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Stress and burnout among graduate students: Moderation by sleep duration and quality

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Abstract

Background.—There are high levels of stress among graduate students, and stress is associated with multiple negative outcomes among student populations, including academic burnout. Sleep could play an important role in explaining the association between stress and burnout, but these relationships have not been explored among the graduate student population. The current study assessed whether or not sleep duration and quality moderated the relationship between stress and burnout (i.e., exhaustion, cynicism, and inefficacy) among graduate students.

Methods.—A sample of 2,683 master's, doctoral, and professional graduate students from two large, public universities completed an online survey. Linear regression models with interaction terms were developed to evaluate the relationships between stress and burnout while examining moderation by sleep duration and quality.

Results.—Participants slept an average of 6.4 hours per night, with 62% indicating good sleep quality. Stress had significant, positive relationships with exhaustion, cynicism, and inefficacy. The relationship between stress and exhaustion lessened as sleep duration increased, and the relationship between stress and exhaustion was weaker among students with good sleep quality when compared with those with poor sleep quality. Neither sleep duration nor sleep quality moderated the relationships between stress and cynicism or stress and inefficacy.

Conclusions.—Improving sleep habits has the potential to lessen the negative association between stress and graduate student functioning. Future research utilizing longitudinal designs is needed to understand the temporality of these associations and the influence of possible co-factors like individual propensity for mental health problems and social support.

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Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Keywords

Graduate students; stress; burnout; sleep

Introduction

Competing demands, along with the rigorous nature of graduate programs, can combine to produce high levels of stress among graduate students [1]. While graduate students face the typical academic pressures of higher education, they also experience additional professional stressors including pressure to publish, teach, and meet advisor expectations. When forced to balance meeting academic and professional goals with outside family and career responsibilities, graduate students might neglect their mental and physical health [2,3]. Research has shown that doctoral students in particular are more affected by mental health problems than the highly educated general population, frequently citing constant strain, feeling unhappy and depressed, and losing sleep over worry [4].

Several studies have confirmed the high-stress nature of graduate education, with stress often defined as feeling that life is unpredictable, uncontrollable, and overloading [5]. In one of the more extensive studies on the mental health needs of graduate students, Hyun et al. [6] found that 45% of graduate students had an emotional or stress-related problem during the past year, and more than half (58%) had a colleague with a similar past-year problem. Results also showed that 46% of graduate students felt overwhelmed frequently or all of the time. Studies have also shown that graduate students report higher levels of stress when compared with both undergraduate students [7] and the general population [8]. Studies by Oswalt & Riddock [9] and Kernan et al. [10] both found that about 75% of their graduate student samples reported being stressed or very stressed.

Stress is associated with decreased functioning among graduate students, with 27% of graduate students who felt stressed during the past-year reporting that it negatively impacted their academic performance [10]. With only 50% to 75% of graduate students completing their degree [11-13], the extent to which stress is associated with graduate student functioning and potential program dropout is an understudied and important area of research. The Graduate Student Stress Model [1] posits that stress is related to burnout among graduate students, which is a concept defined as a “prolonged response to chronic emotional and interpersonal stressors” [14].

Originally applied to occupational environments, burnout is typically defined by three dimensions [15-17]. The first dimension, exhaustion, refers to fatigue that occurs when a person has been depleted of their emotional resources. The second dimension, cynicism, is the development of negative or indifferent attitudes related to the validity of a person’s work. Finally, inefficacy refers to feelings of incompetency and a lack of personal accomplishment. As applied to burnout from an academic program, prior work has assessed these dimensions of burnout among graduate students, particularly exhaustion. Results have showed high levels of exhaustion, cynicism, and inefficacy among graduate students [18-22] and high levels of the exhaustion dimension of burnout are associated with intentions to leave academia [19] and decreased program satisfaction and success [23].

Sleep might play an important role in explaining the potential relationship between stress and burnout among graduate students, as sufficient sleep is critical to emotion and energy regulation. Two cross-sectional studies of psychology graduate students found that fewer hours of sleep and poor sleep hygiene were associated with increased levels of stress [24,25]. Recent studies of medical students [22,26,27] found that poor sleep habits and sleep deprivation were associated with burnout, lower professional efficacy, and decreased quality of life. While sleep is significantly associated with both stress and burnout among graduate students, it is unknown whether or not sleep might moderate the association between stress and burnout among this unique student population.

This study was conducted to advance our understanding of the relationships between stress, sleep, and burnout by utilizing data from a large, diverse sample of graduate students. Specifically, the study aims were to: 1) assess whether or not increased stress was associated with increased levels of the three dimensions of burnout (i.e., exhaustion, cynicism, and inefficacy), and 2) test the hypothesis that both increased sleep duration and better sleep quality would lessen the relationship between stress and all three dimensions of burnout.

We hypothesize that exhaustion will have a higher magnitude association with both stress and sleep as compared with cynicism and inefficacy. Exhaustion is considered the central quality of burnout [14], and many studies on graduate student burnout have only assessed this singular dimension [18,19,23]. However, the potential for stress and sleep to correlate with feelings of cynicism and inefficacy in the graduate school environment should not be overlooked.

Method

Data Collection and Procedures

The sample was drawn from individuals who were currently enrolled in a graduate degree program at one of two participating public universities in the Mid-Atlantic U.S. Graduate students considered advanced special students or those enrolled in graduate certificate or online programs were not eligible for participation. The total sampling frame at both institutions was 56% female and 41% white, with 48% of students enrolled in master's programs and 47% enrolled in doctoral programs. Approval for the study was obtained by the Institutional Review Boards at both participating universities.

In September 2017, graduate students were contacted to participate in the study using a recruitment email that described the purpose of the study and included a link to participate in the web-based survey. Prior to beginning the survey, participants read through the informed consent information and indicated that they voluntarily agreed to participate. The survey consisted of an eligibility screener and 64 survey questions. Data collection was open for one month, and three reminder emails were sent during the data collection period, for a total of four emails sent to participants in the sampling frame. As an incentive, participants chose to enter themselves into a raffle where 350 participants each received a $10 Amazon gift card.

There was an overall sample size of 2,683 graduate students, representing a response rate of 23%. This response rate is similar but lower than other studies of graduate student populations, which yielded response rates of 25% [28] and 34% [6]. Compared with the sampling frame, the study sample had higher proportions of female, non-Hispanic white, and doctoral graduate students.

Measures

Demographic characteristics.—Standard questions were used to collect data on age, sex, race/ethnicity, international student status, employment status, marital status, combined annual household income, and number of children currently living at home.

Program characteristics.—Participants indicated if they were seeking a master's degree, academic doctoral degree (e.g., Ph.D.), or a professional doctoral degree (e.g., M.D., J.D.), how many semesters they had been enrolled in their current graduate degree program, and how many total years it would take for them to complete their degree. Based on their university's definition of student status, participants reported whether or not they were currently enrolled in their program full- or part-time. Using the academic areas defined by Biglan [29], participants' academic disciplines were recoded into one of four categories: 1) natural-pure (agriculture and natural resources and computer, mathematical, and natural sciences); 2) natural-applied (engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy); 3) social-pure (behavioral and social sciences and arts and humanities); and 4) social-applied (business, education, law, architecture, public health, public policy, information studies, journalism, and social work).

Stress.—The Perceived Stress Scale (PSS-10; [5]) was administered, which consists of 10 items rated on a 5-point Likert-type scale, ranging from never (0) to very often (4). Example items include "In the last 30 days, how often have you found that you could not cope with all the things that you had to do?" and "In the last 30 days, how often have you felt confident about your ability to handle your personal problems?". Possible scores range from 0 to 40, with higher scores indicating higher levels of stress. Cronbach's alpha internal consistency of the PSS-10 has ranged from 0.78 to 0.91 among national adult samples [30]. In the current study, the Cronbach's alpha for the PSS-10 scale was 0.87, indicating good internal reliability.

Burnout.—Burnout was measured using three subscale scores of the Maslach Burnout Inventory-Student Survey (MBI-SS; [16,17]). The MBI-SS consists of 15 items that are grouped into three scales: exhaustion (five items), cynicism (four items), and inefficacy (six items). For example, "I feel emotionally drained by my studies" measures exhaustion; "I have become less enthusiastic about my studies" measures cynicism; and "In my opinion, I am not a good student" measures inefficacy. Each item was scored on a 7-point scale ranging from never (0) to always (6), with higher scores indicating higher levels of burnout. Prior studies have used the MBI-SS in both undergraduate and graduate student samples [16,31-33]. Cronbach's alpha values for the internal consistencies of the MBI-SS subscales have ranged from 0.62 to 0.84 in other student samples [17]. In the current study,

Cronbach's alpha values were 0.89, 0.89, and 0.83 for the exhaustion, cynicism, and inefficacy subscales, respectively.

Sleep Duration and Sleep Quality.—Sleep was measured using two questions from the Pittsburgh Sleep Quality Index (PSQI; [34]). Sleep duration was assessed by asking participants how many hours of sleep they got per night on average during the past month and was analyzed as a continuous variable. Sleep quality was assessed by asking participants how they would rate their sleep quality during the past month, with response options of very poor, fairly poor, fairly good, or very good. Sleep quality was dichotomized into *poor* (fairly poor/very poor) and *good* (fairly good/very good) categories.

Statistical Analyses

Twenty-eight percent of the sample had missing data on at least one variable of interest, and analyses of complete and non-complete cases revealed that the data were not missing completely at random [35]. Missing data were handled using multiple imputation of five complete datasets, and statistics were obtained by averaging the results across all imputed datasets [36,37].

Frequencies, means, and standard deviations were computed for stress, exhaustion, cynicism, and inefficacy scores as well as sleep duration and sleep quality. A point-biserial correlation assessed the correlation between sleep duration and sleep quality. Multivariate linear regression models were used to analyze the associations between stress, sleep duration, and sleep quality with exhaustion, cynicism, and inefficacy. Additional linear regression models were run on the associations between stress and all three dimensions of burnout that included interaction terms between stress and both sleep duration and sleep quality. All analyses controlled for demographic (i.e., age, sex, race/ethnicity, international student status, employment status, marital status, income, and children) and program characteristics (i.e., degree type, time enrolled, academic discipline, full-time student status, and anticipated program length) in order to adjust for potential variation in study variables attributed to these characteristics.

SPSS Version 25.0 was used for all analyses with an alpha level set at 0.05.

Results

Sample Characteristics

The majority of the sample was female (63%) and non-Hispanic white (59%), with a mean age of 28 years old (SD=5.8; data not shown in table). About half the sample were enrolled in master's degree programs (44%), 39% were enrolled in academic doctoral degree programs, and 17% were enrolled in professional doctoral degree programs. Students in degree programs in the social-applied disciplines comprised the largest proportion of the sample (41%), followed by the natural-applied (27%), social-pure (17%), and natural-pure (15%) disciplines [29]. Eighty-five percent of students were enrolled full-time, and the majority (73%) had been enrolled in their program for two years or less. More information on the study sample can be found elsewhere [38].

Stress and Burnout

Mean values for stress and burnout are presented in Table 1. With a possible range of 0 to 40, the sample had a mean value of 18.9 (SD=6.9) on the Perceived Stress Scale. Students had higher levels of exhaustion as compared with cynicism or inefficacy, with mean scores of 2.7 (SD=1.4), 1.9 (SD=1.4), and 1.6 (SD=1.0), respectively, on the three dimensions. Results of linear regression models (see Table 2) showed that higher levels of stress were associated with higher levels of exhaustion (β=0.11), cynicism (β=0.10), and inefficacy (β=0.08).

Moderation by Sleep

Students slept an average of 6.4 hours (SD=1.0) per night, with 51% getting less than the recommended 7 hours of sleep on average per night [39]. With regards to sleep quality, 38% rated their sleep as fairly poor or very poor and 62% rated their sleep as fairly good or very good. Sleep duration and sleep quality were moderately, positively correlated (r=0.44, p<0.001). As seen in Table 1, students with good sleep quality had lower mean levels of stress and burnout and slept about one hour more per night than students with poor sleep quality. Sleep duration was negatively associated with exhaustion (β=−0.11; see Table 2), positively associated with cynicism (β=0.08), and not significantly associated with inefficacy. As compared with students with good sleep quality, students with poor sleep quality had significantly higher levels of all three dimensions of burnout.

While sleep did not moderate the associations between stress and cynicism or stress and inefficacy, sleep duration and sleep quality both significantly moderated the relationship between stress and the exhaustion dimension of burnout. The association between stress and exhaustion lessened as sleep duration increased, and the association between stress and exhaustion was weaker among students with good sleep quality when compared with those with poor sleep quality. These significant moderations are illustrated in Figures 1 and 2. Although measured continuously, sleep duration was separated into “less than 7 hours” and “7+ hours” for visual representation purposes in Figure 1, given that 7 to 9 hours of sleep per night is the recommended amount for adults [39].

Discussion

The current study examined the relationship between stress and burnout among graduate students, with emphasis on whether or not sleep duration and sleep quality moderated this relationship. This sample of graduate students reported higher stress levels than the general adult population, with a mean score on the Perceived Stress Scale (PSS-10) of 19. In comparison, a national sample of U.S. adults reported a mean PSS-10 score of 16 [30], which is consistent with prior research on the increased risk for mental health problems among graduate students as compared with the general population [4]. With exhaustion, cynicism, and inefficacy mean scores of 2.7, 1.9, and 1.6, respectively, this sample appeared to have comparable levels of exhaustion and higher levels of cynicism and inefficacy than have been found among general adult employees. Using an international sample, Schaufeli & Salanova [17] found exhaustion, cynicism, and inefficacy mean scores of 2.7, 1.4, and 1.0 among employed adults. These results provide further evidence as to the importance of

studying the graduate student population, with high prevalence of emotional and stress-related problems among graduate students [6]. While variation in academic discipline and differing operationalization techniques make comparison between graduate student samples difficult, the current sample appeared to have lower levels of burnout than were found among other samples of graduate and professional students [18,19,23].

Despite differences in stress and burnout levels between the current and prior graduate student samples, study findings provide additional evidence that increased stress is associated with increased burnout among graduate students [40]. Stress had the strongest association with the exhaustion dimension of burnout, followed by cynicism and inefficacy. This finding is in line with exhaustion being considered the central quality and most obvious manifestation of burnout, and Maslach and colleagues [14] have even termed exhaustion to be the “stress dimension of burnout”.

Given the relationship between burnout and thoughts of leaving school [41] and program dropout [42] suggested by previous studies of graduate and professional students, it is imperative that research efforts continue to examine potential factors that might help to reduce stress-related burnout. There is evidence that burnout among graduate students is reversible [20], and sleep was hypothesized as a potential buffer for the association between stress and burnout in the current study. Graduate students in this sample slept an average of 6.4 hours per night, which is similar to studies of healthcare professional [8], psychology [24], and medical students [43]. As a comparison, the typical U.S. adult sleeps an average of 7.2 hours per night [44].

Direct associations between sleep and burnout were found in this sample, with poor sleep quality associated with increased levels of exhaustion, cynicism, and inefficacy. However, sleep duration had a less consistent relationship with burnout. While sleep duration was negatively associated with exhaustion, we found a positive relationship between sleep duration and cynicism and no relationship between sleep duration and inefficacy. It follows that sleep duration and exhaustion would be significantly correlated, as items assessing the exhaustion dimension of burnout could be directly related to sleep (e.g., “I feel tired when I get up in the morning and have to face another day at the university”). However, it should be noted that exhaustion, as it is measured by the MBI-SS, does not directly equate to daytime fatigue, which was not assessed in the current study. There appears to be a complex relationship between cynicism and sleep, as cynicism was positively associated with sleep duration but negatively associated with good sleep quality. Items assessing the cynicism dimension of burnout captured how graduate students felt about the usefulness and significance of their studies, as well as their own interest and enthusiasm regarding their graduate school work. Students with increased cynicism might be sleeping for more hours per night due to less effort and time spent on their schoolwork as they become less interested in the material. However, students with higher levels of cynicism might experience decreased sleep quality due to anxiety surrounding whether or not they should continue in a program of study that they no longer find rewarding or significant.

Better sleep duration and quality were found to lessen the relationship between stress and the exhaustion dimension of burnout, suggesting that sleep is a modifiable behavior with

potential to assist graduate students in lessening negative outcomes associated with the often unavoidable stress of graduate education. However, results should be interpreted with caution given the small effect sizes found. Sleep quality might be more important than sleep duration when it comes to decreasing levels of burnout, as sleep quality had a stronger and more consistent direct relationship with burnout than sleep duration. This notion is consistent with prior work that has found that sleep quality, but not sleep duration or quantity, is associated with the body's biological response to stress [45]. It is recommended that adults get between 7 and 9 hours of sleep per night [39], which might not be a realistic goal for graduate students balancing academic, professional, and familial responsibilities. Focusing more on high quality sleep might be a more attainable goal, especially because more than half of our sample slept less than 7 hours per night.

The main implication of this study is the need for additional research to guide intervention and prevention efforts aimed at decreasing stress and related outcomes among graduate students. Burnout might be self-perpetuating if graduate students lack adequate coping skills to deal with the inevitable stresses of a graduate program [46]. Our results suggest that sleep might help to lessen outcomes associated with stress, and future research should explore specific sleep behaviors that are realistic and useful for graduate students. Behaviors focused on increasing sleep quality are of particular interest [47], including the effectiveness of strategies such as reducing time to fall asleep, sticking to a sleep schedule, creating an optimal sleep environment, and using mindfulness and relaxation techniques.

Additional knowledge is also needed on factors that might moderate the association between stress and both cynicism and inefficacy, as sleep was not a significant moderator of these relationships in the current study. Social support might be more influential when it comes to decreasing cynicism and inefficacy, which are dimensions of burnout closely related to attitude and sense of accomplishment. A recent meta-analysis by Kim et al. [48] examined the relationship between social support and student burnout and concluded that social support has stronger ties to cynicism and inefficacy than to exhaustion. The advisor relationship is of particular importance, and research has shown that a positive relationship with a faculty advisor is associated with improved mental health [6], decreased stress [49], and less emotional exhaustion [19] among graduate students. Future research should expand on these findings and the findings of the current study to create a more complete list of factors that show evidence of lessening the relationship between stress and graduate student burnout, providing a sound basis for the development of comprehensive programs targeting the reduction of exhaustion, cynicism, and inefficacy.

This study is limited by its cross-sectional design, and future research should examine the bidirectional and longitudinal relationships between stress, sleep, and burnout among graduate students. It has been suggested that burnout is a dynamic process that begins with stress caused by the daily difficulty of everyday life [46]. Stress causes emotional strain and exhaustion, gradually leading to changes in a person's attitudes towards their situation. Graduate students might be confronted with the rigor and stress of graduate school early on in their program, begin to feel emotional strain and exhaustion, and then experience cynicism and inefficacy about their role as a graduate student as a result of continued strain. Longitudinal studies that follow graduate students throughout their program would shed

light on this potential shift through the dimensions of burnout, and this work would help identify the opportune time to intervene with graduate students to lessen exhaustion and prevent attitudinal shifts that might lead to program dropout.

Additional limitations of the current study should also be noted. Participants were sampled from only two universities, limiting generalizability to other samples of graduate students. While our response rate was comparable with other studies of graduate student populations [6,28], there is the potential for differences between responders and non-responders in regards to demographic characteristics, graduate program characteristics, and variables of interest. Validated instruments were used to collect data on stress and burnout, but self-report data is subject to social desirability and other biases. Additional factors influencing stress, sleep, and burnout among graduate students (e.g., personality, emotional regulation, physical health) were not assessed and therefore not controlled for in this study. By only using two single items to measure sleep, the current study did not provide a comprehensive assessment of sleep and might not have fully captured sleep behavior among this graduate student sample. Measuring sleep duration does not account for individual variation in sleep needed, and the National Sleep Foundation recognizes that many adults sleep on the low or high end of recommended sleep duration ranges with no adverse effects [39]. Future research should utilize more detailed sleep measures, including those that capture daytime sleepiness, sleep latency, sleep disturbances, and meeting criteria for a sleep-wake disorder. An important area of future research would also be to include objective measures of sleep in graduate student studies, such as polysomnography, actigraphy, or behavioral response monitoring [50].

Limitations notwithstanding, this study adds to the increasing literature on graduate student health and well-being. This study used a large, diverse sample of graduate students, as the majority of research in the area of graduate student burnout has utilized graduate student samples from singular academic degree programs or disciplines, particularly medical students [20-22,26,27]. Our inclusion of a wide range of graduate students allowed us to control for potential variation in stress, sleep, and burnout that might be attributed to program characteristics, such as academic discipline or program year. Prior research has suggested the presence of such variation, with increased mental health needs among graduate students in humanities programs [6,28], more sleep difficulties among graduate students in clinical programs [10], higher inefficacy during the first year of a program [26], and higher cynicism among graduate students in the later stages of their program [26].

Study findings showed a clear relationship between stress and feelings of exhaustion, cynicism, and inefficacy. Modifiable health behaviors, including improved sleep duration and quality, have the potential to lessen the relationship between stress and burnout during graduate school and should be the focus of continued research on graduate student functioning and success.

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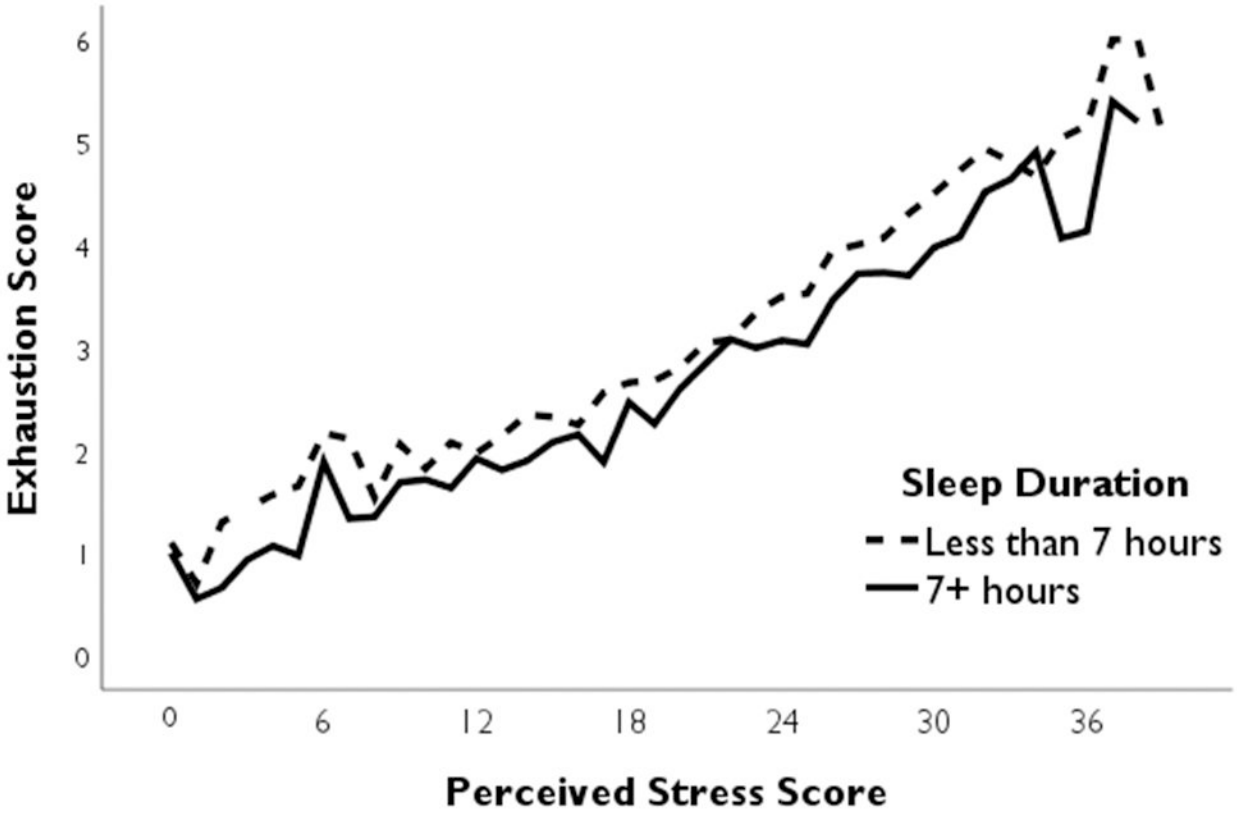

Figure 1. The relationship between stress and exhaustion: Moderation by sleep duration

Note. This figure represents a significant (p<0.001) moderation of the relationship between stress and exhaustion by sleep duration, such that the association between stress and exhaustion lessened as sleep duration increased. Perceived stress scores range from 0 to 40 and exhaustion scores range from 0 to 6. Breaks in the graph are present at stress and exhaustion scores that did not exist in the data. Although measured continuously, sleep duration was separated into "less than 7 hours" and "7+ hours" for visual representation purposes.

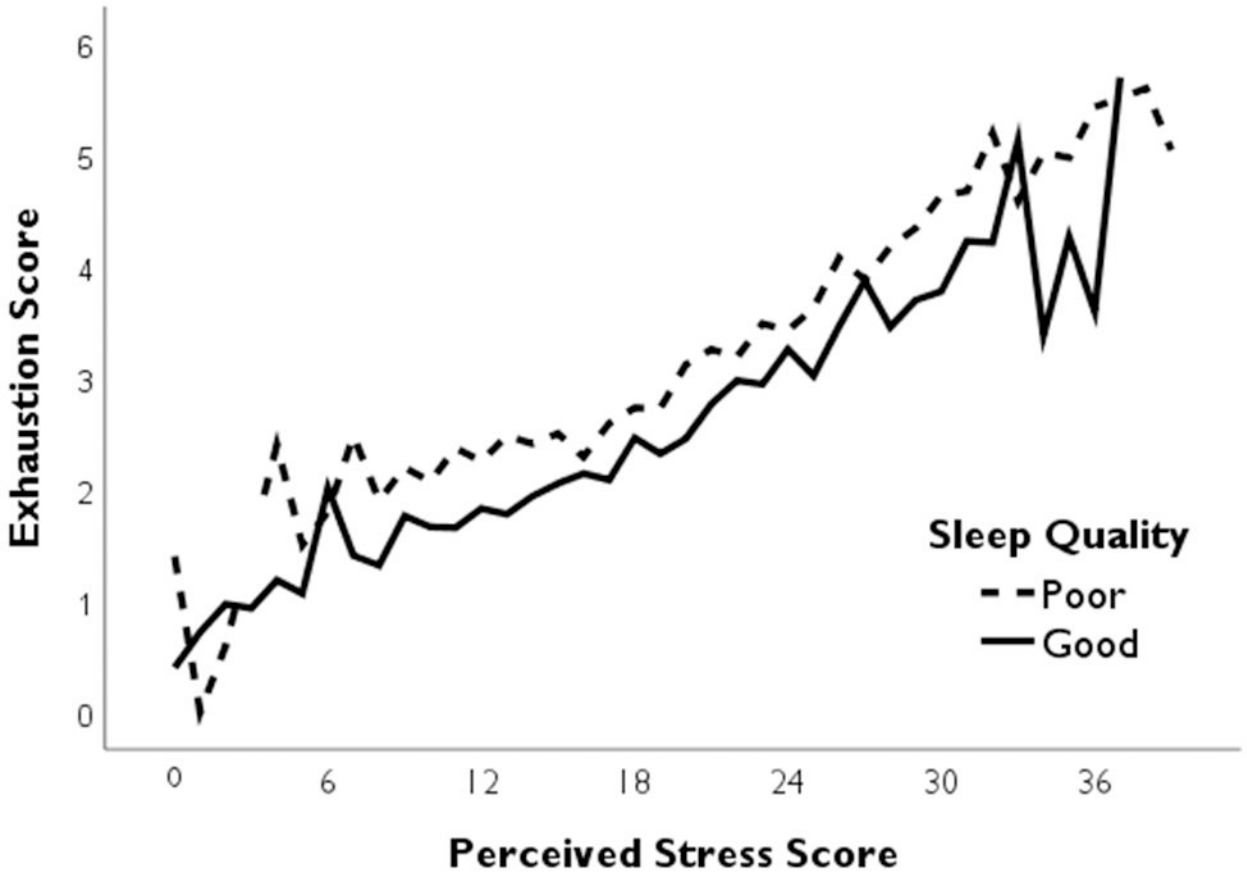

Figure 2. The relationship between stress and exhaustion: Moderation by sleep quality

Note. This figure represents a significant (p<0.001) moderation of the relationship between stress and exhaustion by sleep quality, such that the association between stress and exhaustion was weaker among students with good sleep quality when compared with those with poor sleep quality. Perceived stress scores range from 0 to 40 and exhaustion scores range from 0 to 6. Breaks in the graph are present at stress and exhaustion scores that did not exist in the data. Participants who had “fairly poor” or “very poor” sleep quality were classified as having poor sleep quality. Participants who had “fairly good” or “very good” sleep quality were classified as having good sleep quality.

Table 1.

Stress, burnout, and sleep among graduate students (*n*=2,683)

	Total Sample *n*=2,683	Sleep Quality	
		Fairly Poor/Very Poor *n*=1,027 (38.3%)	*Fairly Good/Very Good* *n*=1,656 (61.7%)
	Mean ± SD	Mean ± SD	Mean ± SD
Perceived Stress Scale Score (0-40)	18.9 ± 6.9	21.4 ± 6.7	17.3 ± 6.5
Burnout—Exhaustion Score (0-6)	2.7 ± 1.4	3.3 ± 1.4	2.4 ± 1.2
Burnout—Cynicism Score (0-6)	1.9 ± 1.4	2.2 ± 1.5	1.7 ± 1.4
Burnout—Inefficacy Score (0-6)	1.6 ± 1.0	1.8 ± 1.1	1.4 ± 0.9
Sleep Duration (Hours)	6.4 ± 1.0	5.9 ± 1.0	6.8 ± 0.9

Note. Higher values indicate higher levels of stress, exhaustion, cynicism, and inefficacy.

Table 2.

Main associations between stress, sleep, and burnout (n=2,683)

	Burnout		
	Exhaustion	**Cynicism**	**Inefficacy**
	β (95% CI)	**β (95% CI)**	**β (95% CI)**
Perceived Stress Scale Score	0.106 (0.100, 0.112) *	0.097 (0.090, 0.104) *	0.079 (0.074, 0.084) *
Sleep Duration	−0.108 (−0.152, −0.064) *	0.082 (0.031, 0.133) *	0.016 (−0.021, 0.053)
Sleep Quality			
Fairly Poor/Very Poor	0.364 (0.273, 0.454) *	0.184 (0.078, 0.290) *	0.089 (0.015, 0.164) *
Fairly Good/Very Good	Reference	Reference	Reference

* $p < 0.05$

Note. Adjusted estimates control for all other predictor variables, as well as demographic (age, sex, race/ethnicity, international student status, employment status, marital status, income, and children) and program characteristics (degree type, time enrolled, academic discipline, full-time student status, and anticipated program length).