefs (e.g., Vincent et al., 2013), to the best of our knowledge, no study has examined the relation between event-specific control beliefs and sleep-related outcomes. Results from our pilot data suggest that event-specific control beliefs were modestly correlated with sleep quality and restfulness, such that higher daily reports of present control were associated with better sleep quality and restfulness (e.g., Person et al., 2020).

On the behavioral level, maladaptive behaviors incompatible with sleep (e.g., delayed bedtime, daytime napping) are postulated to contribute to the perpetuation of insomnia (Riemann et al., 2010). Researchers have hypothesized that the chaotic and unsafe family environments that frequently correspond with child maltreatment may be incompatible with proper sleep hygiene, leading to the development of poor sleep patterns that persist into adulthood (Gregory et al., 2006). Sleep hygiene refers to the behavioral practices and environmental factors that promote healthy sleep, such as routine bed and wake times, caffeine and alcohol usage, and levels of noise, light, and temperature (Stepanski & Wyatt, 2003). Chaotic family environments characterized by high levels of noise, light, and a lack of routine may impede children's ability to develop healthy patterns of sleep. Indeed, family chaos has been linked to sleep disturbance in children (Brown & Low, 2008; Gregory et al., 2005). Furthermore, children who experienced maltreatment may deliberately alter their sleep routines or patterns due to the threat of violence (e.g., sleeping fully clothed, sleeping only when a perpetrator is out of the house; Spilsbury, 2009). For example, victims of childhood sexual abuse in particular may associate bedtime with fear (Charuvastra & Cloitre, 2009), contributing to the ongoing development of poor sleep routines. Research has demonstrated that, in later adolescence and adulthood, sleep hygiene is associated with sleep outcomes, such as the duration or quality of one's sleep. In adult samples, researchers have found a moderate association between sleep hygiene and sleep quality (e.g., Brick et al., 2010; Cho et al., 2013; Mastin et al., 2006), with evidence to suggest that poor sleepers are more likely to engage in poor sleep hygiene (Gellis & Lichstein, 2009)

Also included in the cognitive-behavioral domain of the hyperarousal model of insomnia is the presence of relevant psychopathologies, including depression and anxiety, which can serve to perpetuate sleep disturbance (Riemann et al., 2010). Indeed, symptoms of anxiety, depression, and stress (hereby referred to as "psychological distress") have been associated with sleep disturbance across a number of studies (Almojali et al., 2017; Cunningham et al., 2015; Seun-Fadipe & Mosaku, 2017), and there is evidence to suggest that adults who experienced maltreatment in childhood are more likely to experience psychological distress than those without a history of maltreatment (Edwards et al., 2014; Springer et al., 2007; Wright et al., 2009). For example, in one longitudinal study, psychological distress (defined as a composite of perceived stress, depression and anxiety) mediated the association between emotional neglect and declines in sleep quality during the transition to university among students in the United Kingdom (John-Henderson et al., 2018).

Limitations of Prior Research

Despite the well-established link between child maltreatment and sleep, research into mediators of this association is lacking. First, studies have been limited in their assessment of mediators, with most studies examining only one or two mediators per study. Most conceptual models suggest that a combination of mechanisms are likely at play and perhaps influence one another. Additionally, the relative contributions of potential mediators are difficult to determine when not compared simultaneously. Furthermore, few studies have tested alternative equivalent models. Given the bidirectional nature between sleep and many of the possible mediators, such as distress, it is possible that different patterns of relations between child maltreatment and later

outcomes are also consistent with the data (Doane & Thurston, 2014; Sin et al., 2017). Indeed, in a recent cross-sectional investigation of mental health, perceived health, and sleep quality among undergraduates with a history of ACEs, not only did self-reported symptoms of depression, anxiety, and perceived health mediate the association between ACEs and sleep quality, but sleep quality also partially mediated the association between ACEs and these health outcomes (Rojo-Wissar et al., 2019). Thus, it is important to test for alternative explanations as well (Frazier et al., 2004).

Second, the majority of the studies examining mediators were cross-sectional in nature and thereby limited in their measurement of sleep outcomes, often relying on retrospective measures of sleep. Retrospective reports of sleep, which typically require participants to make estimates about their sleep over the past month, are subject to recall bias and are less accurate than daily reports (e.g., Babkoff et al., 1996; Nehrkorn-Bailey et al., 2018). There is evidence to suggest that retrospective questionnaires are only moderately correlated with daily sleep logs, with retrospective measures eliciting shorter sleep durations, on average (Mallinson et al., 2019; Mullington et al., 1988). Thus, daily self-report measures of sleep may provide more precise sleep data while still allowing for large, ecological data collection (Mallinson et al., 2019).

Finally, only a handful of studies have tested mediators of the association between child maltreatment and sleep in college student samples (Gress-Smith et al., 2015; John-Henderson et al., 2018; Ramsawh et al., 2011; Rojo-Wissar et al., 2019). College is a unique but important period of time in which to investigate these associations. During this time, students are navigating challenging stressors, mental health concerns, and new interpersonal relationships. Simultaneously, students are attempting to establish and

maintain sleep habits, possibly while living away from home for the first time. Indeed, from an intervention perspective, college presents an important opportunity to both identify and intervene on possible mediators of the association between maltreatment and sleep disturbance.

Present Study

To address these gaps in the literature, the present study examined four mediators of the association between child maltreatment and sleep in a sample of college students. This study contributed to the existing literature in several ways. First, the present study investigated multiple mediators in the same model, allowing for comparisons of the relative contributions of each mediator. The four mediators examined in this study--rumination, present control, sleep hygiene, and psychological distress-- can be theorized to represent elements of the cognitive and behavioral dimensions of the hyperarousal model of sleep disturbance. Second, this study compared the hypothesized model to an alternative model examining reverse mediational processes (i.e., does sleep mediate the association between child maltreatment and the proposed mediators--distress, rumination, present control, and sleep hygiene), which few past studies have done. Testing possible equivalent models provides a stronger test of the hypothesized model, as it allows for comparisons of different patterns of relationships among the variables (e.g., MacCallum et al., 1993). In a cross-sectional study investigating alternative models, a model wherein the relationship between ACEs and sleep quality was mediated by depression and anxiety demonstrated a stronger pattern of relations among the variables than a model in which the relationship between ACEs and depression and anxiety was mediated by sleep quality (Rojo-Wissar et al., 2019). Third, the present study assessed sleep using a daily

self-report measure assessed over 14 days, thereby improving upon past studies that assessed sleep using cross-sectional, retrospective designs. In addition, this study utilized a well-validated, multidimensional measure of sleep disturbance, which improves upon studies that analyzed sleep outcomes as separate indices, with many studies reporting on just one or two sleep dimensions. Investigating only one or two sleep indices makes comparisons across studies difficult and contributes to confusion in the sleep literature. Finally, examining these mediators in a college student population lays the groundwork for future prevention and intervention efforts in this vulnerable population.

Our hypotheses were as follows: **(1)** Greater history of child maltreatment will be associated with poorer daily sleep. **(2)** Greater history of child maltreatment will be associated with greater rumination, lower perceived present control, poorer sleep hygiene, and greater distress. **(3)** Greater rumination, lower perceptions of present control over daily stressors, poorer sleep hygiene, and greater psychological distress will be associated with poorer sleep. **(4)** More rumination, lower perceived present control, poorer sleep hygiene, and greater distress will mediate the relation between child maltreatment and subsequent sleep disturbance. **(5)** The hypothesized mediation model, by which child maltreatment has an indirect effect on sleep through the proposed mediators of rumination, present control, sleep hygiene, and distress, will be compared to an alternative mediation model, in which sleep disturbances mediate the relation between child maltreatment and daily experiences (e.g., rumination, present control, sleep hygiene, and distress). We predict that the hypothesized model will result in significant mediation (see Hypothesis 4), whereas sleep will not fully mediate the relation between child maltreatment and average daily experiences of rumination, present control, sleep

hygiene, and distress.[1] Hypotheses were tested using structural equation modeling (SEM). The methods and hypotheses of the present study were pre-registered with the Open Science Framework (OSF) and will be made available upon publication.

Method

Participants and Procedure

Data were collected following approval from the university's Institutional Review Board. Participants were undergraduate students recruited via online methods (e.g., announcements sent to class and student organization listservs, online postings) at two university campuses in the Midwest. Specific efforts were made to recruit students from underrepresented backgrounds, including disseminating announcements among 16 multicultural campus organizations. Interested participants were told that they were being invited to participate in a two-week daily diary research study intended to gain a better understanding of the relations among college students' daily experiences, such as stress, coping, and sleep. As compensation for participation, participants had the option to receive extra credit in participating courses or be entered to win one of 22 $50 Amazon gift cards. An a priori power analysis indicated that a sample of 211 would be needed to detect a good-fit RMSEA value of .05 (per recommendations from Hu & Bentler, 1999) for the full hypothesized model with .80 power (Kim, 2005, Equation 7). A total of 297 students completed the study sign-up and 243 students completed the baseline survey.

Data collection took place from late November to early December 2020. Eligible participants who provided informed consent first completed a baseline survey including measures assessing a history of childhood maltreatment and background variables. For

[1] The phrasing of this hypothesis has been modified from its original form in the OSF pre-registration to reflect a focus on the significance of path coefficients rather than the overall model fit, which is equivalent across models.

two weeks, participants then completed assessments twice daily (morning and evening) via smartphone or web browser. Participants had four hours to complete each survey. Daily assessments included measures of rumination, present control, sleep hygiene, and psychological distress, assessed in the evening, as well as sleep disturbance, assessed each morning. All assessments were self-reported and administered via Qualtrics.

Inclusion and Exclusion Criteria

To be eligible for inclusion, participants were required to be a minimum of 18 years old and to be enrolled at one of the two universities. Participants also needed daily access to either a smartphone or a web browser. Participants without a smartphone were able to access a web-based version of the assessments.

Several steps were taken to ensure high-quality data based on recommendations for online survey research. Following guidelines set forth by Meade and Craig (2012), careless responding was assessed via special items in the baseline survey (e.g., "Answer '3' to this question"). Low-quality data was defined as erroneous responses to at least two of three instructed response questions or affirmative answers to a question asking participants if their data should be used ("We know that sometimes people fill out surveys carelessly or randomly. If you did that, we want to know so that we do not use your data. You will still receive extra credit no matter how you answer: a) Use my data. I put thought into my answers; b) Do not use my data. I did not care when I filled out my survey[s]"). Individuals who provided low-quality data ($n = 9$) were removed from analyses, resulting in a sample of 234 participants. Of that sample, seven participants did not complete any daily surveys and were therefore not included in analyses, resulting in a final sample of 227 participants.

Low-quality data were also identified and removed from daily survey responses (e.g., DeSimone & Harms, 2018; McCabe et al., 2012; McClelland et al., 2021). Poor quality daily data were defined as responses that were a) shorter in duration than might be expected for adequate responses and b) included problematic long-string response patterns (e.g., participants indicated the same response option for every item in a measure, even when reverse-scored items were in use). For morning surveys, short response times were defined as < 54 seconds, whereas the cut-off for evening surveys was < 136 seconds. These cut-offs were calculated by summing two seconds per closed-choice item and five seconds per open-choice item (e.g., McClelland et al., 2021). Morning survey responses were removed if they contained long-string responses on the PROMIS, and evening surveys were removed if long-string responses were present on two of three measures. A total of 16 daily survey responses were removed due to meeting criteria for low quality data: Day 3 (n = 1), Day 4 (n = 1), Day 6 (n = 2), Day 7 (n = 1), Day 8 (n = 4), Day 10 (n = 3), Day 13 (n = 3), Day 14 (n = 1).

Participant Characteristics

Participant demographics are detailed in Table 1. On average, participants were 20.43 years old (SD = 2.81). The majority of participants identified as cisgender women (74.4%) and White/European American (64.3%) or Asian/Asian American (19.4%), with the remaining participants identifying as Black/African American, Hispanic, Latin American, Latinx/a/o/e, or multiracial. Of the 8.4% of participants who selected more than one category, eight students identified as Native American, Hawaiian Native, or Alaskan Native, and two students identified as Middle Eastern or Arab American. The majority of students identified as heterosexual/straight (84.1%) and most students were

single (55.5%). Participants were distributed across classes: first year (26%), second year (22.9%), third year (23.3%), and fourth year (24.7%). Regarding socioeconomic status, 52.5% of students reported their parents/caregivers' income to be higher than the 2020 national median household income (Shrider et al., 2021). About half the participants (53.8%) were working a full or part-time job. Students' majors covered a wide range of areas (e.g., biology, marketing, sociology), though approximately half were majoring or double-majoring in psychology (53.3%). The majority of students in this sample (88.1%) reported their overall health to be "good" or better. 13.2% of participants reported having been diagnosed with a sleep-wake disorder (e.g., insomnia, sleep terrors), with insomnia being the most common. Most participants (80.6%) lived off campus, and the majority of participants slept in private bedrooms (61.2%).

Materials

Please see Appendix A for complete versions of the baseline measures. Daily measures can be found in Appendix B. Additional measures were gathered to address other research questions, and only measures relevant to the current study are described here.

Baseline Characteristics (Baseline)

Basic demographic data including age, gender, race/ethnicity, sexual orientation, socioeconomic status, year in school, international student status, employment status, relationship status, and living situation were assessed at baseline.

History of Childhood Maltreatment (Baseline)

History of childhood maltreatment was assessed at baseline using the 28-item Childhood Trauma Questionnaire-Short Form (CTQ-SF; Bernstein & Fink, 1998). The

CTQ-SF includes five subscales measuring childhood physical, emotional, and sexual abuse, and childhood physical and emotional neglect, each assessed with five items. The measure also includes a three-item validity scale assessing minimization and denial. Participants rated items on a 1 (*never true*) to 5 (*very often true*) scale.

Scores on the CTQ-SF have demonstrated good internal consistency in samples of college students (αs ranging from .88-.96; Gerdner & Allgulander, 2009; Paivio & Cramer, 2004). Cronbach's alpha for the current sample was .93. Research on the factor structure of scores on the CTQ-SF has been conducted across a variety of samples, including among substance abusing individuals, adolescent psychiatric inpatients, and a normative community sample (Bernstein et al., 2003). The five-factor model of the CTQ-SF was supported across these diverse samples, providing evidence for measurement invariance, and results also demonstrated evidence of good criterion-related validity when CTQ-SF scores were compared to therapists' ratings of maltreatment (Bernstein et al., 2003).

Rumination (Evenings)

Rumination was measured daily in the evenings using the four self-focused rumination items from the COPE Revised (R-COPE; Zuckerman & Gagne, 2003). Participants rated items on a four-point scale ranging from 1 (*I didn't do this at all*) to a 4 (*I did this a lot*) with regard to what they did that day (e.g., "I just thought about my problem constantly"). The self-focused rumination items have demonstrated good internal consistency (α = .87) in undergraduate student samples (Zuckerman & Gagne, 2003). Cronbach's alpha for the current sample ranged from .88 to .95 across the 14 days.

Present Control (Evenings)

Present control was measured daily in the evenings using four items from the present control subscale of the Perceived Control over Stressful Events Scale (PCOSES; Frazier et al., 2011). These four items were selected based on their use in a previous daily diary study (see Nguyen-Feng et al., 2019). Participants rated items on a four-point scale ranging from 1 (*strongly agree*) to 4 (*strongly disagree*) with regard to how they felt about daily stressful events (e.g., "How I dealt with the situation was under my control"). Frazier and colleagues (2011) provided data on the internal consistency (αs = .79–.86) and three-to-six week test–retest reliability (*r*s = .48–.59) of present control subscale scores in college student samples. Cronbach's alpha for the current sample ranged from .72 to .88 across the 14 days.

Sleep Hygiene (Mornings)

Sleep hygiene was assessed daily in the mornings using 10 items from the Sleep Hygiene Index adapted for daily use (SHI; Mastin et al., 2006). Items on the SHI were developed from the diagnostic criteria for inadequate sleep hygiene in the International Classification of Sleep Disorders (American Sleep Disorders Association, 1990). Participants answered questions about the previous night including their sleep environment, activities before bed (e.g., "*Exercised to the point of sweating within one hour of going to bed*"), caffeine, alcohol, and tobacco intake, and psychological strain. Participants also indicated whether they napped the previous day and whether they used their bed for activities other than sleeping or sex. These sleep hygiene items were selected for daily assessment based on a previous study examining daily sleep hygiene (Knufinke et al., 2018). Items were coded true/false for each day.

The SHI was previously found to have good test-retest reliability over a four-to-five week period (r = .71; Mastin et al., 2006). Furthermore, among college student samples, the SHI has shown small-to-moderate correlations with measures of sleep quality, such as the Pittsburgh Sleep Quality Index (rs = .29 - .48) and sleepiness (rs = .22 - .24; Mastin et al., 2006; Seun-Fadipe et al., 2018), suggesting that sleep hygiene and sleep outcomes are separate but related constructs. In a sample of college students, scores on the SHI demonstrated only modest internal consistency (α = .66), though Mastin et al. (2006) noted that this reliability score was higher than those reported on other sleep hygiene instruments. Kuder-Richardson scores for the current sample ranged from .30 to .57 across the 14 days of assessment.

Psychological Distress (Evenings)

Psychological distress was measured daily in the evenings using the four-item Patient Health Questionnaire for Depression and Anxiety (PHQ-4; Kroenke et al., 2009) and the four-item Perceived Stress Scale (PSS-4; Cohen & Williamson, 1988), assessing symptoms of depression, anxiety, and stress, respectively. For anxiety and depression symptoms, participants were asked to rate how often during the past day they had been bothered by problems such as "feeling nervous, anxious, or on edge" or "little interest or pleasure in doing things" using a scale from 1 (*not at all*) to 5 (*most of the day*). Directions and anchors for the PHQ-4 were adapted for daily use based on previous daily diary studies using similar measures (e.g., the PHQ-2; Bauer et al., 2018; Pratap et al., 2019). On the PSS-4, participants indicated the degree to which they perceived the events of their day to be uncontrollable, unpredictable, or overloading (e.g., "*Today, how often have you felt difficulties were piling up so high that you couldn't overcome them?*") using

a 5-point scale ranging from 0 (*never*) to 4 (*very often*). The instructions for the PSS-4 were modified to assess stress since the last survey.

Scores on the PHQ-4 have demonstrated good discriminant validity, test-retest reliability, and internal consistency (Staples et al., 2019). Additionally, PHQ-4 scores have demonstrated good internal reliability (Cronbach's αs > 0.76) and validity in college student samples (Byrd-Bredbenner et al., 2021; Khubchandani et al., 2016). Cronbach's alpha for the PSS-4 was .75 in a community sample (Ingram et al., 2016).

Scores on the PHQ-4 and PSS-4, averaged across 14 days of assessment, were highly correlated ($r = .79$) in the current sample. Prior research has conceptualized depression, anxiety, and stress to comprise an emotional state labeled "psychological distress" (e.g., DiPietro et al., 2006; Ridner, 2004), and measures of perceived stress, depression, and anxiety have been combined in previous research among college students (e.g., John-Henderson et al., 2018). Based on these precedents, items from the PHQ-4 and PSS-4 were summed to create a composite measure of psychological distress. In the current sample, Cronbach's alphas for the composite distress measure ranged from .84 to .90 across the 14 days of assessment.

Sleep (Mornings)

Sleep was assessed daily in the mornings using a modified version of the adult eight-item Patient-Reported Outcomes Measurement Information System Sleep Disturbance scale (PROMIS-SD; Yu et al., 2012). This instrument assesses problems with sleep (e.g., "*My sleep was restless*"; "*I had trouble sleeping*"), whether sleep was refreshing, difficulty falling and staying asleep, sleep satisfaction, sufficiency (e.g., "*I got enough sleep*"), and sleep quality. Instructions and response options were modified to

assess the previous night's sleep. All items used a five-point scale: seven items used an intensity scale ranging from 1 (*not at all*) to 5 (*very much*) and the one item assessing sleep quality used a scale ranging from 1 (*very poor*) to 5 (*very good*). Higher scores on the PROMIS-SD indicate greater severity of sleep disturbance. Similar PROMIS measures have been adapted for daily use while retaining comparable psychometric properties (Schneider et al., 2013).

The PROMIS-SD items were developed using item response theory, which is useful for selecting items with the greatest information for describing a construct like sleep disturbance. The full SD item bank consists of 27 items, and the eight-item short form consists of the eight best-performing items based on computerized adaptive testing simulations. Scores on the PROMIS-SD short form have demonstrated high correspondence (r = .83) with a commonly used measure of sleep quality, the Pittsburgh Sleep Quality Index (Buysse et al., 1989), demonstrating convergent validity (Yu et al., 2012). The PROMIS-SD has also demonstrated good internal consistency (αs = .84 - .95) in adult community and clinical samples (Lei et al., 2020; Strainge et al., 2019; Yu et al., 2012). Cronbach's alpha for the current sample ranged from .87 to .92 across the 14 days of assessment.

Additional daily sleep diary questions assessing sleep timing (e.g., bedtime, risetime), sleep duration, and time spent in bed were gathered for purposes of descriptive analyses. Sleep efficiency, which refers to the percentage of time in bed spent sleeping, was calculated by dividing hours spent in bed (rise time - bedtime) by participants' reported actual sleep duration.

Analysis Plan

SEM analyses were conducted using Mplus 8.7 to test the direct and indirect effects of child maltreatment on sleep disturbance through rumination, present control, sleep hygiene, and distress. See Figure 1 for the conceptual model. The analyses for each hypothesized outcome were as follows:

(1) Students with a history of greater child maltreatment will have poorer nightly sleep (path *c'*, Figure 1). The five CTQ-SF subscales (emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect) served as indicators of the latent child maltreatment variable. The primary outcome was sleep disturbance, as measured daily by the PROMIS-SD; sleep disturbance scores for participants with at least two days' worth of sleep data were averaged across the 14 days and included in analyses. By aggregating observations, we reduced error variance and improved the reliability of our sleep measurement. Given the lack of research supporting a latent factor structure of the PROMIS sleep disturbance measure, sleep disturbance was modeled as an observed rather than latent variable.

(2) History of child maltreatment will be associated with greater rumination (R-COPE), lower perceptions of present control (PCOSES), poorer sleep hygiene (SHI), and greater distress (PHQ-4/PSS-4; *paths* a_1-a_4, Figure 1). Measures of rumination, present control, sleep hygiene, and distress were assessed daily over two weeks and total scores were aggregated across the 14 days. For each of the daily experience variables (e.g., rumination, present control, sleep hygiene, and distress), only data for participants who completed at least two daily assessments were retained in analyses. In line with efforts to reduce participant burden within our daily diary design, single scales were used

to measure each of the mediating variables. As such, these variables were modeled as observed rather than latent variables. This was deemed more appropriate than using multiple single indicators or item parcels to model each latent construct, as several researchers have detailed the disadvantages and potential biases associated with the use of a large number of indicators (e.g., Hayduk & Littvay, 2012) and item parcels (e.g., Bandalos, 2002).

(3) Greater rumination, lower perceived present control over daily stressors, poorer sleep hygiene, and greater psychological distress will be associated with poorer sleep (paths b_1-b_4, Figure 1).

(4) More rumination, lower perceived present control, poorer sleep hygiene, and greater distress will mediate the relation between history of child maltreatment and subsequent sleep disturbance (Figure 1).

(5) The hypothesized mediation model, by which child maltreatment has an indirect effect on sleep through the proposed mediators of rumination, present control, sleep hygiene, and distress, will result in significant mediation, whereas the alternative mediation model (Figure 2), in which sleep mediates the relation between child maltreatment and daily experiences (e.g., rumination, present control, sleep hygiene, and distress) will not result in significant mediation.

Model fit for all models was assessed using the Root Mean Square Error of Approximation (RMSEA), the Standardized Root Mean Squared Residual (SRMR), and the Comparative Fit Index (CFI). Using Hu and Bentler's (1999) guidelines, models were deemed a good fit if RMSEA values were ≤ .06, SRMR values ≤ .08, and CFI values ≥ .95. Missing data were handled using full information maximum likelihood estimation.

Results

Preliminary Analyses

SPSS Version 27 was used for preliminary data analyses. Normality was assessed using visual inspection of the histograms and QQ plots of the residuals. Outliers were identified using Grubbs' test (Grubbs & Beck, 1972), with the critical value selected from a two-sided test using a 1% significance level for a sample of 200. Grubbs' test indicated one outlier value in the CTQ and one outlier in the PCOSES; identified outliers were subsequently Winsorized (i.e., changed to the next highest value). Visual inspection of the histograms and QQ plots of the residuals demonstrated adequate normality. Visual inspection of residual dependence plots indicated that linearity and homoscedasticity assumptions were met, respectively (e.g., Fife, 2020). Bivariate correlations were screened as an initial check for multicollinearity (Table 2). Although no bivariate correlations were higher than r =.85 (e.g., Weston & Gore, 2006), the correlation between psychological distress and rumination was r = .81, suggesting further examination may be warranted. Further inspection of the variables' variance inflation factors and tolerance statistics did not indicate extreme multivariate collinearity. Therefore, both variables were retained in analysis.

Participants completed 19 of the 28 (68%) daily surveys on average, with 66% of participants completing > 50% of surveys. Fewer participants completed surveys over time (e.g., 83% of participants completed PM surveys on Day 1 vs. 56% of participants who completed PM surveys on Day 14). The number of completed daily surveys was not significantly related to age, gender, race/ethnicity, sexual orientation,[2] childhood

[2] Participation rates were unrelated to demographic variables of gender, race, and sexual orientation when these variables were coded in their original form (e.g., multiple categories) as well as when coded as binary variables.

maltreatment, average daily rumination, present control, sleep hygiene, or psychological distress (Table 3). Survey completion rates were, however, related to participants' average ratings of sleep disturbance, such that the *better* participants' sleep, the higher the number of completed daily surveys (r = -.17, p < .05).

The prevalence of child maltreatment in this sample as measured by the CTQ (M = 1.51, SD = .52) was similar to that observed in other college student samples (e.g., M = 1.42, SD = .43; Kaubrys et al., 2021). Using cut-off scores for at least low severity maltreatment (Bernstein & Fink, 1998), emotional neglect (44%) and abuse (43%) were most common, followed by physical neglect (27%), sexual abuse (17%), and physical abuse (16%). Across the 14 days, participants reported sleeping an average of 7 hours and 30 minutes per night, with 92% average sleep efficiency. On the PROMIS, participants reported absent to slight levels of sleep disturbance on average (M = 18.86, SD = 4.36), with 12% of participants indicating "mild" sleep disturbance or higher (T-score > 55; PROMIS Health Organization and PROMIS Cooperative Group, 2012). Average total scores on the PROMIS were significantly associated with participants' average sleep duration (r = -.44, p < .01) and average sleep efficiency (r = -.49, p < .01), such that longer duration and higher efficiency were negatively associated with sleep disturbance.

Average ratings of the daily mediating variables (rumination, present control, sleep hygiene, and distress) were not significantly associated with participants' sexual orientation (Table 4). However, average ratings of rumination were significantly associated with gender,[3] such that female-identified students had higher rumination (M = 7.23, SD = 2.17) than their male-identified peers (M = 6.4, SD = 2.4), t(202) = -2.2, p <

[3] Gender was coded as a binary variable due to insufficient number of observations across categories when coded in its original form.

.05. Perceived control was significantly associated with both age and race/ethnicity,[4] such that older participants had lower perceived present control (r = .18, p < .01), as did racial/ethnic minority students (M = 7.67, SD = 1.89) when compared to their White peers (M = 7.08, SD = 1.66), t(205) = -2.35, p < .05. There were also significant gender differences with regards to average sleep hygiene and psychological distress. Female-identified students had poorer sleep hygiene (M = 2.92, SD = 1.19) than male-identified students (M = 2.46, SD = 1.15), t(202) = -2.28, p < 05. Female students also had higher average ratings of distress (M = 15.18, SD = 5.02) as compared to their male peers (M = 12.76, SD = 4.56), t(202) = -2.91, p < .01. Average ratings of sleep disturbance were not significantly associated with participants' age, gender, race/ethnicity, sexual orientation, or living arrangements (e.g., sleeping in a shared vs. private bedroom).

Correlations and descriptive statistics for key variables, including the mediating variables (rumination, present control, sleep hygiene, and psychological distress) are shown in Table 2. A greater history of child maltreatment was associated with sleep disturbance (r = .27) as well as with all mediating variables except for present control (rs = .19 - .33). All proposed mediators were significantly associated with one another (rs = .14 - .81). All mediating variables were also significantly correlated with sleep disturbance (rs = .21 - 41).

Mediation Models

Hypothesized Model with Psychological Distress, Rumination, Sleep Hygiene, and Present Control as Mediators

[4] Race/ethnicity was coded as a binary variable due to insufficient number of observations across categories when coded in its original form.

The fit of the hypothesized structural model (see Figure 3) was RMSEA = .08, SRMR = .04, and CFI = .96, indicating acceptable fit. In line with our first hypothesis, child maltreatment was associated with greater sleep disturbance via direct unmediated effect (β = .17, $p < .05$). Hypothesis two was partially supported, such that history of maltreatment was associated with greater daily psychological distress (β = .35, $p < .001$), greater daily rumination (β = .25, $p < .001$), and poorer daily sleep hygiene (β = .25, $p < .001$) over a two-week period. However, child maltreatment was not significantly associated with perceptions of present control (β = .05, $p = .52$). Hypothesis three was also partially supported: poorer sleep hygiene across the 14 days was associated with poorer sleep (β = .27, $p < .001$). However, no other mediator was significantly associated with sleep. There was a significant indirect effect of child maltreatment on sleep disturbance through sleep hygiene (β = .07, $p < .01$, 95% CI [.02, .12]), although the direct path between child maltreatment and sleep also was significant, providing only partial support for our fourth hypothesis**.** Contrary to our hypotheses, the indirect effects of child maltreatment on sleep through psychological distress, rumination, and present control were not significant.[5] In total, the predictors included in the model explain 26% of the variance in sleep disturbances.

Alternative Model with Sleep Disturbance as a Mediator

The path reversal mediation model included indirect paths between the latent child maltreatment variable and the four outcome variables (psychological distress, rumination, sleep hygiene, and present control) through sleep disturbance as well as

[5] Given the high bivariate correlation between rumination and psychological distress, structural equation models excluding each of these variables were examined. Without rumination in the model, there was a significant indirect effect of child maltreatment on sleep through distress (β = .06, $p < .05$, 95% CI [.003, .11]); the direct path from maltreatment to sleep also remained significant. Without distress in the model, sleep hygiene remains the only significant mediator of the relation between maltreatment and sleep.

direct paths from the latent maltreatment variable to each of the four outcome variables. The fit of the alternative model was identical to that of the hypothesized model (RMSEA = .08, SRMR = .04, and CFI = .96; see Figure 4). Contrary to our hypotheses, the alternative model demonstrated significant indirect effects of child maltreatment on psychological distress (β = .10, $p < .01$, 95% CI [.04, .15]), rumination (β = .09, $p < .01$, 95% CI [.03, .14]), sleep hygiene (β = .11, $p < .001$, 95% CI [.05, .18]), and present control (β = .07, $p < .05$, 95% CI [.02, .13]) through sleep disturbance. The direct paths between child maltreatment and psychological distress and child maltreatment and rumination remained significant, though this was not true for sleep hygiene nor present control.

Discussion

The primary aim of the present study was to assess rumination, present control, sleep hygiene, and psychological distress as mediators of the relation between child maltreatment and sleep disturbance in a college student sample. The study added to the literature by assessing multiple mediators, including an alternative reverse mediational model for comparison, using daily diary methods to assess mediators and sleep disturbance, and examining these associations in a sample at high-risk for sleep disturbance (i.e., college students). Key findings, limitations, and future directions are discussed.

Key Findings

In line with the first hypothesis, history of child maltreatment was associated with increased sleep disturbance. This finding contributes to a growing body of research supporting a robust association between child maltreatment and sleep disturbances across

the lifespan, including among college-age adults (e.g., Brown et al., 2022). Sleep is an important part of college students' functioning, having shown associations with academic performance (e.g., Hartmann & Pritchard, 2018), mental health (e.g., Fernandez-Mendoza et al., 2009; Taylor et al., 2013), and physical health (e.g. Windle et al., 2018). The results of our study further highlight the need for the role of child maltreatment in college students' sleep health to be considered in health promotion efforts for college students.

Our second aim was to examine the associations between child maltreatment and average daily distress, rumination, perceived present control, and sleep hygiene. We found partial support for the hypothesis that maltreatment would be significantly associated with each of these variables. Specifically, maltreatment was associated with greater daily psychological distress, greater daily rumination, and poorer daily sleep hygiene. With regard to distress and rumination, these findings align with numerous extant studies demonstrating that adults who experienced maltreatment in childhood are more likely to experience psychological distress (Edwards et al., 2014; Springer et al., 2007; Wright et al., 2009) and engage in rumination (e.g., Raes & Hermans, 2008; Sarin & Nolen-Hoeksema, 2010; Szabo et al., 2020) than those without a history of maltreatment. Although fewer studies have examined the relation between child maltreatment and sleep hygiene, our study contributes to findings suggesting that adults with histories of maltreatment have poorer sleep hygiene. As others have hypothesized (e.g., Gregory et al., 2006), the chaotic and unsafe family environments that frequently correspond with child maltreatment may be incompatible with proper sleep hygiene, leading to the development of poor sleep patterns that persist into adulthood.

In contrast to our hypothesis, child maltreatment was not significantly associated with perceptions of present control. Overall, there is limited research on the association between early experiences of maltreatment and later perceptions of control. Although theoretical models of anxiety development suggest that early experiences with uncontrollable events may lead to a greater likelihood of perceiving events as uncontrollable in adulthood (Chorpita & Barlow, 1998), research investigating event-specific control is mixed. Childhood emotional abuse and exposure to interpersonal violence in childhood were unrelated to present control in two previous studies (Nguyen-Feng et al., 2017; Nguyen-Feng et al., 2015). It may be that child maltreatment is more strongly associated with general perceptions of control vs. event-specific control beliefs, as were measured in the present study, though a direct test of this hypothesis would be needed before conclusions could be drawn.

Our third aim was to examine associations between distress, rumination, present control, sleep hygiene, and sleep disturbance. We found only partial support for our third hypothesis that each of these mediators would be associated with sleep disturbance: although there were significant bivariate correlations between sleep and each of the mediators, when included together in the structural equation model, only poorer sleep hygiene was associated with greater sleep disturbance. This finding aligns with a body of research demonstrating that sleep hygiene behaviors are associated with sleep outcomes, such as the duration or quality of one's sleep with a moderate effect size (e.g., Brick et al., 2010; Cho et al., 2013; Mastin et al., 2006). In a meta-analytic review of risk and protective factors for adolescent sleep, sleep hygiene was the only factor associated with

all three sleep parameters reviewed (bedtime, sleep onset latency, and sleep duration; Bartel et al., 2015).

There is relatively little research linking perceived control beliefs to sleep disturbance. The non-significant findings of this study contrast with data from our pilot study in college students, which found that higher average daily reports of present control were moderately correlated with better sleep quality and restfulness (rs = .21-.22, $p < .01$; Person et al., 2020). Furthermore, studies investigating general control beliefs have found that individuals with a more internal locus of control tend to report better global sleep quality (Li et al., 2015) and shorter sleep latency (Mikulincer et al., 1989). The results of the present study suggest that more research on the relation between perceived control and sleep is needed to clarify this relation.

Surprisingly, neither rumination nor psychological distress were associated with sleep disturbance in the model, in contrast to research demonstrating that individuals who engage in rumination have poorer sleep across a variety of sleep indices (e.g., Amaral et al., 2018; Guastella & Moulds, 2007; Van Laethem et al., 2016) as well as linking psychological distress to sleep disturbance (e.g., Almojali et al., 2017; Cunningham et al., 2015; Seun-Fadipe & Mosaku, 2017). It may be that our measure of sleep hygiene captured aspects of distress and rumination in its items: “I went to bed feeling stressed, angry, upset, or nervous” and “I thought, planned, or worried when I was in bed,” thereby making the rumination and distress scales redundant when included in the mediation model. However, it should be noted that bivariate correlations among these scales were only moderate (e.g., rs = .45 - .47), and statistical tests assessing for multicollinearity did not indicate redundancy. However, given our correlational findings suggesting an

association between sleep, rumination, and distress, as well as past research, future investigations of the pathways mediating the relation between maltreatment and sleep might choose to include a more narrow measure of sleep hygiene (e.g., focusing only on the behavioral and environmental aspects that could influence sleep) to better clarify these mechanisms.

Our fourth aim was to improve upon literature investigating the mechanisms underlying the relation between child maltreatment and sleep by assessing the relative contributions of four mediators in the same model. In contrast to our hypotheses, psychological distress, rumination, and present control were not significant mediators of the association between maltreatment and sleep disturbance. The only significant indirect effect to emerge was through sleep hygiene, and here the direct effect from child maltreatment to sleep disturbance remained significant, indicating that sleep hygiene is a partial mediator of this association. This is a novel finding, as to the best of our knowledge, only one other study has tested the mediating role of sleep hygiene, finding that poorer sleep hygiene partially accounted for the relation between childhood sexual abuse and sleep disturbance in a sample of U.S. adults (Higgs et al., 2020). For survivors of child maltreatment, behavioral adjustments to the nighttime routine (e.g., such as deliberately altering sleep routines due to the threat of violence) may be adaptive in childhood but no longer so in adulthood (e.g., Spilsbury, 2009).

The non-significance of psychological distress and rumination as mediators are in contrast to results of prior studies that found a significant mediating effect of these variables. For example, in a sample of German adults, rumination partially mediated the relation between child maltreatment and insomnia symptoms, though not sleep quality

(Pfaff & Schlarb, 2022). Two studies have found perceived stress--one aspect of psychological distress--to partially mediate the relation between child adversity or trauma and sleep disturbance (Cardoso et al. 2018; Gress- Smith et al., 2015), whereas several other studies have found self-reported depression, anxiety, mental distress, and stress to mediate or partially mediate this association (Chapman et al., 2013; John-Henderson et al., 2018; McPhie et al., 2014; Rojo-Wissar et al., 2019). Most recently, an investigation among a sample of German college students found a significant mediating effect of psychological distress on the relation between maltreatment and sleep disturbance (Jarczok et al., 2022). None of the aforementioned studies included sleep hygiene in their models. As was previously noted, the measure of sleep hygiene included in the present study included items that may conceptually overlap with rumination and psychological distress. Moreover, rumination is strongly associated with symptoms of anxiety and depression (e.g., Nolen-Hoeksema, 2000), and the measures of rumination and psychological distress were strongly correlated in the present study. Our exploratory analyses of separate models excluding rumination and distress, respectively, suggested that distress may be a significant partial mediator when rumination is removed from the model. Future investigations might consider investigating the temporal associations by which each of these processes influence one another day-to-day and across time.

The final aim was to compare the hypothesized model to an alternative mediation model, in which sleep mediates the relation between child maltreatment and daily experiences of rumination, present control, sleep hygiene, and distress. To the best of our knowledge, only two prior studies have examined reverse mediation models. Although John-Henderson and colleagues (2018) found psychological distress to be a significant

mediator of the relation between child maltreatment and sleep quality during college students' transition to university, in testing an alternate model, sleep did not mediate the relation between maltreatment and distress. In another college student sample, sleep quality partially mediated the relation between ACEs and depression and anxiety, although the reverse model resulted in stronger associations: depression and anxiety fully mediated the relation between ACEs and sleep quality (Rojo-Wissar et al., 2019).

In the present study, in contrast to our hypothesis, sleep disturbance significantly mediated the associations between child maltreatment and both present control and sleep hygiene, and partially mediated the associations between maltreatment and rumination and distress. This finding draws attention to the interrelatedness of sleep and the cognitive, emotional, and behavioral processes that can affect it. For example, in their systematic review, Alvaro and colleagues (2013) found evidence to support bidirectional associations between insomnia, anxiety and depression. Other studies have highlighted the importance of sleep on cognition, affective reactivity, and emotional information processing (see Walker, 2009 for a review). Adults with a history of child maltreatment may be even more vulnerable to disruptions in both sleep and related regulatory processes. In a recent study, inadequate sleep in childhood and sleep problems in young adulthood partially explained the relation between child maltreatment and anxiety and depression in middle adulthood in a prospective longitudinal study (Javakhishvili & Widom, 2021). Furthermore, there is a growing body of research suggesting that sleep is one pathway through which child maltreatment may influence other health-related outcomes later in life (e.g., Kajeepeta et al., 2015). Fuligni and colleagues (2021) propose a model through which sleep disturbance contributes to early adversity's later impact on

health through shared neurobiological mechanisms (e.g., brain development, functioning of the HPA axis and immune system). Taken together, these results, as well as the findings from the present study, provide evidence to suggest possible bidirectional associations among sleep disturbance, cognitive processes (e.g., perceived present control, rumination), psychological distress, and sleep-related behavior among adults with a history of maltreatment. Future studies might prioritize disentangling the bidirectionality by which regulatory processes, poor sleep, and mental and physical health outcomes influence each other across the lifespan through use of prospective longitudinal studies.

Limitations

The findings of the present study must be considered in light of several limitations. First, our sample was primarily White, female and comprised of students attending 4-year colleges, limiting the generalizability of our results to more diverse college student samples. Future research designs should recruit more diverse samples and include measures of racial/ethnic discrimination to more comprehensively examine the effects of maltreatment *and* experiences of race-based stress on sleep among college students (Slopen et al., 2016). Second, the present study did not include objective measures of sleep. Subjective measures have only weak-to-moderate correspondence with objective assessments such as actigraphy and polysomnography (e.g., Goelema et al., 2018). This low correspondence, accompanied by the fact that some sleep indices can only be captured by subjective or objective measures, has led some researchers to hypothesize that subjective and objective measures of sleep may capture overlapping but separate facets of the sleep experience (e.g., Argyropoulos et al., 2003). In their

systematic review, Brown et al. (2022) found that 81% of studies examining association between maltreatment and adult sleep outcomes used self-report to assess sleep. Therefore, although the findings of the present study may be limited in application to the subjective elements of sleep, they are easily compared to past research on the topic. Moreover, in the college mental health settings through which most college students are likely to have their sleep concerns assessed, subjective reports of sleep are far more commonly used for assessment and diagnosis than polysomnography (e.g., "sleep studies"). Third, although our study provided a novel contribution by assessing multiple mediators in the same model, no physiological measures of hyperarousal were included. The hyperarousal theory of insomnia suggests that there is a neurobiologic domain through which physiological responses to stress (e.g., changes to cortisol and heart rate responses) serve as an additional pathway through which sleep is affected (Riemann et al., 2010). Therefore, future studies should include physiological measures in addition to self-report measures of the cognitive/behavioral domains to more thoroughly assess the hyperarousal model of insomnia as a theory to explain the link between child maltreatment and sleep.

Despite these limitations, this study results in a number of implications that can inform future intervention efforts on college campuses. Importantly, our findings contribute to a body of research demonstrating the need for trauma-informed care of sleep disturbance. Undergraduate students typically report significant rates of sleep disturbance (e.g., Taylor et al., 2013), and, developmentally, college is a time when many students experience a period of adjustment including social, physical, and behavioral changes, which may make them even more vulnerable to poor sleep (e.g.,

John-Henderson et al., 2018). Fortunately, sleep is a modifiable factor, and the results of our study suggest that sleep hygiene is a significant pathway by which prior experiences of maltreatment contribute to poor sleep. This suggests that for students with histories of maltreatment, interventions addressing college students' sleep habits should be prioritized. In their systematic review of interventions to improve sleep among college students, Friedrich and Schlarb (2018) found that sleep hygiene interventions demonstrated small to medium effects, and cognitive behavioral interventions demonstrated large effects. These results suggest that education on sleep hygiene behaviors alone may not be sufficient, and rather students likely benefit most from sleep interventions that include other active components. For example, a study evaluating the feasibility and efficacy of a sleep health promotion program for college students demonstrated improved sleep (e.g., decreased sleep onset latency and greater sleep efficiency) after students engaged in the following intervention components: email feedback based on their sleep diary *and* an in-person group presentation on sleep health (Levenson et al., 2016).

Conclusion

In conclusion, we had hypothesized that distress, rumination, sleep hygiene, and present control would mediate the relation between child maltreatment and sleep disturbance. However, sleep hygiene emerged as the only significant mediating effect, and examination of an alternative mediating model suggested a possible bidirectional relation between sleep and each of the mediating variables. Interventions that modify sleep hygiene behaviors may be an effective method for improving sleep among college

students with a history of child maltreatment. Additionally, targeting students' sleep may have ameliorative effects on students' cognition and mood.

Table 1

Demographic Characteristics

Age	
18-19	38.7%
20-21	40.1%
22+	21.2%
Gender	
Cisgender woman	74.4%
Cisgender man	22%
Transgender man or woman, nonbinary, agender	3.4%
Race/ethnicity	
European American or White	64.3%
Asian/Asian American	19.4%
Black/African American	5.3%
Hispanic, Latin American, or Latinx/a/o/e	2.2%
Selected one or more option	8.4%
Sexual orientation	
Heterosexual/straight	84.1%
Bisexual/pansexual/queer	11.5%
Gay/lesbian/queer	2.6%
Other (e.g., asexual)	1.8%
Romantic relationship status	
Single	55.5%
In a committed relationship and not living together	20.3%
Dating	16.7%

Married or in a committed relationship and cohabitating	5.7%
Year in school	
First year	26%
Second year	22.9%
Third year	23.3%
Fourth year	24.7%
Other (e.g., fifth year or transfer student)	3.1%
International student	9.7%
First-generation college student	25.6%
Socioeconomic status	
$0 - $64,999	18.5%
$65,000 - $99,999	22.5%
$100,000 - $149,999	18.1%
$150,000 or more	23.8%
Employment status	
Part-time job	49.8%
Not currently working	46.3%
Full-time job	4%
Overall health	
Excellent	9.3%
Very good	38.3%
Good	40.5%
Fair or worse	11.9%
Presence of sleep disorders	
Insomnia	5.3%

Other sleep-wake condition (e.g., Sleep Apnea)	7.8%
Living arrangements	
Off-campus housing, sleep in private bedroom	34.3%
Off-campus housing, sleep in shared bedroom	21.6%
Parent/caregiver's home, sleep in private bedroom	21.6%
Residence hall/on-campus housing, sleep in shared room	10.6%
Residence hall/on-campus housing, sleep in private room	5.3%
Parent/caregiver's home, sleep in shared bedroom	3.1%
Other (e.g., Fraternity/Sorority, sleep in shared room)	3.6%

Table 2

Means and Correlations of Study Variables

Variable	1.	2.	3.	4.	5.	6.	*M (SD)*	Range
1. Cumulative maltreatment score	—						1.51 (.52)	1-5
2. Psychological distress	.33**	—					14.65 (4.99)	4-36
3. Rumination	.24**	.81**	—				7.04 (2.23)	4-16
4. Sleep hygiene	.19**	.47**	.45**	—			2.82 (1.19)	0-10
5. Present control	.05	.34**	.24**	.14*	—		7.29 (1.77)	4-16
6. Sleep disturbance	.27**	.38**	.31**	.41**	.21**	—	18.86 (4.36)	8-40

Note. $N = 234$. Daily process variables were averaged across 14 days. Higher scores indicate *greater amounts* of the variable, with the exception of present control; higher present control scores indicate *lower* present control. Higher scores on the sleep hygiene variable indicate a greater number of poor sleep hygiene behaviors.
* $p < .05$ ** $p < .01$

Table 3

Demographics and Key Variables by Number of Completed Daily Surveys

	r	*M (SD)*	*M (SD)*	*t*	*d*
Gender		Male	Female		
		17 (9.37)	18.92 (8.93)	-1.34	.21
Race/ethnicity		White/European American	Racial/ethnic minority		
		18.10 (9.19)	19.38 (8.78)	-1.02	.14
Sexual orientation		Heterosexual/straight	LGBTQ+		
		18.87 (8.88)	16.92 (9.84)	1.19	.22
Age	.06				
Cumulative maltreatment score	-.08				
Rumination	-.11				
Present control	-.02				
Sleep hygiene	-.10				
Psychological distress	-.12				
Sleep disturbance	-.17*				

Note. $N = 227$. Total number of completed daily surveys ranged from 0-28. Participation rates were unrelated to demographic variables of gender, race, and sexual orientation when these variables were coded in their original form (e.g., multiple categories) as well as when coded as binary variables.
* $p < .05$ ** $p < .01$

Table 4

Mediating and Outcome Variables by Participant Demographics

	M (SD)	*M (SD)*	*t*	*d*
	Male	Female		
Rumination	6.4 (2.4)	7.23 (2.17)	-2.2*	.37
Present control	7.27 (1.89)	7.28 (1.75)	-.02	.00
Sleep hygiene	2.46 (1.15)	2.92 (1.19)	-2.28*	.38
Psychological distress	12.76 (4.56)	15.18 (5.02)	-2.91**	.49
Sleep disturbance	18.52 (4.23)	19.01 (4.44)	-.67	.11
	White/European American	Racial/ethnic minority		
Rumination	7.00 (2.13)	7.09 (2.41)	-.29	.04
Present control	7.08 (1.66)	7.67 (1.89)	-2.35*	.34
Sleep hygiene	2.83 (1.17)	2.81 (1.24)	.14	.02
Psychological distress	14.74 (4.97)	14.47 (5.05)	.37	.05
Sleep disturbance	18.79 (4.43)	19.01 (4.25)	-.35	.05
	Heterosexual/straight	LGBTQ+		
Rumination	7.00 (2.2)	7.25 (2.44)	-.60	.11
Present control	7.38 (1.74)	6.83 (1.86)	1.63	.31
Sleep hygiene	2.79 (1.2)	3.01 (1.1)	-1.0	.19
Psychological distress	14.47 (5.06)	15.61 (4.5)	-1.19	.23
Sleep disturbance	18.8 (4.28)	19.19 (4.81)	-.47	.09
	r			

	Age
Rumination	-.05
Present control	.18**
Sleep hygiene	-.08
Psychological distress	-.03
Sleep disturbance	.12

Note. $N = 227$. Demographic variables of gender, race, and sexual orientation were coded as binary variables due to insufficient numbers of observations across categories when coded in their original forms.
* $p < .05$ ** $p < .01$

Figure 1

Conceptual Hypothesized Model

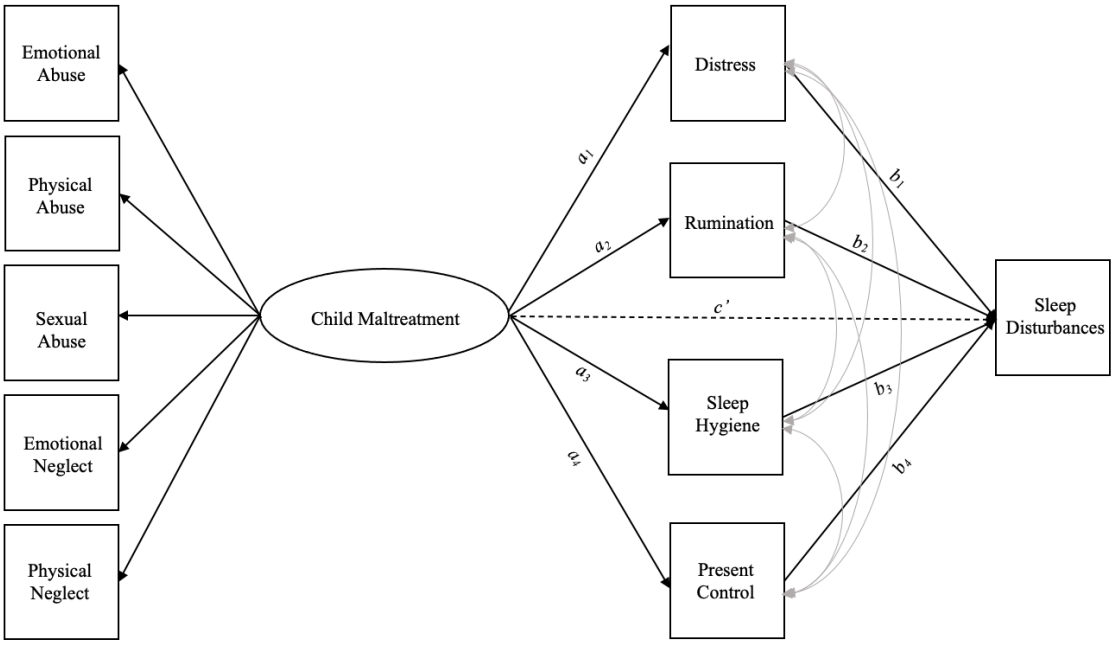


Figure 2

Conceptual Alternative Model

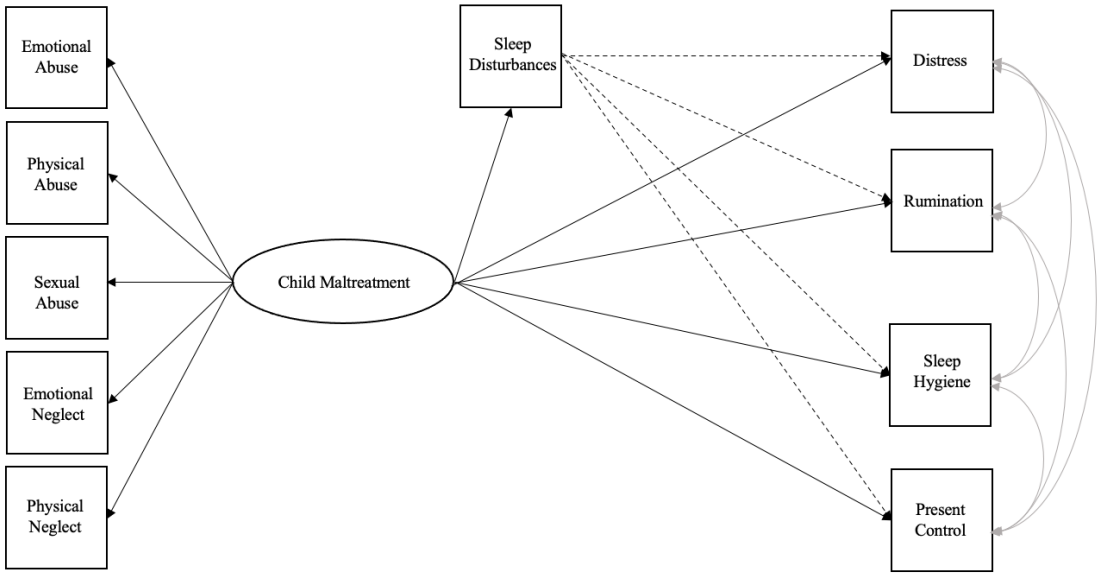
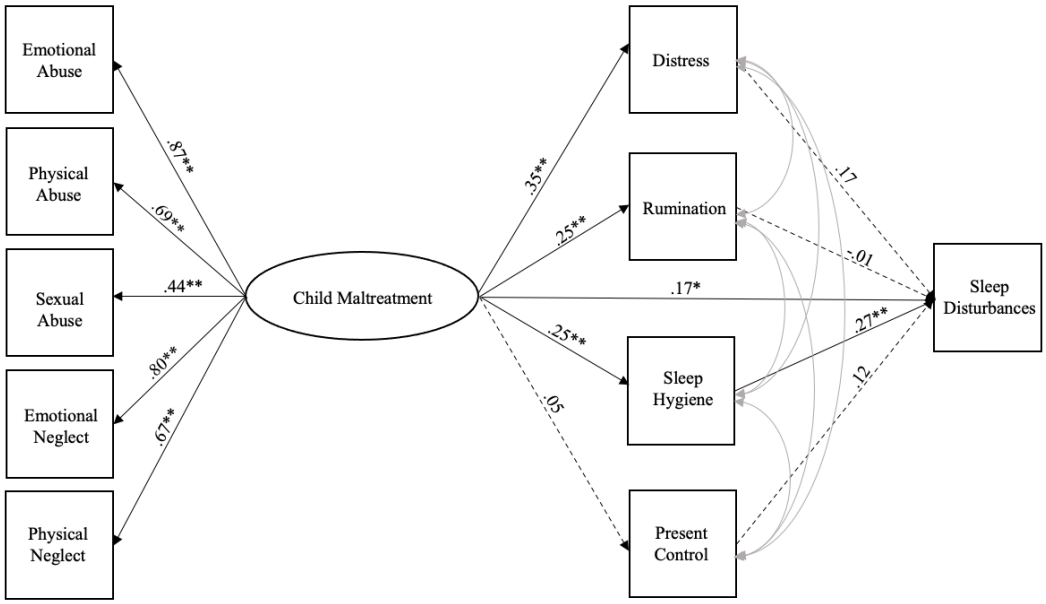


Figure 3

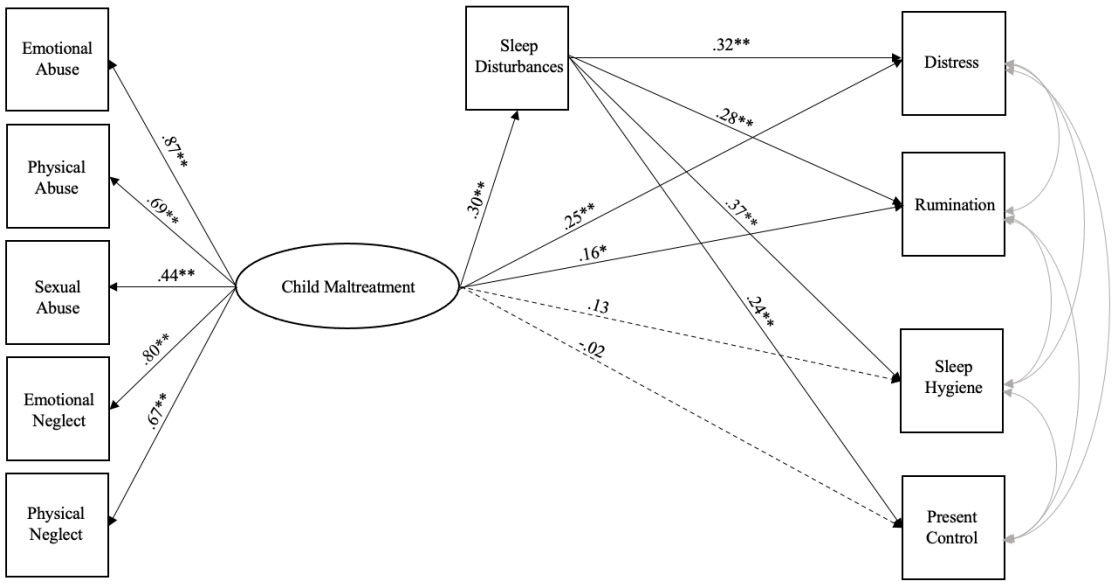
Structural Equation Model Assessing Mediators of the Relation Between Maltreatment and Sleep



Note. $N = 234$. Values are standardized coefficients. Fit indices: RMSEA = .08; SRMR = .04; CFI = .96. The indirect effect of child maltreatment on sleep disturbance through sleep hygiene was significant (β = .07, $p < .01$, 95% CI [.02, .12]). Together, all predictors in the model explained 26% of the variance in sleep disturbance ($R^2 = .26$).
* $p < .05$ ** $p < .01$

Figure 4

Alternate Model Assessing Sleep as a Mediator Between Maltreatment and Average Daily Variables



Note. $N = 234$. Values are standardized coefficients. Fit indices: RMSEA = .08; SRMR = .04; CFI = .96. There were significant indirect effects of child maltreatment on psychological distress (β = .10, $p < .01$, 95% CI [.04, .15]), rumination (β = .09, $p < .01$, 95% CI [.03, .14]), sleep hygiene (β = .11, $p < .001$, 95% CI [.05, .18]), and present control (β = .07, $p < .05$, 95% CI [.02, .13]) through sleep disturbance.
* $p < .05$ ** $p < .01$

References

Almojali, A. I., Almalki, S. A., Alothman, A. S., Masuadi, E. M., & Alaqeel, M. K. (2017). The prevalence and association of stress with sleep quality among medical students. *Journal of Epidemiology and Global Health, 7*(3), 169-174. https://doi.org/10.1016/j.jegh.2017.04.005

Alvaro, P. K., Roberts, R. M., & Harris, J. K. (2013). A systematic review assessing bidirectionality between sleep disturbances, anxiety, and depression. *Sleep, 36*(7), 1059-1068. http://dx.doi.org/10.5665/sleep.2810

Amaral, A. P., Soares, M. J., Pinto, A. M., Pereira, A. T., Madeira, N., Bos, S. C., Marques, M., Roque, C., & Macedo, A. (2018). Sleep difficulties in college students: The role of stress, affect and cognitive processes. *Psychiatry Research, 260*, 331-337. https://doi.org/10.1016/j.psychres.2017.11.072

American Sleep Disorders Association (1990). *International Classification of Sleep Disorders: Diagnostic and Coding Manual*, American Sleep Disorders Association, Rochester, MN, pp. 73–77.

Arata, C. M., Langhinrichsen-Rohling, J., Bowers, D., & O'Farrill-Swails, L. (2005). Single versus multi-type maltreatment: An examination of the long-term effects of child abuse. *Journal of Aggression, Maltreatment & Trauma, 11*(4), 29-52. https://doi.org/10.1300/J146v11n04_02

Argyropoulos, S. V., Hicks, J. A., Nash, J. R., Bell, C. J., Rich, A. S., Nutt, D. J., & Wilson, S. J. (2003). Correlation of subjective and objective sleep measurements at different stages of the treatment of depression. *Psychiatry Research, 120*(2), 179–190. https://doi.org/10.1016/S0165-1781(03)00187-2

Babkoff, H., Weller, A., & Lavidor, M. (1996). A comparison of prospective and retrospective assessments of sleep. *Journal of Clinical Epidemiology, 49*(4), 455-460. https://doi.org/10.1016/0895-4356(95)00529-3

Bandalos, D. L. (2002). The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling. *Structural Equation Modeling, 9*, 78–102. http://dx.doi.org/10.1207/S15328007 SEM0901_5

Bartel, K. A., Gradisar, M., & Williamson, P. (2015). Protective and risk factors for adolescent sleep: A meta-analytic review. *Sleep Medicine Reviews, 21*, 72-85. http://dx.doi.org/10.1016/j.smrv.2014.08.002

Bauer, A. M., Baldwin, S. A., Anguera, J. A., Areán, P. A., & Atkins, D. C. (2018). Comparing approaches to mobile depression assessment for measurement-based care: Prospective study. *Journal of Medical Internet Research, 20*(6), e10001. https://doi.org/10.2196/10001

Bernstein, D. P., & Fink, L. (1998). Childhood Trauma Questionnaire: A retrospective self-report. Manual. The Psychological Corporation.

Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., Stokes, J., Handelsman, L., Medrano, M., Desmond, D., & Zule, W. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect, 27*(2), 169-190. https://doi.org/10.1016/S0145-2134(02)00541-0

Brick, C. A., Seely, D. L., & Palermo, T. M. (2010). Association between sleep hygiene and sleep quality in medical students. *Behavioral Sleep Medicine, 8*(2), 113-121. https://doi.org/10.1080/15402001003622925

Brown, E. D., & Low, C. M. (2008). Chaotic living conditions and sleep problems associated with children's responses to academic challenge. *Journal of Family Psychology, 22*(6), 920-923. https://doi.org/10.1037/a0013652

Brown, S. M., Rodriguez, K. E., Smith, A. D., Ricker, A., & Williamson, A. A. (2022). Associations between childhood maltreatment and behavioral sleep disturbances across the lifespan: A systematic review. *Sleep Medicine Reviews*, 101621. https://doi.org/10.1016/j.smrv.2022.101621

Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28*, 193-213.

Byrd-Bredbenner, C., Eck, K., & Quick, V. (2021). GAD-7, GAD-2, and GAD-mini: Psychometric properties and norms of university students in the United States. *General Hospital Psychiatry, 69*, 61-66. https://doi.org/10.1016/j.genhosppsych.2021.01.002

Cardoso, J., Almeida, T., Ramos, C., & Sousa, S. (2018). Relationship between childhood trauma and sleep disturbances: The role of perceived stress as a mediator. *Journal of Aggression, Maltreatment & Trauma, 27*(10), 1075-1089. https://doi.org/10.1080/10926771.2018.1501628

Carney, C. E., Harris, A. L., Moss, T. G., & Edinger, J. D. (2010). Distinguishing rumination from worry in clinical insomnia. *Behaviour Research and Therapy, 48*(6), 540-546. https://doi.org/10.1016/j.brat.2010.03.004

Chapman, D. P., Liu, Y., Presely-Cantrell, L. R., Edwards, V. J., Wheaton, A. G., Perry, G. S., Croft, J. B. (2013). Adverse childhood experiences and frequent insufficient

sleep in 5 U.S. states. *BMC Public Health, 13*(3), 1-9. https://doi.org/10.1186/1471-2458-13-3

Charuvastra, A., & Cloitre, M. (2009). Safe enough to sleep: Sleep disruptions associated with trauma, posttraumatic stress, and anxiety in children and adolescents. *Child and Adolescent Psychiatric Clinics of North America, 18*(4), 877-891. https://doi.org/10.1016/j.chc.2009.04.002

Cho, S., Kim, G. S., & Lee, J. H. (2013). Psychometric evaluation of the sleep hygiene index: A sample of patients with chronic pain. *Health and Quality of Life Outcomes, 11*(213), 1-7. https://doi.org/10.1186/1477-7525-11-213

Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124*(1), 3-21. https://doi.org/10.1037/0033-2909.124.1.3

Clemmons, J. C., Walsh, K., DiLillo, D., & Messman-Moore, T. L. (2007). Unique and combined contributions of multiple child abuse types and abuse severity to adult trauma symptomatology. *Child Maltreatment, 12*(2), 172-181. https://doi.org/10.1177/1077559506298248

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), The social psychology of health: Claremont Symposium on Applied Social Psychology (pp. 31–67). Newbury Park, CA: Sage.

Cunningham, T. J., Wheaton, A. G., & Giles, W. H. (2015). The association between psychological distress and self-reported sleep duration in a population-based sample of women and men. *Sleep Disorders*, Article ID *172064*, 1–8.

https://doi.org/10.1155/2015/172064

DeSimone, J. A., & Harms, P. D. (2018). Dirty data: The effects of screening respondents who provide low-quality data in survey research. *Journal of Business and Psychology, 33*(5), 559-577. https://doi.org/10.1007/s10869-017-9514-9

DiPietro, J. A., Novak, M. F., Costigan, K. A., Atella, L. D., & Reusing, S. P. (2006). Maternal psychological distress during pregnancy in relation to child development at age two. *Child Development, 77*, 573–587. https://doi.org/10.1111/j.1467-8624.2006.00891.x

Doane, L. D., & Thurston, E. C. (2014). Associations among sleep, daily experiences, and loneliness in adolescence: Evidence of moderating and bidirectional pathways. *Journal of Adolescence, 37*(2), 145-154. https://doi.org/10.1016/j.adolescence.2013.11.009

Edinger, J. D. (2016). Treatment manual: Cognitive-behavioral insomnia therapy. Veterans Affairs and Duke University Medical Centers. https://www.med.unc.edu/neurology/sleepclin/jdedingrCBTManual.pdf

Edwards, K. M., Probst, D. R., Rodenhizer-Stämpfli, K. A., Gidycz, C. A., & Tansill, E. C. (2014). Multiplicity of child maltreatment and biopsychosocial outcomes in young adulthood: The moderating role of resiliency characteristics among female survivors. *Child Maltreatment, 19*(3-4), 188-198. https://doi.org/10.1177/1077559514543354

Fernández-Mendoza, J., Vela-Bueno, A., Vgontzas, A. N., Olavarrieta-Bernardino, S., Ramos-Platón, M. J., Bixler, E. O., & De la Cruz-Troca, J. J. (2009). Nighttime sleep and daytime functioning correlates of the insomnia complaint in young

adults. *Journal of Adolescence, 32*(5), 1059-1074. https://doi.org/10.1016/j.adolescence.2009.03.005

Fife, D. (2020). The eight steps of data analysis: A graphical framework to promote sound statistical analysis. *Perspectives on Psychological Science, 15*(4), 1054-1075. https://doi.org/10.1177/1745691620917333

Frazier, P. A., Berman, M., & Steward, J. (2001). Perceived control and posttraumatic stress: A temporal model. *Applied and Preventive Psychology, 10*, 207-223. https://doi.org/10.1016/S0962-1849(01)80015-9

Frazier, P. A., Keenan, N., Anders, S., Perera, S., Shallcross, S., & Hintz, S. (2011). Perceived past, present, and future control and adjustment to stressful life events. *Journal of Personality and Social Psychology, 100(*4), 749-765. https://doi.org/10.1037/a0022405

Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology, 51*(1), 115-134. https://doi.org/10.1037/0022-0167.51.1.115

Friedrich, A., & Schlarb, A. A. (2018). Let's talk about sleep: A systematic review of psychological interventions to improve sleep in college students. *Journal of Sleep Research, 27*(1), 4–22. https://doi.org/10.1111/jsr.12568

Fuligni, A. J., Chiang, J. J., & Tottenham, N. (2021). Sleep disturbance and the long-term impact of early adversity. *Neuroscience & Biobehavioral Reviews, 126*, 304-313. https://doi.org/10.1016/j.neubiorev.2021.03.021

Gellis, L. A., & Lichstein, K. L. (2009). Sleep hygiene practices of good and poor sleepers in the United States: An internet-based study. *Behavior Therapy, 40*(1),

1-9. https://doi.org/10.1016/j.beth.2008.02.001

Gerdner, A., & Allgulander, C. (2009). Psychometric properties of the Swedish version of the Childhood Trauma Questionnaire—Short Form (CTQ-SF). *Nordic Journal of Psychiatry, 63*(2), 160-170. https://doi.org/10.1080/08039480802514366

Goelema, M., Leufkens, T., Haakma, R., Markopoulos, P., & Walla, P. (2018). Determinants of self-reported sleep quality in healthy sleepers and patients. *Cogent Psychology, 5*(1), 1499197. https://doi.org/10.1080/23311908.2018.1499197

Gregory, A. M., Caspi, A., Moffitt, T. E., & Poulton, R. (2006). Family conflict in childhood: A predictor of later insomnia. *Sleep, 29*(8), 1063-1067. https://doi.org/10.1093/sleep/29.8.1063

Gregory, A. M., Eley, T. C., O'Connor, T. G., Rijsdijk, F. V., & Plomin, R. (2005). Family influences on the association between sleep problems and anxiety in a large sample of pre-school aged twins. *Personality and Individual Differences, 39*(8), 1337-1348. https://doi.org/10.1016/j.paid.2005.06.008

Gress-Smith, J. L., Roubinov, D. S., Andreotti, C., Compas, B. E., & Luecken, L. J. (2015). Prevalence, severity and risk factors for depressive symptoms and insomnia in college undergraduates. *Stress and Health, 31*(1), 63-70. https://doi.org/10.1002/smi.2509

Grubbs, F. E., & Beck, G. (1972). Extension of sample sizes and percentage points for significance tests of outlying observations. *Technometrics, 14*(4), 847-854.

Guastella, A. J., & Moulds, M. L. (2007). The impact of rumination on sleep quality following a stressful life event. *Personality and Individual Differences, 42*(6),

1151-1162. https://doi.org/10.1016/j.paid.2006.04.028

Hartmann, M. E., & Prichard, J. R. (2018). Calculating the contribution of sleep problems to undergraduates' academic success. *Sleep Health, 4*(5), 463-471. https://doi.org/10.1016/j.sleh.2018.07.002

Harvey, A. G., Tang, N. K., & Browning, L. (2005). Cognitive approaches to insomnia. *Clinical Psychology Review, 25*(5), 593-611. https://doi.org/10.1016/j.cpr.2005.04.005

Hayduk, L. A., & Littvay, L. (2012). Should researchers use single indicators, best indicators, or multiple indicators in structural equation models? *BMC Medical Research Methodology, 12*, 159–176. http://dx.doi.org/10.1186/1471-2288-12-159

Higgs, E., Drolet, C. E., & Belicki, K. (2020). The impact of childhood sexual abuse on sleep in adulthood. *Child Abuse & Neglect, 107*, 104567. https://doi.org/10.1016/j.chiabu.2020.104567

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55. https://doi.org/10.1080/10705519909540118

Ingram IV, P. B., Clarke, E., & Lichtenberg, J. W. (2016). Confirmatory factor analysis of the Perceived Stress Scale‐4 in a community sample. *Stress and Health, 32*(2), 173-176. https://doi.org/10.1002/smi.2592

Irving, S. M., & Ferraro, K. F. (2006). Reports of abusive experiences during childhood and adult health ratings: Personal control as a pathway? *Journal of Aging and Health, 18*(3), 458-485. https://doi.org/10.1177/0898264305280994

Jarczok, M., Lange, S., Domhardt, M., Baumeister, H., & Jud, A. (2022). Can you sleep?

Effect of retrospective recall of child maltreatment on sleep parameters and the mediating role of psychological distress among students of two German universities. *Nature and Science of Sleep, 14*, 1299-1310. https://doi.org/10.2147/NSS.S360610

Javakhishvili, M., & Widom, C. S. (2021). Childhood maltreatment, sleep disturbances, and anxiety and depression: A prospective longitudinal investigation. *Journal of Applied Developmental Psychology, 77*, 101351. https://doi.org/10.1016/j.appdev.2021.101351

John-Henderson, N. A., Williams, S. E., Brindle, R. C., & Ginty, A. T. (2018). Changes in sleep quality and levels of psychological distress during the adaptation to university: The role of childhood adversity. *British Journal of Psychology, 109*, 694-707. https://doi.org/10.1111/bjop.12314

Joiner, W. J. (2018). The neurobiological basis of sleep and sleep disorders. *Physiology, 33*(5), 317-327. https://doi.org/10.1152/physiol.00013.2018

Kajeepeta, S., Gelaye, B., Jackson, C. L., & Williams, M. A. (2015). Adverse childhood experiences are associated with adult sleep disorders: A systematic review. *Sleep Medicine, 16*(3), 320-330. https://doi.org/10.1016/j.sleep.2014.12.013

Kalmakis, K. A., & Chandler, G. E. (2015). Health consequences of adverse childhood experiences: A systematic review. *Journal of the American Association of Nurse Practitioners, 27*(8), 457-465. https://doi.org/10.1002/2327-6924.12215

Kaubrys, M., Baker, M. R., Frazier, P. A., & Nguyen-Feng, V. N. (2021). Relations among daily stressors, childhood maltreatment, and sleep in college students. *Journal of Counseling Psychology, 68*(4), 489-500.

https://doi.org/10.1037/cou0000549

Kenney, S. R., Paves, A. P., Grimaldi, E. M., & LaBrie, J. W. (2014). Sleep quality and alcohol risk in college students: Examining the moderating effects of drinking motives. *Journal of American College Health, 62*(5), 301-308. https://doi.org/10.1080/07448481.2014.897953

Khubchandani, J., Brey, R., Kotecki, J., Kleinfelder, J., & Anderson, J. (2016). The psychometric properties of PHQ-4 depression and anxiety screening scale among college students. *Archives of Psychiatric Nursing, 30*(4), 457-462. https://doi.org/10.1016/j.apnu.2016.01.014

Kim, K. H. (2005). The relation among fit indexes, power, and sample size in structural equation modeling. *Structural Equation Modeling, 12*(3), 368-390. https://doi.org/10.1207/s15328007sem1203_2

Knufinke, M., Nieuwenhuys, A., Geurts, S. A., Coenen, A. M., & Kompier, M. A. (2018). Self‐reported sleep quantity, quality and sleep hygiene in elite athletes. *Journal of Sleep Research, 27*(1), 78-85. https://doi.org/10.1111/jsr.12509

Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: The PHQ–4. *Psychosomatics, 50*(6), 613-621. https://doi.org/10.1016/S0033-3182(09)70864-3

Lei, D. K., Yousaf, M., Janmohamed, S. R., Vakharia, P. P., Chopra, R., Sacotte, R., Patel, V., Singam, S., Immaneni, R., Kantor, D. Y., Hsu, J. I., & Silverberg, J. I. (2020). Validation of patient‐reported outcomes information system sleep disturbance and sleep‐related impairment in adults with atopic dermatitis. *British Journal of Dermatology, 183*(5), 875-882. https://doi.org/10.1111/bjd.18920

Levenson, J. C., Miller, E., Hafer, B. L., Reidell, M. F., Buysse, D. J., & Franzen, P. L. (2016). Pilot study of a sleep health promotion program for college students. *Sleep Health, 2*(2), 167-174. https://doi.org/10.1016/j.sleh.2016.03.006

Li, J., Lepp, A., & Barkley, J. E. (2015). Locus of control and cell phone use: Implications for sleep quality, academic performance, and subjective well-being. *Computers in Human Behavior, 52*, 450-457. https://doi.org/10.1016/j.chb.2015.06.021

MacCallum, R. C., Wegener, D. T., Uchino, B. N., & Fabrigar, L. R. (1993). The problem of equivalent models in applications of covariance structure analysis. *Psychological Bulletin, 114*(1), 185-199. https://doi.org/10.1037/0033-2909.114.1.185

Mallinson, D. C., Kamenetsky, M. E., Hagen, E. W., & Peppard, P. E. (2019). Subjective sleep measurement: Comparing sleep diary to questionnaire. *Nature and Science of Sleep, 11*, 197-206. https://doi.org/10.2147/NSS.S217867

Maples, L. A., Park, S. S., Nolen, J. P., & Rosén, L. A. (2014). Resilience to childhood abuse and neglect in college students. *Journal of Aggression, Maltreatment & Trauma, 23*(10), 1001-1019. https://doi.org/10.1080/10926771.2014.964435

Mastin, D. F., Bryson, J., & Corwyn, R. (2006). Assessment of sleep hygiene using the Sleep Hygiene Index. *Journal of Behavioral Medicine, 29*(3), 223-227. https://doi.org/10.1007/s10865-006-9047-6

McCabe, K. O., Mack, L., & Fleeson, W. (2012). A guide for data cleaning in experience sampling studies. In M. R. Mehl & T. S. Conner (Eds.), Handbook of Research Methods for Studying Daily Life (pp. 321-338). New York, NY: Guilford Press.

McClelland, S. I., Baker, M. R., Papp, L. J., & Dutcher, H. J. (2021). *Identifying low-quality cases in online survey research: Recommendations for researchers* [Manuscript submitted for publication]. Departments of Psychology and Women's & Gender Studies, University of Michigan.

McPhie, M. L., Weiss, J. A., & Wekerle, C. (2014). Psychological distress as a mediator of the relationship between childhood maltreatment and sleep quality in adolescence: Results from the Maltreatment and Adolescent Pathways (MAP) Longitudinal Study. *Child Abuse & Neglect, 38*(12), 2044-2052. https://doi.org/10.1016/j.chiabu.2014.07.009

Meade, A. W., & Craig, S. B. (2012). Identifying careless responses in survey data. *Psychological Methods, 17*, 437-455. https://doi.org/10.1037/a0028085

Mikulincer, M., Glaubman, H., Wasserman, O., Porat, A., & Birger, M. (1989). Control-related beliefs and sleep characteristics of posttraumatic stress disorder patients. *Psychological Reports, 65*(2), 567-576. https://doi.org/10.2466/pr0.1989.65.2.567

Mullington, J., Spielman, A., Wells, R., & Hoffman, R. (1988). Subjective estimation of nocturnal sleep length and stability of sleep patterns: A 42 night sleep log study. *Sleep Research, 17*, 342.

Nehrkorn-Bailey, A. M., Reardon, M. S., & Hicks Patrick, J. (2018). Some methodological and analytical issues related to real-time data capture studies. *Translational Issues in Psychological Science, 4*(4), 349-361. https://doi.org/10.1037/tps0000177

Nguyen-Feng, V. N., Baker, M. R., Merians, A. N., & Frazier, P. A. (2017). Sexual

victimization, childhood emotional abuse, and distress: Daily coping and perceived control as mediators. *Journal of Counseling Psychology, 64*(6), 672–683. https://doi.org/10.1037/cou0000244

Nguyen-Feng, V. N., Frazier, P. A., Greer, C. S., Howard, K. G., Paulsen, J. A., Meredith, L., & Kim, S. (2015). A randomized controlled trial of a web-based intervention to reduce distress among students with a history of interpersonal violence. *Psychology of Violence, 5*(4), 444–454. https://doi.org/10.1037/a0039596

Nguyen-Feng, V. N., Romano, F. N., & Frazier, P. (2019). Emotional abuse moderates efficacy of an ecological momentary stress management intervention for college students. *Journal of Counseling Psychology, 66*(4), 461–472. https://doi.org/10.1037/cou0000332

Nolen-Hoeksema, S. (2000). The role of rumination in depressive disorders and mixed anxiety/depressive symptoms. *Journal of Abnormal Psychology, 109*(3), 504-511. https://doi.org/10.1037//0021-843X.109.3.504

Noll, J. G., Trickett, P. K., Susman, E. J., & Putnam, F. W. (2006). Sleep disturbances and childhood sexual abuse. *Journal of Pediatric Psychology, 31*(5), 469-480. https://doi.org/10.1093/jpepsy/jsj040

Paivio, S. C., & Cramer, K. M. (2004). Factor structure and reliability of the Childhood Trauma Questionnaire in a Canadian undergraduate student sample. *Child Abuse & Neglect, 28*(8), 889-904. https://doi.org/10.1016/j.chiabu.2004.01.011

Person, A., Kaubrys, M., Nguyen-Feng, V., & Frazier, P. (2020). Childhood trauma and later sleep outcomes: Potential mechanisms [Unpublished report]. Psychology Department, University of Minnesota Twin Cities.

Pfaff, A., Jud, A., & Schlarb, A. (2021). Systematic review on the association between sleep-related hyperarousal and child maltreatment. *Sleep Medicine, 84*, 219-226. https://doi.org/10.1016/j.sleep.2021.05.041

Pfaff, A., & Schlarb, A. A. (2022). Child maltreatment and sleep: Two pathways explaining the link. *Journal of Sleep Research, 31*(2), e13455. https://doi.org/10.1111/jsr.13455

Pratap, A., Atkins, D. C., Renn, B. N., Tanana, M. J., Mooney, S. D., Anguera, J. A., & Areán, P. A. (2019). The accuracy of passive phone sensors in predicting daily mood. *Depression and Anxiety, 36*(1), 72-81. https://doi.org/10.1002/da.22822

PROMIS Health Organization and PROMIS Cooperative Group. (2012). Level 2—Sleep Disturbance—Adult (PROMIS—Sleep Disturbance— Short Form). [Measurement instrument]. Retrieved from https://www.psychiatry.org/Psychiatrists/Practice/DSM/Educational-Resources/DSM-5-Assessment-Measures

Raes, F., & Hermans, D. (2008). On the mediating role of subtypes of rumination in the relationship between childhood emotional abuse and depressed mood: Brooding versus reflection. *Depression and Anxiety, 25*(12), 1067-1070. https://doi.org/10.1002/da.20447

Ramsawh, H. J., Ancoli-Israel, S., Sullivan, S. G., Hitchcock, C. A. (2011). Neuroticism mediates the relationship between childhood adversity and adult sleep quality. *Behavioral Sleep Medicine, 9*,130-143. https://doi.org/10.1080/15402002.2011.583895

Ridner, S. H. (2004). Psychological distress: Concept analysis. *Journal of Advanced*

Nursing, 45(5), 536-545. https://doi.org/10.1046/j.1365-2648.2003.02938.x

Riemann, D., Spiegelhalder, K., Feige, B., Voderholzer, U., Berger, M., Perlis, M., & Nissen, C. (2010). The hyperarousal model of insomnia: A review of the concept and its evidence. *Sleep Medicine Reviews, 14*(1), 19-31. https://doi.org/10.1016/j.smrv.2009.04.002

Rojo-Wissar, D. M., Davidson, R. D., Beck, C. J., Kobayashi, U. S., VanBlargan, A. C., & Haynes, P. L. (2019). Sleep quality and perceived health in college undergraduates with adverse childhood experiences. *Sleep Health, 5*(2), 187-192. https://doi.org/10.1016/j.sleh.2018.11.007

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied, 80*(1), 1-28. https://doi.org/10.1037/h0092976

Sarin, S., & Nolen-Hoeksema, S. (2010). The dangers of dwelling: An examination of the relationship between rumination and consumptive coping in survivors of childhood sexual abuse. *Cognition and Emotion, 24*(1), 71-85. https://doi.org/10.1080/02699930802563668

Schneider, S., Choi, S. W., Junghaenel, D. U., Schwartz, J. E., & Stone, A. A. (2013). Psychometric characteristics of daily diaries for the Patient-Reported Outcomes Measurement Information System (PROMIS®): A preliminary investigation. *Quality of Life Research, 22*(7), 1859-1869.

Seun-Fadipe, C. T., & Mosaku, K. S. (2017). Sleep quality and psychological distress among undergraduate students of a Nigerian university. *Sleep Health, 3*(3), 190-194. https://doi.org/10.1016/j.sleh.2017.02.004

Seun-Fadipe, C. T., Aloba, O. O., Oginni, O. A., & Mosaku, K. S. (2018). Sleep hygiene index: Psychometric characteristics and usefulness as a screening tool in a sample of Nigerian undergraduate students. *Journal of Clinical Sleep Medicine, 14*(08), 1285-1292. https://doi.org/10.5664/jcsm.7256

Shrider, E. A., Kollar, M., Chen, F., & Semega, J. (2021). Income and poverty in the United States: 2020. *Current Population Reports. US Census Bureau.*

Sin, N. L., Almeida, D. M., Crain, T. L., Kossek, E. E., Berkman, L. F., & Buxton, O. M. (2017). Bidirectional, temporal associations of sleep with positive events, affect, and stressors in daily life across a week. *Annals of Behavioral Medicine, 51*(3), 402-415. https://doi.org/10.1007/s12160-016-9864-y

Slopen, N., Lewis, T. T., & Williams, D. R. (2016). Discrimination and sleep: A systematic review. *Sleep Medicine, 18*, 88-95. https://doi.org/10.1016/j.sleep.2015.01.012

Spilsbury, J. C. (2009). Sleep as a mediator in the pathway from violence-induced traumatic stress to poorer health and functioning: A review of the literature and proposed conceptual model. *Behavioral Sleep Medicine, 7*(4), 223-244. https://doi.org/10.1080/15402000903190207

Springer, K. W., Sheridan, J., Kuo, D., & Carnes, M. (2007). Long-term physical and mental health consequences of childhood physical abuse: Results from a large population-based sample of men and women. *Child Abuse & Neglect, 31*(5), 517-530. https://doi.org/10.1016/j.chiabu.2007.01.003

Staples, L. G., Dear, B. F., Gandy, M., Fogliati, V., Fogliati, R., Karin, E., Nielssen, O., & Titov, N. (2019). Psychometric properties and clinical utility of brief measures of

depression, anxiety, and general distress: The PHQ-2, GAD-2, and K-6. *General Hospital Psychiatry, 56*, 13-18. https://doi.org/10.1016/j.genhosppsych.2018.11.003

Stepanski, E. J., & Wyatt, J. K. (2003). Use of sleep hygiene in the treatment of insomnia. *Sleep Medicine Reviews, 7*(3), 215-225. https://doi.org/10.1053/smrv.2001.0246

Strainge, L., Sullivan, M. C., Blackmon, J. E., Cruess, S. E., Wheeler, D., & Cruess, D. G. (2019). PROMIS®-assessed sleep problems and physical health symptoms in adult psychiatric inpatients. *Health Psychology, 38*(5), 376-385. http://dx.doi.org/10.1037/hea0000651

Szabo, Y. Z., Nelson, S. M., & Lantrip, C. (2020). Cognitive complaints in neuropsychologically normal adults: A brief report on the roles of childhood abuse and rumination. *Traumatology, 26*(1), 29–34. https://doi.org/10.1037/trm0000209

Taylor, D. J., Bramoweth, A. D., Grieser, E. A., Tatum, J. I., & Roane, B. M. (2013). Epidemiology of insomnia in college students: Relationship with mental health, quality of life, and substance use difficulties. *Behavior Therapy, 44*(3), 339-348. https://doi.org/10.1016/j.beth.2012.12.001

Thompson, E. R. (2007). Development and validation of an internationally reliable short-form of the Positive and Negative Affect Schedule (PANAS). *Journal of Cross-Cultural Psychology, 38*(2), 227-242. https://doi.org/10.1177/0022022106297301

U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. (2022).

Child Maltreatment 2020. Available from https://www.acf.hhs.gov/cb/data-research/child-maltreatment.

Van Laethem, M., Beckers, D. G., van Hooff, M. L., Dijksterhuis, A., & Geurts, S. A. (2016). Day-to-day relations between stress and sleep and the mediating role of perseverative cognition. *Sleep Medicine, 24*, 71-79. https://doi.org/10.1016/j.sleep.2016.06.020

Vincent, N., Walsh, K., & Chiang, D. (2013). Control and coping in chronic insomnia: A daily diary study. *Behaviour Research and Therapy, 51*(6), 240-246. https://doi.org/10.1016/j.brat.2013.02.004

Walker, M. P. (2009). The role of sleep in cognition and emotion. *Annals of the New York Academy of Sciences, 1156*(1), 168-197. https://doi.org/10.1111/j.1749-6632.2009.04416.x

Weston, R., & Gore Jr, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719-751. https://doi.org/10.1177/0011000006286345

Windle, M., Haardörfer, R., Getachew, B., Shah, J., Payne, J., Pillai, D., & Berg, C. J. (2018). A multivariate analysis of adverse childhood experiences and health behaviors and outcomes among college students. *Journal of American College Health, 66*(4), 246-251. https://doi.org/10.1080/07448481.2018.1431892

Wright, M. O. D., Crawford, E., & Del Castillo, D. (2009). Childhood emotional maltreatment and later psychological distress among college students: The mediating role of maladaptive schemas. *Child Abuse & Neglect, 33*(1), 59-68.

https://doi.org/10.1016/j.chiabu.2008.12.007

Yip, T., Cham, H., Wang, Y., & El‐Sheikh, M. (2020). Discrimination and sleep mediate ethnic/racial identity and adolescent adjustment: Uncovering change processes with slope‐as‐mediator mediation. *Child Development, 91*(3), 1021-1043. https://doi.org/10.1111/cdev.13276

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

Zoccola, P. M., Dickerson, S. S., & Lam, S. (2009). Rumination predicts longer sleep onset latency after an acute psychosocial stressor. *Psychosomatic Medicine, 71*(7), 771-775. https://doi.org/10.1097/PSY.0b013e3181ae58e8

Zuckerman, M., & Gagne, M. (2003). The COPE revised: Proposing a 5-factor model of coping strategies. *Journal of Research in Personality, 37*, 169-204. https://doi.org/10.1016/S0092- 6566(02)00563-9

Appendix A
Baseline Measures

Childhood Trauma Questionnaire-Short Form (Bernstein & Fink, 1998)

The following questions ask about some of your experiences growing up as a child and a teenager. Please try to answer as honestly as you can. For each question, select the response that best describes how you feel.

When I was growing up...

1 = Never true

2 = Rarely true

3 = Sometimes true

4 = Often true

5 = Very often true

1. I didn't have enough to eat.
2. I knew that there was someone to take care of me and protect me.
3. People in my family called me things like “stupid,” “lazy,” or “ugly.”
4. My parents were too drunk or high to take care of the family.
5. There was someone in my family who helped me feel that I was important or special.
6. I had to wear dirty clothes.
7. I felt loved.
8. I thought that my parents wished I had never been born.
9. I got hit so hard by someone in my family that I had to see a doctor or go to the hospital.
10. There was nothing I wanted to change about my family.
11. People in my family hit me so hard that it left me with bruises or marks.
12. I was punished with a belt, a board, a cord, or some other hard object.
13. People in my family looked out for each other.
14. People in my family said hurtful or insulting things to me.
15. I believe that I was physically abused.
16. I had the perfect childhood.
17. I got hit or beaten so badly that it was noticed by someone like a teacher, neighbor, or doctor.
18. I felt that someone in my family hated me.
19. People in my family felt close to each other.
20. Someone tried to touch me in a sexual way or tried to make me touch them.
21. I had the best family in the world.
22. Someone threatened to hurt me or tell lies about me unless I did something sexual with them.
23. Someone tried to make me do sexual things or watch sexual things.

24. Someone molested me.
25. I believe that I was emotionally abused.
26. There was someone to take me to the doctor if I needed it.
27. I believe that I was sexually abused.
28. My family was a source of strength and support.

Baseline characteristics

1. What is your age (in years)?
2. What year are you in school?
    a. First
    b. Second
    c. Third
    d. Fourth
    e. Other, please describe:
3. What is your academic major?
4. What is your cumulative GPA (e.g., 3.45)?
5. Are you an international student?
    a. Yes
    b. No
6. If you are an international student, what country are you from?
7. Are you a first-generation college student (i.e., your parents/primary guardians have not completed a bachelor's degree)?
8. What's your current employment status?
    a. I have a full-time job
    b. I have a part-time job
    c. I am not currently working
9. What is your gender?
    a. Cisgender woman (assigned female at birth and identify as a woman)
    b. Cisgender man (assigned male at birth and identify as a man)
    c. Transgender man
    d. Transgender woman
    e. Gender non-conforming
    f. Nonbinary
    g. Agender
    h. Genderqueer
    i. Genderfluid
    j. Questioning
    k. Other, please describe:
10. What is your current relationship status?
    a. Single

   b. Dating
   c. In a committed relationship and not living together
   d. In a committed relationship and cohabitating
   e. Married
   f. Divorced
   g. Separated
   h. Widowed
   i. Other, please describe:
11. What best describes your sexual orientation?
   a. Heterosexual or straight
   b. Gay, lesbian, or (monosexual) queer
   c. Bisexual, pansexual, or (non-monosexual) queer
   d. Other, please describe (e.g., fluid, queer, demisexual, asexual):
12. How do you describe your race/ethnicity? (Select one or more)
   a. European American or White
   b. African American or Black
   c. Asian American or Asian
   d. Hispanic or Latin American or Latinx/a/o/e
   e. Native American, Hawaiian Native, or Alaskan Native
   f. Middle Eastern or Arab American
   g. Other, please describe
13. What is your height in feet (') and inches (")?
14. What is your approximate weight in pounds? (1 kilogram = 2.2 pounds)
15. How would you describe your overall health?
   a. Excellent
   b. Very good
   c. Good
   d. Fair
   e. Poor
16. What are your living arrangements?
   a. Parent/caregiver's home, sleep in shared bedroom
   b. Parent/caregiver's home, sleep in private bedroom
   c. Off-campus housing, live alone
   d. Off-campus housing, have roommates/partner/children, sleep in shared bedroom
   e. Off-campus housing, have roommates/partner/children, sleep in private bedroom
   f. Residence hall/on-campus housing, sleep in shared room
   g. Residence hall/on-campus housing, sleep in private room
   h. Fraternity/Sorority, sleep in shared room

i. Fraternity/Sorority, sleep in private room
j. Homeless or inconsistent housing
k. Other, please describe

17. Please select your parents/step‐parents/adult caretakers' current yearly income.
    a. $0 ‐ $21,999
    b. $22,000 ‐ $39,999
    c. $40,000 ‐ $64,999
    d. $65,000 ‐ $83,999
    e. $84,000 ‐ $99,999
    f. $100,000 ‐ $149,999
    g. $150,000 ‐$199,999
    h. $200,000 or more
    i. Don't know
18. Have you ever been diagnosed by a medical or mental health professional with any of the following ongoing or chronic sleep-wake disorders?
    a. Insomnia
    b. Sleep Apnea
    c. Hypersomnolence
    d. Narcolepsy
    e. Restless Leg Syndrome
    f. Sleep Paralysis
    g. Sleep Terrors (or night terrors)
    h. Sleep Walking
    i. Other sleep-wake condition not listed above (please specify)

Appendix B
Daily Measures

Morning Survey

Sleep Log (adapted from Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Edinger, 2016)

These questions ask about your sleep last night. Please provide your best estimate. For example, if you went to bed at 11:45pm, please select "11" from the Hour column, "45" from the Minute column, and "PM" from the AM/PM column. Please note that midnight is 12:00 AM and noon is 12:00 PM.

1. What time did you go to bed last night (i.e., attempt to fall asleep)?
2. What time did you wake up (and stay up) this morning?
3. How much actual sleep did you get last night? (This may be different than the time you spent in bed.) For example, if you estimate that you slept 8 hours and 15 minutes, please select "8" from the Hours column and "15" from the Minutes column.

PROMIS Sleep Disturbance (SD) scale (adapted from Yu et al., 2012).

Please answer the following questions with regard to how you slept last night:

1 = Not at all
2 = A little bit
3 = Somewhat
4 = Quite a bit
5 = Very much

1. My sleep was restless…
2. I was satisfied with my sleep…
3. My sleep was refreshing…
4. I had difficulty falling asleep…
5. I had trouble staying asleep…
6. I had trouble sleeping…
7. I got enough sleep...

Please answer regarding your sleep last night:

5 = Very poor
4 = Poor
3 = Fair
2 = Good
1 = Very good

8. My sleep quality was…

Sleep Hygiene Index (adapted from Mastin et al., 2006)

Please indicate whether any of the following are true for you (True/False):
Last night or yesterday I…

1. Took a daytime nap(s) lasting for a total of two or more hours.
2. Exercised to the point of sweating within one hour of going to bed.
3. Used alcohol, tobacco, or caffeine within four hours of going to bed or after going to bed.
4. Did something that might wake me up before bedtime (e.g., played video games, used the internet, or cleaned).
5. Went to bed feeling stressed, angry, upset, or nervous.
6. Used my bed for things other than sleeping or sex (e.g., watching television, reading, eating, or studying).
7. Slept on an uncomfortable bed (e.g., poor mattress or pillow, too much or not enough blankets).
8. Slept in an uncomfortable bedroom (e.g., too bright, too stuffy, too hot, too cold, or too noisy).
9. Did important work before bedtime (e.g., paid bills, scheduled, or studied).
10. Thought, planned, or worried when I was in bed.

Evening Survey

Patient Health Questionnaire for Depression and Anxiety (adapted from Kroenke et al., 2009)
Over the past day, how often have you been bothered by any of the following problems?
1 = Not at all
5= Most of the day

1. Feeling nervous, anxious, or on edge
2. Not being able to stop or control worrying
3. Little interest or pleasure in doing things
4. Feeling down, depressed, or hopeless

Four-item version of the Perceived Stress Scale (adapted from Cohen & Williamson, 1988)
Today, how often have you…
0 = Never
1 = Almost never
2 = Sometimes
3 = Fairly often
4 = Very often

1. Felt that you were unable to control important things in life?
2. Felt confident about your ability to handle personal problems?
3. Felt things were going your way?

4. felt difficulties were piling up so high that you couldn't overcome them?

COPE Revised - Self-Focused Rumination Subscale (adapted from Zuckerman & Gagne, 2003)

Please answer these questions with regard to what you did today:

1 = I didn't do this at all

2 = I did this a little bit

3 = I did this a medium amount

4 = I did this a lot

1. I just thought about my problem(s) constantly
2. I returned in my head again and again to what is troubling me
3. I relived the problem(s) by dwelling on it all the time
4. I brooded over my problem(s) non-stop

Present Control over Stressful Events Scale, Present Control subscale (adapted from Frazier et al., 2011)

Using the following scale, please respond with regard to how you felt today about the event you described above.

1 = Strongly disagree

2 = Disagree somewhat

3 = Agree somewhat

4 = Strongly agree

1. How I dealt with the situation was under my control.
2. I had control over my reactions to the situation.
3. I had control over how I thought about the situation.
4. I tried to focus on things I had control over.