

ABSTRACT

Title of Dissertation: GRADUATE SCHOOL BURNOUT AND ATTRITION:
EXAMINING ASSOCIATIONS WITH SUBSTANCE
USE, MENTAL HEALTH PROBLEMS, AND
ACADEMIC SUPPORT

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There is a well-established connection between health and academic achievement among high school and undergraduate students. Despite the high prevalence of substance use and mental health problems during young adulthood, few studies have examined these relationships among graduate students. Two distinct but interrelated studies were conducted to examine substance use and mental health problems as potential contributors to graduate student burnout and attrition, both individually and in conjunction with academic support factors including advisor satisfaction, departmental support, and program climate. The selection of these variables was determined by an overarching socio-ecological framework, whereby academic success is driven by multiple spheres of influence. The first study utilized secondary data to understand the associations between patterns in alcohol consumption, marijuana use, and mental health during the undergraduate college years and graduate degree completion. The lack of association found between behavioral health during college and graduate degree completion might be due to a decrease in mental health and substance use problems during the post-college years, as well as a possible selection effect where those with mental health and substance use problems are less likely to enroll in graduate school.

The second study involved primary data collection to examine the correlates of substance use, mental health problems, and academic support among a sample of graduate students, as well as evaluate the associations between these variables and three dimensions of burnout (exhaustion, cynicism, and inefficacy). Findings showed graduate student subgroups that might be at increased risk for behavioral health problems, particularly professional doctoral students and students enrolled in programs in the humanities and social sciences. High-risk alcohol use, stress, and depression symptoms were all associated with increased levels of burnout, but high levels of departmental and advisor support appeared to buffer this effect.

This research is a first step in extending knowledge on the relationship between potentially modifiable health-related risk factors and graduate student burnout and attrition. This line of research has implications for graduate students, faculty, and administrators who are committed to improving student success and well-being.

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Dedication

This dissertation is dedicated to my niece, Annaliese.
You'll always be my little buddy.

Acknowledgements

To my advisor, mentor, and chair Dr. Amelia Arria, thank you for your continuing guidance over the past four years. Your unwavering support has helped me grow into a better student, researcher, and professional, and I am forever grateful for your academic and personal guidance. Working with you has given me the confidence to begin my independent career, and I will take your advice with me as I move forward.

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To all graduate students- find your support system, discover healthy ways to cope, and know that you can reach the goal you've set out to achieve.

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Chapter 1: Introduction

Background of the Problem

Each year, about three million students are enrolled in graduate programs in the United States (McFarland et al., 2017), with 71% enrolled in master's programs, 13% enrolled in professional programs, and 6% enrolled in doctoral programs (Baum & Steele, 2017). Not only is a graduate degree program a demanding undertaking for the student, but it is also a large investment of time, resources, and money for graduate institutions. Graduate degree programs are the gateway to critically important positions in our society, such as researchers, teachers, health professionals, lawyers, and a wealth of technical workers (Lovitts, 2001). An increasing number of young adults are enrolling in graduate school, and of students who completed a bachelor's degree in 2007-2008, 39% went on to enroll in a graduate degree program within four years of college graduation (Baum & Steele, 2017). However, graduate school completion is suboptimal, with completion estimates ranging from 50% to 75% of those who enter a graduate degree program, with differences by degree type and academic discipline (Ali & Kohun, 2006; Baum & Steele, 2017; Lovitts & Nelson, 2000).

There are many reasons why a graduate student might not complete graduate school, such as financial strain, family obligations, or program-level characteristics such as program design or climate (Ali & Kohun, 2006). Prior research has shown that certain populations are at comparatively higher risk for not completing a graduate degree than others. Burnout and attrition are highest among women (Baum & Steele, 2017; Dahlin et al., 2007), African-American/black students (Lovitts & Nelson, 2000), domestic students (Most, 2008), students enrolled in programs in the humanities (Lovitts & Nelson, 2000),

and students enrolled in master's degree programs (Baum & Steele, 2017). One limitation of current research on graduate student attrition has been the utilization of samples from singular academic disciplines or programs. Demographic and program-level factors have been the predominant focus of research on graduate school success, and health status and health risk behaviors have not been included. This imbalance in the literature most likely results from a lack of public health-oriented researchers who explore educational achievement as an outcome variable as opposed to a predictor of health status. However, in recent years our understanding of the contribution of substance use and mental health problems to educational difficulties in high school and college students has grown. The current research extends this literature by examining the relationship between behavioral health and the achievement of graduate students.

The graduate student population is very heterogeneous. According to the Council of Graduate Schools (Okahana & Zhou, 2017), more than half of graduate school enrollees in Fall 2016 were women and about 50% of students were non-Hispanic white. About 20% of graduate students in 2016 were international students, and 58% were attending full-time. Nearly 75% of graduate students were enrolled in master's programs and 26% were enrolled in doctoral programs, with the most common academic disciplines as education, business, and health sciences. Enrollment in graduate school typically occurs during young adulthood, with about half of students 29 years of age or younger, 28% 30 to 39 years old, and 22% 40 years old and older (Bell, 2009). Importantly, the timing of graduate school enrollment coincides with peak developmental periods for the onset of substance use disorders and mental health problems.

Alcohol consumption and marijuana use are the most frequently used substances among young adults (Center for Behavioral Health Statistics and Quality, 2017a). A longitudinal study by Fergusson et al. (2015) observed that marijuana use estimates were highest during the mid-20s as compared to other ages, and the onset of lifetime dependence peaks at age 23 for alcohol and age 20 for marijuana (Haberstick et al., 2014). Nonmedical use of prescription drugs, including stimulants, analgesics, tranquilizers, and sedatives, defined as the intentional use of a medication without a prescription or use in a way other than as prescribed, has received renewed attention in the past two decades (Arria & Compton, 2017). Being more educated is a risk factor for some forms of substance use throughout the life course. According to the 2016 National Survey on Drug Use and Health, lifetime illicit drug use is higher among adults aged 18 and older who are college graduates (52.8%) when compared to high school graduates (46.5%) and those who did not graduate high school (34.5%) (Center for Behavioral Health Statistics and Quality, 2017a).

Anxiety and depression are among the most common types of mental health disorders and typically have their onset during young adulthood, including panic disorder, generalized anxiety disorder, and major depression (Kessler et al., 2005). While prior research has shown no difference in the prevalence of anxiety or depression among college students and their non-college attending peers (Blanco et al., 2008), a recent study by Bracke et al. (2013) challenged the assumption that the higher the level of educational attainment, the better an individual's mental health status. Findings from this study revealed that individuals who have acquired a level of education that exceeds the level of education required for their job report increased depression symptoms. These cross-

sectional findings highlight a need to conduct research among highly educated samples as well as examine mental health at all stages, from symptoms to disorder.

Different subpopulations of graduate students might be at increased risk for substance use, mental health problems, and levels of academic support. In the general population, being male and being non-Hispanic white are associated with substance abuse and dependence (Anthony et al., 1994; Farmer et al., 2015; Haberstick et al., 2014), and being non-Hispanic white and female are risk factors for anxiety and mood disorders (Kessler et al., 2005). Very few research studies have examined the program-level correlates of substance use and mental health problems among graduate students, but limited information suggests that individuals in a particular academic discipline might be at increased risk for certain types of substance use and related problems. For example, business students consume more alcohol than both social work and medical students (Dahlin et al., 2011; Waring et al., 1984), and the prevalence of marijuana use and binge drinking differs across health specialties (Trinkoff & Storr, 1998). Doctoral students, as compared to master's students, experience higher levels of academic support (Hardré & Hackett, 2015), and these differences need to be considered when assessing the role academic support might play in the relationship between mental health, substance use, and graduate student success.

Theoretical Framework

Several theories have been used to explain the factors that contribute to student retention, with the majority of studies focusing on students at the undergraduate level. Aljohani (2016) comprehensively reviewed the most influential theoretical models of student retention during the last several decades, including the Undergraduate Dropout

Process Model (Spady, 1970, 1971), which was the first theoretical model of student retention available in the empirical literature. The main assumption of this model is that a student's decision to drop out of a degree program is influenced by their integration into both the academic and social systems of their institution. These two systems include factors related to the interaction between the individual student's attributes (e.g., skills and attitudes) and the environmental demands of the institution itself (e.g., courses and peers) (Aljohani, 2016). The Institutional Departure Model (Tinto, 1975, 1993) expanded the notion that multiple levels of influence exist and posited that student success relies upon academic achievement, such as receiving good grades, as well as social achievement, such as having positive interactions with faculty and staff. A student's initial commitment to a degree program is shaped by their pre-entry attributes, and these commitments change throughout the degree program based on external factors (e.g., family or job demands) as well as academic and social integration into the institutional environment (Aljohani, 2016).

In 1980, John Bean developed the Student Attrition Model (Bean, 1980, 1982) to include students' reasons behind withdrawal from a degree program. Bean's model posited three domains of variables that determined dropout: background variables, organizational determinants, and intervening variables (e.g., satisfaction and institutional commitment) (Bean, 1980). In a later revision, he emphasized intent as the main predictor of dropout and added environmental and attitudinal domains to the model alongside background and organizational determinants (Aljohani, 2016; Bean, 1982). Around the same time, Pascarella (1980) developed the Student-Faculty Informal Contact Model to highlight the importance of interactions between students and faculty on student

persistence. Similar to previous models of student retention, Pascarella's model included student background characteristics and institutional factors, both of which predict educational outcomes and ultimately the decision to persist or withdraw from school (Aljohani, 2016).

Despite the comprehensive picture these models paint of student retention and dropout, the differences between the graduate student population and other academic populations such as high school and college students call for revised or new models to explain academic achievement or attrition among graduate students. Graduate students are typically older, more familiar with higher education and their current discipline, might have work experience, and are often juggling additional adult and family responsibilities (Baird, 1993). Because non-traditional undergraduate students often share qualities with graduate students, such as having additional responsibilities, the Non-Traditional Undergraduate Student Attrition Model (Bean & Metzner, 1985) is useful because it includes some of the differences between undergraduate and graduate students that might influence retention (Aljohani, 2016). The most notable contribution of this model was the addition of stress as a psychological variable that was predicted by background, academic, and environmental variables. In this model, stress influences college dropout both directly and indirectly through intent to leave a degree program (Bean & Metzner, 1985). Girves & Wemmerus (1988) theorized that factors unique to the graduate student experience, such as the student-advisor relationship and financial support, would influence progress and persistence. Girves' model includes the influence of department characteristics, student characteristics, financial support, and student perceptions of their relationship with faculty on grades, program involvement,

satisfaction with department, and alienation, all of which directly influence academic progress.

These conceptual models describe a wealth of factors contributing to student dropout, but surprisingly all exclude health-related variables such as substance use and mental health problems. With the exception of stress in the Non-Traditional Undergraduate Student Attrition Model (Bean & Metzner, 1985), only one other conceptual framework was found that highlighted the relationship between mental health and student burnout. In the Graduate Student Stress Model, Offstein et al. (2004) describe the following as contributors to the stress experienced by graduate students: (1) rigorous graduate school requirements, standards, and expectations, (2) personality disposition of typical graduate students, (3) limited time (perceived or actual), (4) competing internal and external demands, (5) internal conflict, (6) life stage, and (7) international study. Offstein's model posits that these factors cause stress among graduate students, and these elevated levels of stress then cause negative consequences for graduate students, including mental and physical exhaustion, burnout, indecisiveness, and failure.

While Offstein's model begins to address the role of mental health on the graduate student experience, this model oversimplifies the concept of stress. This model does not address the connection between stress and mental health in that substance use and/or mental health problems can exacerbate stress levels or enhance graduate students' perception of adversity associated with life events. According to the Diathesis-Stress Model (Monroe & Simons, 1991), an individual's predisposition to mental health problems interacts with stress from their outside environment to produce mental health disorders. Each graduate student's vulnerability to disorder differs, and this

predisposition and their ability to cope with the stress of a graduate degree program combine to influence whether they will develop mental health problems. This research aimed to examine the individual and additive roles of stress, mental health problems, and substance use on graduate student outcomes.

Figure 1 below combines the conceptual models explaining dropout created by Spady, Tinto, Bean, Pascarella, Girves, and Offstein. The factors influencing dropout in each of these models were synthesized and organized into the levels of the socio-ecological model (Centers for Disease Control and Prevention, 2015)- institutional, social relationship, and individual factors- to create an overall picture of possible determinants of graduate student success. Health factors figure prominently in the model, as they are the focus of the current research.

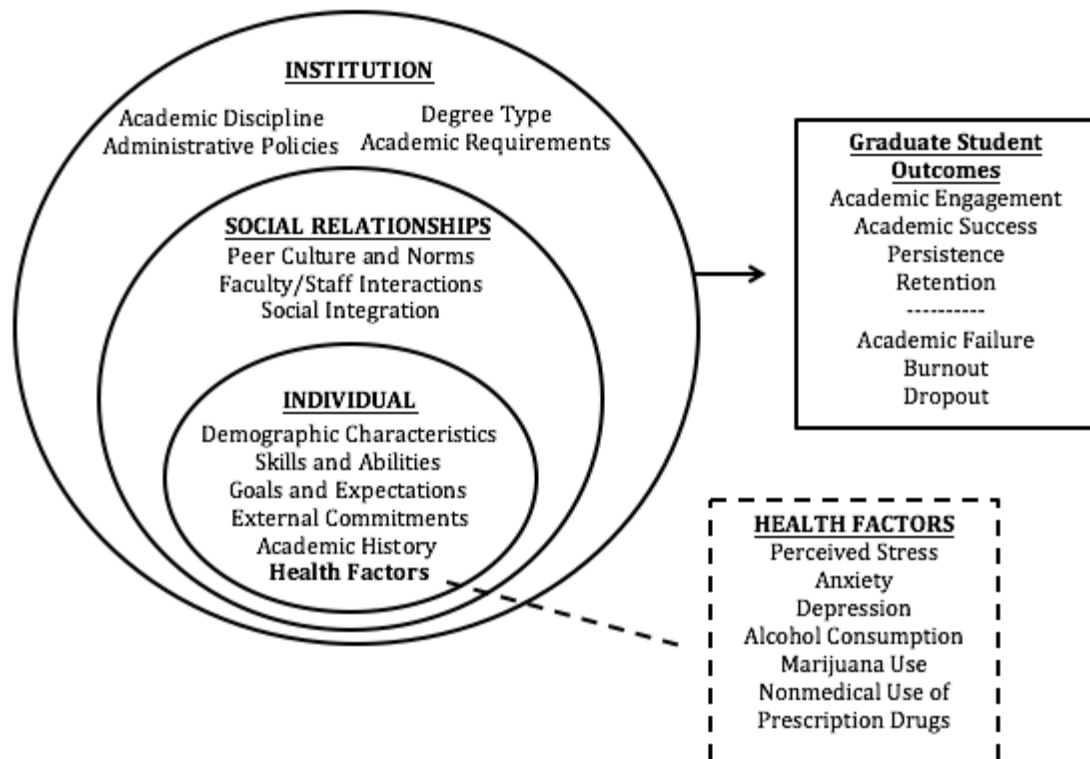


Figure 1.1 Multidimensional conceptual model of factors influencing academic engagement and retention among graduate students

At the individual level, demographic characteristics and student background characteristics such as age, gender, race and ethnicity, socioeconomic status, and marital status (Bean & Metzner, 1985; Girves & Wemmerus, 1988) are important to consider. Having goals and expectations that are compatible with obtaining a graduate degree influence the likelihood of completion, as theorized by Spady (1970), Bean (1985), and Pascarella (1980). A student might be more likely to graduate if they have a desire for the degree and understand what is expected of them to obtain that goal. A student must also have the skills and abilities necessary to obtain a degree (Pascarella, 1980; Tinto, 1993), which Spady (1970) referred to as academic potential. This potential, coupled with educational outcomes (i.e., academic performance) during school, directly influences a student's decision to drop out of or stay in school as well as meet degree requirements (Bean & Metzner, 1985; Girves & Wemmerus, 1988; Pascarella, 1980; Spady, 1970; Tinto, 1993). Particularly for graduate students, external commitments, such as family and work obligations, must be considered as either potential risk or protective factors for degree obtainment depending on the level of support offered by these external people and circumstances (Bean & Metzner, 1985; Offstein et al., 2004; Tinto, 1993). For example, a full-time job might affect academic performance due to time constraints, but a supportive family could bolster the likelihood of academic success.

Several theories mentioned previously describe the importance of peer culture and social interactions (Pascarella, 1980; Spady, 1970), as social integration into the program and institutional environment influence a student's commitment to degree obtainment (Bean & Metzner, 1985; Spady, 1970; Tinto, 1993). Similarly, faculty/staff interactions impact both academic and social integration into the higher education environment

(Bean, 1980; Offstein et al., 2004; Pascarella, 1980; Tinto, 1993), and these relationships can increase academic performance and overall student satisfaction as well as act as a coping mechanism when facing the stress of a degree program. On the institutional level, factors such as academic discipline, degree type, academic requirements, and policies related to curriculum, time to degree, and faculty advising potentially impact student success (Bean, 1980; Girves & Wemmerus, 1988; Pascarella, 1980). Type of degree and academic discipline might influence academic rigor as well as faculty commitment to teaching and advising, and more rigorous academic requirements might act as a barrier to degree obtainment.

Health-related factors are included as an individual-level construct that is potentially affected by all preceding levels of influence. Using an ecological approach to identifying risk factors for the development and severity of substance use and mental health problems, the Substance Abuse and Mental Health Services Administration identified individual-level factors (e.g., employment, income, and personality), relationship-level factors (e.g., peer interaction and social connectivity), and community-level factors (e.g., school/work environment and community involvement) (Behavioral Health Indicators Workgroup). It is theorized that mental health and substance use affect student dropout through several mechanisms including cognitive deficits, normative behaviors, and reward perception.

The current study focuses on the association between these institutional factors, social factors, and a subset of individual factors and burnout and non-degree completion among graduate students. At the individual-level, only demographic characteristics and external commitments were examined in addition to health-related variables, given their

status as risk factors for substance use and mental health problems. The influence of skills and abilities, goals and expectations, and academic history on attrition are outside the scope of this research, as these factors pertain more to a student's academic performance (e.g., grades) as opposed to their substance use, mental health, and social relationships, which are the main variables of interest.

Purpose of the Study

To examine the influence of substance use and mental health problems on burnout and attrition among graduate students, two distinct but interrelated studies were conducted. The first study was a secondary analysis of data from a subsample of students from the College Life Study (Arria et al., 2008a; Vincent et al., 2012), a longitudinal study of the health behaviors of a cohort of young adults, some of whom went on to enroll in graduate degree programs during young adulthood. The longitudinal nature of this study allowed for an exploration of the influence of alcohol consumption, marijuana use, and mental health prior to graduate school on the degree completion of graduate students. The second study built on these findings by exploring variables which were not included in the College Life Study. Primary data was collected from students enrolled in master's, doctoral, and professional-level degree programs at two universities. The assessment measured (1) demographic characteristics, (2) program-level characteristics such as degree type and academic discipline, (3) mental health problems, (4) substance use behaviors, (5) academic support, and (6) burnout of graduate students. Both the independent and additive relationships among substance use, mental health problems, academic support, and burnout of graduate students were examined.

Public Health Implications

Existing research has shown that mental health and substance use disorders are associated with decreased likelihood of enrolling in higher education (Kessler et al., 1995), suggesting that graduate students might inherently be at low risk for substance use or mental health problems. However, lifetime prevalence of illicit drug use is higher among college graduates when compared to high school graduates (Center for Behavioral Health Statistics and Quality, 2017a), indicating that students with higher levels of education are at risk for behavioral health problems. Understanding the relationships between substance use, mental health problems, academic support, and burnout and attrition of graduate students are important for designing environments that can better promote graduate student health and support academic success. Academic institutions can be more proactive about screening graduate students for substance use and mental health problems and intervening to decrease likelihood of student dropout. Decreased attrition will contribute to a stronger and healthier professional workforce, as education has been found to be one of the strongest predictors of health. Lower levels of formal education are associated with risky health behaviors including smoking, being overweight, and low levels of physical activity, as well as an earlier age of death (Freudenberg & Ruglis, 2007). In a proposed model of the consequences of student distress among medical students, Dyrbye et al. (2005) outlined several potential consequences of student burnout, including broken relationships, substance abuse, poor self-care, and a decline in physical health.

The implications of this research move beyond a successful graduate school experience and have the potential to impact the health and functioning of graduate

students after graduation when they enter the workforce. Society depends on highly educated people to fill not only academic jobs, but jobs in positions of authority as well as jobs where they are caring for others, such as health professions (Lovitts, 2001). Mental health and substance use problems carried over from graduate school could affect employment and job stability as well as the ability to meet the job requirements that are imperative to such important positions in society.

Research Aims and Hypotheses

Study #1 (Longitudinal Analysis of Graduate Students in the College Life Study)

Aim #1: Characterize alcohol consumption and marijuana use patterns among a sample of graduate students during their undergraduate college years. Group-based trajectory modeling was used to characterize patterns across time in alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency during the first four years of college.

Aim #2: Assess the relationship between alcohol consumption and marijuana use patterns during college and the graduate degree completion of a sample of graduate students. Regression modeling was used to test the strength and direction of the relationship between the subgroups characterized in Aim #1 and graduate degree completion. Initial analyses tested direct relationships, and multivariate analyses were used to adjust for demographic characteristics, degree type, and year of enrollment.

H1: Lower levels of alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency during college are significantly associated with graduate degree completion.

Aim #3: Assess the relationship between anxiety and depression symptoms during college and the graduate degree completion of a sample of graduate students.

Regression modeling was used to test the relationship between anxiety and depression symptoms during college and graduate degree completion. Initial analyses tested direct relationships, and multivariate analyses were used to adjust for demographic characteristics, degree type, and year of enrollment.

H2: Lower levels of anxiety and depression symptoms during college are significantly associated with graduate degree completion.

Study #2 (Cross-sectional Analysis of Current Graduate Students)

Aim #4: Characterize alcohol consumption, marijuana use, nonmedical use of prescription drugs, and a selected set of substance use correlates among a sample of graduate students. Descriptive statistics were used to describe the alcohol consumption quantity, alcohol consumption frequency, marijuana use frequency, and frequency of nonmedical use of prescription drugs. Subgroup differences based on demographic and program characteristics were assessed.

H3: Younger age, being male, being unmarried, not having children, being in the earlier stages of a degree, and being enrolled in a non-professional degree

program are significantly associated with higher levels of alcohol consumption, marijuana use, and nonmedical use of prescription drugs.

Aim #5: Describe mental health problems among a sample of graduate students.

Perceived stress, anxiety symptoms, depression symptoms, and the prevalence of anxiety and depression disorders were assessed. Subgroup differences based on demographic and program characteristics were assessed.

H4: Being female, non-White, unmarried, not having children, being in the later stages of a degree, and being enrolled in a non-professional degree program are significantly associated with mental health problems.

Aim #6: Describe academic support among a sample of graduate students.

Departmental support, advisor satisfaction, and program climate were examined. Subgroup differences based on demographic and program characteristics were assessed.

Aim #7: Describe burnout among a sample of graduate students. The prevalence of three dimensions of burnout (exhaustion, cynicism, and inefficacy) were examined.

Subgroup differences based on demographic and program characteristics were assessed.

H5: Being female, non-White, unmarried, a domestic student, and enrolled in a non-professional degree program are significantly associated with burnout.

Aim #8: Examine the relationships between mental health problems, substance use, academic support, and burnout among a sample of graduate students.

Aim 8.1. Regression modeling was used to assess the direct relationships between perceived stress, anxiety symptoms, depression symptoms, and mental health disorders and academic support and burnout, as well as the multivariate relationships after adjusting for demographic and program characteristics, academic support, and all other mental health and substance use variables.

H6: Lower levels of academic support are significantly associated with higher levels of stress, anxiety, and depression.

H7: Higher levels of stress, anxiety, and depression are significantly associated with higher levels of burnout.

Aim 8.2. Regression modeling was used to assess the direct relationships between alcohol consumption, marijuana use, and nonmedical use of prescription drugs and academic support and burnout, as well as the multivariate relationships after adjusting for demographic and program characteristics, academic support, and all other mental health and substance use variables.

H8: Lower levels of academic support are significantly associated with higher levels of alcohol consumption, marijuana use, and nonmedical use of prescription drugs.

H9: Higher levels of alcohol consumption, marijuana use, and nonmedical use of prescription drugs are significantly associated with higher levels of burnout.

Aim 8.3. Regression modeling was used to assess the direct relationships between departmental support, advisor satisfaction, and burnout, as well as the multivariate

relationships after adjusting for demographic and program characteristics, mental health, substance use, and all other academic support variables.

H10: Higher levels of departmental support and advisor satisfaction are significantly associated with lower levels of burnout.

Aim 8.4. Regression modeling with interaction terms was used to assess the moderating effects of departmental support and advisor satisfaction on the relationships between substance use and burnout and mental health problems and burnout, while adjusting for demographic and program characteristics, mental health, substance use, and academic support variables.

H11: The association between substance use and burnout is weaker among graduate students with higher levels of academic support.

H12: The association between mental health problems and burnout is weaker among graduate students with higher levels of academic support.

Definition of Terms

Young adulthood. While definitions vary, people between the ages of 20 and 39 are typically considered young adults.

Graduate school. In this study, graduate school refers to educational programs at the master's, doctoral, and professional levels. Only students enrolled in degree-seeking programs were considered as enrolled in graduate school.

Burnout. For this research, burnout was characterized by three components, including exhaustion, cynicism, and inefficacy. Exhaustion is considered the draining of emotional resources, cynicism is defined as a negative attitude, and inefficacy is a tendency to feel incompetent or lacking in personal accomplishment (Schaufeli & Salanova, 2007).

Attrition. In this context, attrition, or dropout, refers to leaving an educational program before a degree has been earned.

Behavioral Health. Behavioral health is an overarching term that refers to mental health and substance use. According to the Substance Abuse and Mental Health Services Administration, behavioral health conditions include mental disorders, substance use disorders, co-occurring disorders, and co-existing disorders (Substance Abuse and Mental Health Services Administration, 2017).

Perceived Stress. While often considered to be highly subjective, the basic definition of stress is a relationship between the individual and their environment that the person appraises to exceed their resources for coping (Lazarus, 1966).

Anxiety disorders. According to the DSM-V (American Psychiatric Association, 2013), anxiety disorders encompass obsessive-compulsive disorders, anxiety

disorders, and trauma and stressor-related disorders. The current research asked participants if they have been diagnosed with any anxiety disorder, but they did not specify the type of disorder.

Depressive/mood disorders. According to the DSM-V (American Psychiatric Association, 2013), depressive disorders include such disorders as disruptive mood dysregulation disorder and major depressive disorder. The current research asked participants if they have been diagnosed with any depressive disorder, but they did not specify the type of disorder.

Academic support. While academic and professional support can encompass several different factors, this research focused on departmental support, advisor satisfaction, and program climate. Departmental support refers to a student's perception of how much they are valued and appreciated by department faculty, advisor satisfaction refers to a student's contentment with their faculty advisor, and program climate refers to a student's sense of community and/or competition among students, staff, and faculty.

Chapter 2: Literature Review

The following literature review is organized by first presenting the available information regarding the prevalence and risk factors of alcohol consumption, marijuana use, and the nonmedical use of prescription drugs among young adults and graduate students. Second, the prevalence and risk factors of anxiety and depression symptoms and disorder among young adults and graduate students are described. Lastly, the possible impact of substance use and mental health problems on academic performance, as well as the potentially moderating role of academic support, are discussed based on findings from high school, undergraduate, and graduate student samples.

Substance Use

Prevalence and Risk Factors Among Young Adults

Alcohol Consumption. Alcohol consumption is best conceptualized as a continuum starting with any use and ending with more frequent or heavy drinking patterns (operationalized as excessive drinking), as well as meeting standard diagnostic criteria (i.e., alcohol use disorder). One of the most common measures of excessive drinking is binge drinking, which is defined as drinking five or more drinks for men and four or more drinks for women on the same occasion on at least one day in the past 30 days. Binge drinking on five or more days in the past 30 days constitutes heavy drinking (Center for Behavioral Health Statistics and Quality, 2017b). Alcohol use disorder is measured using criteria from the Diagnostic and Statistical Manual of Mental Disorders and is characterized by compulsive alcohol use, loss of control over alcohol intake, and a negative emotional state when not drinking (American Psychiatric Association, 2013).

Alcohol use during young adulthood, when most students are enrolled in graduate school, is prevalent in the United States. According to data from the 2016 National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b), 57% of young adults (i.e., 18 to 25-year-olds) and 55% of adults 26 and older report past-month alcohol use. Binge drinking is also prevalent among young adults (38%) and older adults (24%). About one in ten young adults and 6% of older adults are considered heavy drinkers, and alcohol use disorder is more common among young adults (11%) than older adults (5%) (Center for Behavioral Health Statistics and Quality, 2017b). Using data from the National Longitudinal Study of Adolescent Health, Haberstick et al. (2014) estimated the lifetime prevalence of alcohol abuse and dependence at 12% and 13% among 24 to 32-year-olds, with the onset of lifetime dependence peaking at age 23. This high-risk period for the development of alcohol use disorder coincides with typical graduate student enrollment, with half of graduate students enrolling between ages 22 and 29 (Bell, 2009).

Marijuana Use. The most commonly used illicit drug among young adults is marijuana, with 21% of 18 to 25-year-olds and 7% of older adults using marijuana in the past month (Center for Behavioral Health Statistics and Quality, 2017b). A longitudinal cohort study conducted by Fergusson et al. (2015) in New Zealand examined patterns of marijuana use and dependence throughout young adulthood. Prevalence at ages 21, 25, and 30 were 47%, 44%, and 36% for any past-year marijuana use, and 16%, 12%, and 7% for at least weekly use, respectively. When compared to all other developmental periods studied, the prevalence of marijuana use was highest during the mid-20s. Based on criteria from the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition

(American Psychiatric Association, 2000), 5% of young adults and 1% of older adults meet criteria for marijuana use disorder (Center for Behavioral Health Statistics and Quality, 2017b). However, prevalence of disorder among youth and young adults who used marijuana in past 30 days is around 15% (Richter et al., 2017). Using data from the National Longitudinal Study of Adolescent Health, Haberstick et al. (2014) estimated the lifetime prevalence of marijuana abuse and dependence at 4% and 8% among 24 to 32-year-olds, with onset of lifetime dependence peaking at age 20. With the exception of tobacco and alcohol, marijuana accounts for more dependence than any other drug (Anthony et al., 1994).

Nonmedical Use of Prescription Drugs. In addition to alcohol and marijuana use, the nonmedical use of prescription drugs, particularly among college students and young adults, has received an increasing amount of attention in the research literature. Nonmedical use is defined as the intentional use of prescription drugs without a prescription, in a way other than prescribed, or for the experience or feeling it causes (National Institute on Drug Abuse, 2018). Different classes of prescription drugs are used nonmedically, including stimulants, analgesics, tranquilizers, and sedatives. It is estimated that about 5% of young adults and 2% of older adults nonmedically use prescription drugs. Among 18 to 25-year-olds, 2.2%, 1.8%, 1.5%, and 0.1% used prescription stimulants, analgesics, tranquilizers, and sedatives nonmedically in the past month, respectively. Among individuals who are 26 and older, 1.2%, 0.6%, 0.4%, and 0.2% used prescription analgesics, tranquilizers, stimulants, and sedatives in the past month, respectively (Center for Behavioral Health Statistics and Quality, 2017b).

Risk Factors. Substance use and dependence are not distributed randomly within the population. Men have a higher lifetime prevalence of alcohol and marijuana use and are more likely than women to develop alcohol and marijuana dependence (Anthony et al., 1994; Center for Behavioral Health Statistics and Quality, 2017a; Farmer et al., 2015; Haberstick et al., 2014). Younger age is also a risk factor for drug and alcohol dependence, as discussed previously. Past-year alcohol and marijuana dependence are highest among 18 to 25-year-olds when compared to all other age groups (Center for Behavioral Health Statistics and Quality, 2017a). Differences by age reflect the high-risk nature of developmental periods, namely adolescence and young adulthood, for substance use and dependence. Age-related differences might be driven by neurodevelopmental factors (Sturman & Moghaddam, 2012), as well as lower perceived risk and higher perceived availability of drugs, particularly marijuana, among youth and young adults (Center for Behavioral Health Statistics and Quality, 2017a).

Other risk domains that have been studied in relation to risk for drug and alcohol use and dependence include race/ethnicity, income level, and marital status. Non-Hispanic whites have the highest prevalence of lifetime alcohol use and, with the exception of Native Hawaiian or other Pacific Islanders, have the highest lifetime prevalence of marijuana use when compared to individuals from other racial and ethnic groups (Center for Behavioral Health Statistics and Quality, 2017a). While white and Native American individuals have a greater risk for alcohol dependence relative to other racial and ethnic groups, black and Hispanic individuals appear to have higher prevalence of recurrent or persistent dependence as well as more severe alcohol-related consequences when compared to non-Hispanic whites. These differences might be due to

social and economic disadvantage, increased availability, stigma, and decreased treatment utilization among minority racial and ethnic groups (Chartier & Caetano, 2010).

However, affluence is also associated with risk, especially for excessive drinking and marijuana use among adolescents and young adults (Luthar et al., 2013).

Generally, variables associated with the nonmedical use of prescription drugs among college students include being male, being non-Hispanic white, and having a lifetime history of prescription drug use (Johnston et al., 2013; McCabe et al., 2014; National Center on Addiction and Substance Abuse, 2007). For prescription stimulants in particular, annual prevalence of nonmedical use is higher among college students than young adults who did not pursue higher education (Johnston et al., 2013), which might be due to a belief that these types of drugs will enhance academic performance (National Center on Addiction and Substance Abuse, 2007). Most young adults who engage in nonmedical use of prescription drugs have either a history of substance use involvement or are current excessive drinkers or marijuana users (Arria et al., 2018; McCabe, 2005; O'Grady et al., 2009).

Substance Use Among Graduate Students

Little research has been conducted to understand the magnitude, correlates, and consequences of substance use among graduate students. Most studies have used cross-sectional designs and samples of graduate students from singular academic disciplines. Table 2.1 below presents the prevalence estimates available from prior research studies.

Table 2.1 Estimates of alcohol use behaviors among graduate student samples

Study	Discipline	Measure	Prevalence Estimate
Frank et al. (2008)	Medicine	Past-month alcohol consumption	78%
Kernan et al. (2011)	Health Sciences		47%
Shah et al. (2009)	Medicine	Past-year alcohol consumption	86%
English et al. (2011)	Pharmacy		86%
Bidwal et al. (2015)	Health Professions		67%
Stecker (2004)	Health Sciences		80%
Waring et al. (1984)	Social work and business	Current alcohol consumption	90%
Cranford et al. (2009)*	Varied		35%
Rutledge et al. (2016)*	Varied	Past two-week binge drinking (5 or more drinks consumed in one sitting)	26%
Nelson et al. (2009)	Varied		22%
Bidwal et al. (2015)	Health Professions	Past-year binge drinking	33%
Dahlin et al. (2011)	Medicine	Harmful alcohol consumption (AUDIT score of 11 or above)	17%
Shah et al. (2009)	Medicine	At-risk alcohol consumption (AUDIT score of 8 or above)	18%
Frank et al. (2008)	Medicine	Excessive alcohol consumption (past-month binge drinking or average of more than two drinks a day for men and one drink a day for women)	33%
English et al. (2011)	Pharmacy	Alcohol dependence	25%

*In these studies, binge drinking was defined as four drinks (women) or five drinks (men) during one drinking occasion.

Even less information is available regarding marijuana use among graduate students, with only five U.S. studies found that explored this issue. Prevalence estimates of marijuana use ranged from 6% in the past 30 days (Cranford et al., 2009) to 12% (Bidwal et al., 2015) and 14% (Shah et al., 2009) in the past year. Stecker (2004) found

that 25% of graduate students reported illegal drug use, with 84% of that drug use accounted for by marijuana. Kernan et al. (2011) did not specify marijuana, but found that 9% of graduate students reported drug use in the past year.

Most studies describing the nonmedical use of prescription drugs among graduate students have focused on the nonmedical use of prescription stimulants among graduate students in health professional programs. Bidwal et al. (2015) assessed graduate students in medicine, physician assistant, and pharmacy programs and found that 9% of students reported lifetime nonmedical stimulant use, with 10% of lifetime users reporting use 2 to 3 times a month, 14% using daily, and 12% using only during examination periods during the past year. Other studies utilizing samples of medical and dental students have found estimates in a similar range (i.e., from 10% to 15%) (Bucher et al., 2013; McNiel et al., 2011; Tuttle et al., 2010; Wasserman et al., 2014). In a study of non-clinical graduate students, past-year and lifetime nonmedical use of prescription stimulants were estimated to be 6% and 18%, respectively. In this sample, 11% of graduate students had used prescription stimulants nonmedically while also consuming alcohol, and nonmedical use of prescription stimulants was associated with increased levels of anxiety, stress, and mental restlessness (Verdi et al., 2016).

Few studies have examined the individual and program-level correlates of substance use among graduate students. Harmful or excessive alcohol consumption among graduate students have been found to be associated with younger age (Jackson et al., 2016; Rutledge et al., 2016; Shah et al., 2009), being male (English et al., 2011; Frank et al., 2008; Shah et al., 2009), being in the earlier stages of a graduate program (English et al., 2011; Shah et al., 2009), high levels of educational debt (Jackson et al., 2016),

being unmarried (English et al., 2011; Jackson et al., 2016; Shah et al., 2009), and not having children (English et al., 2011). Individual-level risk factors for nonmedical use of prescription stimulants among graduate students include being Hispanic or white, heavy alcohol use, and smoking (Bidwal et al., 2015). With respect to program-level factors, a higher prevalence of alcohol use has been documented among business students compared to other academic disciplines (Dahlin et al., 2011; Waring et al., 1984) as well as among non-clinical graduate students when compared to professional students (Kernan et al., 2011).

Substance Use Context and Motives

Compared to studies of undergraduate students, less research has focused on the motives and context of substance use, particularly alcohol use, among graduate students. In general, drinking motives are used to better understand why a person decides to consume alcohol and whether they expect the positive consequences of drinking will outweigh the positive consequences of not drinking (Cox & Klinger, 1988). Drinking motives are grouped into four broad categories, including social motives (e.g., drinking to enhance social confidence or affiliate with others), enhancement motives (e.g., drinking to celebrate or to get high), conformity motives (e.g., drinking because of peer pressure), and coping motives (e.g., drinking to escape, avoid, or regulate unpleasant emotions) (Kuntsche et al., 2005).

Certain motives are associated with unique risk factors and consequences. Research has shown a relationship between coping motives and occupational problems, risky behaviors, and poor self-care, and conformity motives have been directly linked to diminished self-perception and impaired control (Merrill & Read, 2010). Martens et al.

(2008) found a relationship between all four motive categories and alcohol-related problems, with coping and enhancement motives having the strongest relationship to these negative outcomes. Merrill & Read (2010) found a direct relationship between coping motives and academic problems among college students, suggesting that students who drink to deal with negative emotions are at increased risk for low academic achievement.

Drinking motives often change based on situational context, making the context of alcohol use an important area of study. Social context is the immediate environment in which drinking occurs, and context involves an interaction of intrapersonal, temporal, and situational factors (Thombs et al., 1997). Among college student drinkers, six social contexts have been identified: social facilitation (e.g., drinking at a party with friends), peer acceptance (e.g., drinking to fit in), emotional pain (e.g., drinking to forget about problems), family drinking (e.g., drinking as part of a family celebration), sex seeking (e.g., drinking to gain courage to talk to someone of the opposite sex), and motor vehicle (e.g., drinking while driving around) (Beck et al., 2008; Thombs et al., 1993).

Distinct social contexts of drinking have been linked to certain negative outcomes. Among undergraduate students, drinking for social facilitation is associated with drinking and driving, drinking in the context of motor vehicles is associated with alcohol abuse and dependence, and drinking in the context of emotional pain is associated with depression (Beck et al., 2008). More exploration of the association between social context of alcohol consumption and adverse outcomes among graduate students is warranted, while considering the differences between undergraduate and graduate students. For example, it might be more appropriate to ask a graduate student how often

they drink with other graduate students or while doing schoolwork, as opposed to at home with their parents or at parties in dormitories, fraternities, and sororities, which might be more appropriate in research on undergraduates.

Mental Health Problems

Prevalence and Risk Factors Among Young Adults

Anxiety and Depression. Mental health problems occur on a continuum from symptoms to disorder, with mental health often fluctuating over time. Except for impulse-control disorders, the most common classes of mental health disorders are anxiety and mood disorders (Kessler et al., 2005). While there are many different types of anxiety and depressive/mood disorders, anxiety disorders are characterized by intense worry or fear that does not go away and often worsens over time, and depressive or mood disorders cause severe symptoms such as hopelessness, guilt, and sadness that affect everyday life (National Institute of Mental Health, 2016). Many anxiety and depressive disorders have their onset during young adulthood, including panic disorder (24 years), generalized anxiety disorder (31 years), and major depressive disorder (32 years) (Kessler et al., 2005).

It is likely that the prevalence of these issues is underestimated due to stigma and low rates of mental health treatment-seeking, particularly among young adults. Lifetime prevalence of anxiety and mood disorders are 29% and 21%, respectively (Kessler et al., 2005). About 22% of young adults ages 18-25 had a mental health disorder in the past year, but only 35% of these young adults used mental health services (Center for Behavioral Health Statistics and Quality, 2017b). These numbers highlight the

importance of measuring anxiety and depression symptoms in addition to diagnosed or treated anxiety and depression, especially among young adults.

Co-occurrence of Mental Health Problems and Substance Use Disorders.

According to the 2016 National Survey on Drug Use and Health, more than 8 million adults 18 and older have both a mental health and a substance use disorder. Co-occurrence is most common among young adults, with 6.1% having both a mental health and a substance use disorder as compared to only 4.5% of adults between ages 26 and 49 and 1.5% of adults ages 50 and older (Center for Behavioral Health Statistics and Quality, 2017b). Individuals with mental health disorders are more likely to experience a substance use disorder than those without a mental health disorder (Substance Abuse and Mental Health Services Administration, 2016). Almost 90% of individuals with both disorders developed a mental health disorder before developing a substance use disorder (Najt et al., 2011), suggesting that risky substance use could be a purported way to “cope” with distressful symptoms of a mental health disorder.

Risk Factors. Mental health disorders result from a complex interplay between biologic and environmental factors. Mental health disorders are more common among individuals with blood relatives who also have a mental health disorder, suggesting the importance of genetic factors. Differences in brain chemistry and structure have been observed to be in association with mental health disorders. Environmental exposures, such as stressful life situations, traumatic experiences, substance use, and social neglect also increase risk for mental health disorders (Uher & Zwickler, 2017).

There are a multitude of correlates of mental health disorders, with some acting as potential risk markers and some with a more direct contributory relationship.

Additionally, some correlates might be the result of a shared propensity with a third variable, such as temperament or personality. While this distinction is complex, known correlates of mental health disorders include low self-esteem, poor physical health, difficulties at school, family conflict, unemployment, and poverty. Other correlates at the community and cultural levels include low socioeconomic status, discrimination, social exclusion, neighborhood violence, and peer pressure (World Health Organization, 2012). Research has also shown that demographic characteristics are associated with increased risk for anxiety and mood disorders, including being female and non-Hispanic white (Kessler et al., 2005).

Mental Health Problems Among Graduate Students

Competing demands, along with the rigorous nature of graduate programs, can combine to produce high levels of stress, anxiety, and depression symptoms among graduate students (Offstein et al., 2004). Graduate students are often pressured to meet academic deadlines and reach professional goals and perhaps neglect their mental health (Grube et al., 2005; Mazzola et al., 2011). Environmental exposure and current life circumstances, such as the stress of a graduate program, might exacerbate underlying predisposition for mental health problems and contribute to mental health symptoms or possibly the development of a disorder (Uher & Zwickler, 2017). In a recent study of mental health among graduate students, Levecque et al. (2017) found that doctoral students are more affected by mental health problems than the highly educated general population and have 2.4 times higher the risk for developing a psychiatric disorder. The most common mental health problems found among graduate students were feeling under

constant strain (41%), feeling unhappy and depressed (30%), and losing sleep over worry (28%).

Stress. Several studies have confirmed the high-stress nature of graduate education by examining the prevalence of stress and emotional exhaustion among graduate students. In one of the more extensive studies on the mental health needs of graduate students, Hyun et al. (2006) found that 45% of graduate students reported having an emotional or stress-related problem in the past year, and more than half (58%) reported having a colleague with a similar past-year problem. Results also showed that 46% of graduate students felt overwhelmed and 40% of students reported feeling exhausted either frequently or all of the time. Studies have also shown that graduate students report higher levels of stress when compared to both undergraduate students (Wyatt & Oswalt, 2013) and the general population (Bidwal et al., 2015). Other prevalence estimates of stress and emotional exhaustion among graduate students have been reported at 36% (Hunter & Devine, 2016), 74% (Oswalt & Riddock, 2007), and even as high as 75% (Kernan et al., 2011).

Anxiety and Depression. The prevalence and related consequences of anxiety and depression among graduate students have been examined using a wide range of instruments to measure mental health. Table 2.2 below outlines existing estimates of both anxiety and depression among graduate students.

A handful of studies have found differences in the prevalence of mental health problems among graduate students based on individual and program-level characteristics. Like the general population, female graduate students appear to be more likely to experience depression symptoms or meet criteria for depression than male graduate

Table 2.2 Estimates of anxiety and depression among graduate student samples

Study	Sample	Instrument	Outcome	Prevalence Estimate
Anxiety				
Bidwal et al. (2015)	Health Professions	Clinical Diagnosis	Lifetime diagnosis of anxiety disorder	10%
Eisenberg et al. (2007)	Varied	PHQ-9	Clinically significant anxiety symptoms	4%
Evans et al. (2018)		GAD-7	Moderate to severe anxiety symptoms	41%
Depression				
Bidwal et al. (2015)	Health Professions	Clinical Diagnosis	Lifetime diagnosis of depression	6%
Wyatt and Oswalt (2013)	Varied			17%
Eisenberg et al. (2007)	Varied	PHQ-9		11%
Dahlin et al. (2011)	Business and Medicine	MDI	Clinically significant depression symptoms	11%
Stecker (2004)	Medicine	DSM-IV		25%
Laurence et al. (2009)	Dentistry	ZDS	High depressive symptoms	17%
Evans et al. (2018)	Varied	PHQ-9	Moderate to severe depression symptoms	39%
Puthran et al. (2016)	Medicine	Meta-analysis	Depression or depressive symptoms	28%
Rotenstein et al. (2016)				27%

Note: PHQ = Patient Health Questionnaire; GAD = Generalized Anxiety Disorder; MDI = Major Depression Inventory; DSM = Diagnostic and Statistical Manual of Mental Disorders; ZDS = Zung Depression Scale

students (Eisenberg et al., 2007; Hyun et al., 2006). In a combined sample of undergraduate and graduate students, Eisenberg et al. (2007) found that female students and students with financial problems were more likely to meet criteria for anxiety disorders, non-White students were more likely to meet criteria for depression, and being

married was associated with fewer mental health problems. Levecque et al. (2017) confirmed that having a partner was associated with lower levels of psychological distress and also found that graduate students with children had lower odds of having or developing a psychiatric disorder. Marriage and children appear to have a protective effect, possibly due to the presence of a social support system. Students who have been enrolled in graduate school for longer tend to have more mental health needs (Hyun et al., 2006), which was confirmed in a study by Laurence et al. (2009). Results showed that fourth-year dental students had the highest prevalence of depression symptoms (22%) when compared to first-year (19%), second-year (8%), and third-year (20%) students. Academic expectations might become more rigorous in the later stages of a graduate program, contributing to an increase in mental health symptoms.

Of emerging interest are differences based on degree type and academic discipline so that screening and prevention efforts can be provided for high-risk graduate student groups. Hyun et al. (2006) found that graduate students in the humanities were 11% more likely to report mental health needs than students enrolled in professional schools, which was confirmed by Lipson et al. (2016). Lipson et al. (2016) conducted one of the most comprehensive studies of graduate student mental health by academic discipline and found that medical students were significantly less likely to screen positive for depression than doctoral students in the social sciences. Compared to all disciplines, art and design master's students and social work doctoral students had the highest prevalence of depression, and law students at the master's-level and humanities doctoral students had the highest prevalence of anxiety. It was suggested that students in the arts and humanities face a unique set of stressors surrounding making unique contributions to the

field and pressure towards creativity, innovation, and originality. When examining differences by health concentration, Bidwal et al. (2015) found that graduate students in medicine and physician assistant programs were more than twice as likely to report a history of anxiety disorder and a history of depression when compared to graduate students in pharmacy programs. The authors noted that these findings could be due to differences in risk factors, particularly demographic characteristics, among these student subgroups.

Possible Impact on Academic Performance and Achievement

Substance Use and Academic Achievement

Alcohol consumption, marijuana use, and the nonmedical use of prescription drugs during adolescence and young adulthood are associated with negative health and social consequences later in life. Research has shown a relationship between heavy alcohol use and unemployment (Lee et al., 2015), injury and disease (Rehm et al., 2010), psychiatric morbidity, and homelessness (Viner & Taylor, 2007). Marijuana use during adolescence and young adulthood has been associated with a wide range of consequences, including unemployment (Danielsson et al., 2015; Fergusson et al., 2015), welfare assistance (Danielsson et al., 2015; Fergusson & Boden, 2008; Fergusson et al., 2015), lower income (Fergusson & Boden, 2008), mental health problems (Fergusson et al., 2015; MacDonald & Pappas, 2016), and decreased life satisfaction (Fergusson & Boden, 2008). Marijuana use is also associated with lower workforce productivity (Hara et al., 2013) and use of other illicit drugs (Silins et al., 2014). Nonmedical use of prescription drugs has also been linked to heavy alcohol use, illicit drug use, mental

health disorders, risky sexual behavior, and emergency department visits (Benotsch et al., 2011; National Center on Addiction and Substance Abuse, 2007; Prevention, 2010).

Decreased academic performance because of substance use has been studied utilizing samples of high school and undergraduate college students. A recent review by MacDonald and Pappas (2016) called underachievement the most well supported correlate of marijuana use. Longitudinal research has found that both alcohol and marijuana use in middle school predict academic unpreparedness and delinquency in high school. Additionally, alcohol and marijuana use in early adolescence predict poor academic performance in high school (D'Amico et al., 2016), such as lower grade point average and lower SAT scores (Meier et al., 2015). In a longitudinal study of adolescents and young adults, Fergusson et al. (2003) found that students who used marijuana more than 100 times were almost six times more likely to drop out of high school or college than students who abstained from marijuana use. Additional studies of adolescents found that regular marijuana use is associated with increased risk of lower academic achievement and dropping out of school (Hooper et al., 2014; Lynskey et al., 2003). Arria et al. (2015) found that frequent marijuana use during college predicts subsequent declines in GPA, both directly and through increases in skipping class.

Alcohol and marijuana use are not only associated with poor academic performance but with attrition from both high school and college. Kelly et al. (2015) found that compared to non-users, students using mainly alcohol were 1.5 times more likely to drop out of high school, and students using alcohol, tobacco, and marijuana (poly-drug users) were 2.5 times more likely to drop out of high school. These results were confirmed by additional studies that found that students who use marijuana are less

likely than non-users to complete school and obtain a college degree (Bray, 2000; Silins et al., 2014). Maggs et al. (2015) examined data from the Monitoring the Future study and found that, when compared to infrequent users and non-users, frequent marijuana users were less likely to earn Bachelor's degrees. Suerken et al. (2016) found that college students who frequently used marijuana throughout college were more likely to drop out of college when compared to non-users, and marijuana users reported lower GPAs than non-users. Two studies using data from the longitudinal College Life Study found that marijuana use predicted discontinuous enrollment in college (Arria et al., 2013b) and marijuana use during the first year of college affected delayed graduation years later (Arria et al., 2015).

Of concern is attrition among students meeting criteria for substance use disorder, which has been examined in several studies. Anthony et al. (1994) compared adults who had completed 13-15 years of education with those who completed 16 or more years of education and found that those with less years of education were 1.36 times more likely to have a history of alcohol dependence. Kessler et al. (1995) found that students with a substance use disorder were 2.3 times more likely to drop out of high school and 1.4 times more likely to drop out of college, and Leach et al. (2012) found that both alcohol use disorder and cannabis use disorder were associated with increased likelihood of not completing high school. Results from a twin study by Grant et al. (2012) found that twins who used alcohol before age 18 and twins with a lifetime history of alcohol dependence had an increased likelihood of completing less than 16 years of education. In a longitudinal study of the long-term effects of mental health disorders on educational attainment, Mojtabai et al. (2015) found that alcohol and drug use disorders were

associated with lower odds of graduating from both high school and college. Lastly, a study by Hunt et al. (2010) found that cannabis use disorder was significantly associated with failure to graduate from college.

Studies have also shown a link between the nonmedical use of prescription drugs and educational outcomes. McCabe et al. (2004) found that nonmedical use of prescription stimulants was higher among adolescents with no plans to attend college, and nonmedical use of prescription drugs has consistently been linked to lower grades among those who do enroll in college (McCabe et al., 2006; McCabe et al., 2005). In a study of the relationship between nonmedical use of prescription drugs and academic behaviors of college students, Arria et al. (2008b) found that nonmedical use of prescription stimulants and analgesics predicted lower grade point average, and users more frequently skipped classes and spent less time studying. However, it is important to note that the relationship between nonmedical use and GPA was confounded by the use of other illicit drugs.

There are several explanations as to why substance use is associated with poor educational outcomes. First, the relationship might be explained by the effects of alcohol and marijuana on cognition (Battistella et al., 2014; Fergusson et al., 2015; Jacobus & Tapert, 2013; Yücel et al., 2008). Verbal learning, memory, executive functioning, IQ, and attention, which are critical for academic success, are impaired by both acute and chronic exposure to marijuana (Broyd et al., 2016; Crean et al., 2011; Fontes et al., 2011; Gruber et al., 2012; Indlekofer et al., 2009; Meier et al., 2012; Solowij et al., 2011). Another explanation for the relationship is that substance use might be associated with anti-conventional peer groups, where individuals who become more involved in

substance use might affiliate with peers who feel that more normative behaviors, such as degree obtainment, are less desirable (Fergusson et al., 2015).

Arria et al. (2013a) suggests that reward perception might also play a role in the relationship between substance use and low educational achievement, as individuals who use drugs and alcohol are enticed by the immediate, rewarding effects of substance use and therefore re-prioritize the importance of more challenging academic pursuits. Use of substances can lead to increased cravings, which then increase the likelihood of continued use (van Hemel-Ruiter et al., 2013), ultimately leading to an attention shift away from longer-term rewards, such as academic achievement, to short-term rewards experienced by drug and alcohol use.

Few studies have examined the association between substance use and academic variables among graduate students. Kernan et al. (2011) found that 5% of health science graduate students who consumed alcohol reported negative academic outcomes related to their alcohol consumption, and English et al. (2011) found that 7% of Pharm.D students reported that their alcohol use behaviors negatively affected their grades. English et al. (2011) found that 15% of students surveyed reported that alcohol use had led them to fall behind in their coursework, and 17% reported that alcohol use led them to be tardy to work or school. Jackson et al. (2016) examined burnout and alcohol abuse/dependence among medical students and concluded that students who were burned out were more likely to meet criteria for alcohol abuse or dependence. Kernan et al. (2011) did not specify marijuana use, but found that 9% of graduate students reported drug use in the past year, and 9% of those students felt their academics had been negatively impacted by their drug use. In the only study that was found regarding the association between the

nonmedical use of prescription drugs and academic performance among graduate students, Bidwal et al. (2015) found that 39% of health professional students reported that nonmedical use of prescription stimulants improved their academic performance, 61% reported that their performance stayed the same, and no participants reported a decline. In this study, graduate students cited improving concentration and focus as the most important reason for the nonmedical use of prescription stimulants, with other reasons including improving alertness and performing better scholastically. Almost 90% of the sample reported that they were aware that other graduate students at their institution used prescription stimulants nonmedically to enhance their academic performance. These results are consistent with studies by Tuttle et al. (2010) and Verdi et al. (2016), which found that the most commonly reported reason for the nonmedical use of prescription stimulants among graduate students was to improve academic performance. However research suggests that this belief is illusory and that nonmedical use of prescription stimulants is not associated with actual academic benefits (Arria et al., 2017b).

Mental Health Problems and Academic Achievement

Mental health disorders are associated with negative outcomes including reduced household income (Kawakami et al., 2012), substance use (Kedzior & Laeber, 2014), and unemployment (Baggio et al., 2015). In a summary of the adverse outcomes related to mental health disorders, the World Health Organization identified increased vulnerability to stigma and discrimination, violence, abuse, reduced access to health and social services, increased disability and premature death, poverty, social withdrawal, and sleep and eating problems (World Health Organization, 2012). In addition, a history of mental

health disorders, particularly clinical depression, has been identified as a major risk factor for suicide (National Center for Injury Prevention and Control, 2016), and suicide is the second leading cause of death among persons ages 15-34 years (National Center for Injury Prevention and Control, 2015). Of increasing interest is the relationship between mental health problems and educational attainment, and several research studies have shown that internalizing disorders, which include anxiety and mood disorders, are associated with low educational attainment among high school and undergraduate college students (Esch et al., 2014).

An early study by Kessler et al. (1995) found that students with an anxiety disorder were 1.4 times more likely to drop out of high school and 1.4 times more likely to drop out of college once enrolled. Results were similar for mood disorders, as students with a mood disorder were 1.5 times more likely to drop out of high school and 2.9 times more likely to drop out of college once enrolled. Quiroga et al. (2012) found that depression in seventh grade students increased the likelihood of school dropout by 2.75, and Leach et al. (2012) reported that early onset major depression and obsessive-compulsive disorder were both associated with increased risk for not completing high school. In a longitudinal study of the long-term effects of mental disorders on educational attainment, Mojtabai et al. (2015) found that anxiety and depressive disorders were associated with lower odds of graduating from high school, and anxiety disorders were associated with lower odds of going to college. College students with mental health disorders also report less campus engagement and poorer relationships (Salzer, 2012), as well as discontinuous enrollment in college (Arria et al., 2013b). Eisenberg et al. (2007) found that 18% of undergraduate students missed academic obligations because of a

mental health problem, and 44% reported that mental or emotional difficulties affected their past-month academic performance.

Only a few studies have examined academic outcomes related to mental health problems in graduate student samples. There are academic implications to high stress and exhaustion, with 27% of graduate students who felt stressed in the past-year reporting that it negatively impacted their academic performance (Kernan et al., 2011). In a study of doctoral-level psychology students, Nelson et al. (2001) found that students with higher GPAs were more likely to report stress regarding their coursework, and the highest reported stressors among students were their courses, dissertation work, and their financial situation. Eisenberg et al. (2009) found a significant association between depression and both GPA and attrition among graduate students. Kernan et al. (2011) found that 28% of graduate students reported depression or anxiety in the past year, and 44% of those students faced academic hardship due to their mental health problems. When asked about the effects of mental health on academic performance, graduate students report that anxiety led to a lower grade on an exam/project (8%), a lower grade in a course (2%), an incomplete or dropped course (1%), or a disruption in thesis, dissertation, or practicum work (2%). Depression affected these same areas among 5%, 2%, 1%, and 2% of students, respectively (Wyatt & Oswalt, 2013).

Sleep might play an important role in explaining the relationship between mental health problems and poor academic outcomes, as sufficient sleep is critical to emotion and energy regulation. Existing research suggests that insomnia and sleep quality are bi-directionally related to anxiety and depression (Alvaro et al., 2013; Peach et al., 2016), and stress among students is predicted by their sleep patterns and habits (McKinzie et al.,

2006). Studies of undergraduate students have shown a relationship between sleep and academic performance. Edens (2006) examined academic motivation among undergraduate students and found that excessive sleepiness was associated with a motivation to earn good grades, procrastination, low academic self-efficacy, and increased number of credits taken per semester. While assessing the prevalence of sleep disorders, Gaultney (2010) found that about a quarter of the undergraduate students sampled were at risk for a sleep disorder, and risk for sleep disorder was associated with being in academic jeopardy. A study by Taylor et al. (2013) found that total sleep time, time awake before arising, and total sleep time inconsistency were significant predictors of poor academic performance among college students.

The majority of research on sleep habits among graduate students has been conducted in samples of medical students, possibly due to evidence of graduate students in clinical programs reporting more academic problems related to their sleep difficulties than those in non-clinical programs (Kernan et al., 2011). In one study, Ayala et al. (2017) found that even though a sample of medical students were sleeping an average of seven hours a night, the majority reported low sleep quality. Brick et al. (2010) measured sleep hygiene habits among medical students and found that half the sample met the clinical cutoff for poor sleep quality, and students in earlier class years had worse sleep quality than students in later class years. A study by Wolf & Rosenstock (2017) assessed the relationship between sleep, depression, and burnout among graduate students and found that poor sleep was associated with burnout, lower professional efficacy, and higher levels of exhaustion. Results also showed that both depression and sleeping less than seven hours a night were predictors of burnout in this sample. In addition to these

studies of clinical graduate students, two studies of graduate students studying psychology found sleep patterns and practices predicted stress levels (McKinzie et al., 2006; Myers et al., 2012).

Co-Occurring Disorders and Academic Achievement

Due to the prevalence of co-occurring disorders, the association between substance use and mental health problems cannot be ignored. Undiagnosed and untreated co-occurring disorders are associated with several severe consequences, including an increased likelihood of homelessness, physical illness, incarceration, suicide, and early death (Rush & Koegl, 2008; Substance Abuse and Mental Health Services Administration, 2016). Of interest is the association between co-occurring mental health and substance use disorders and educational attainment, particularly among young adults. Past-year prevalence of co-occurring disorders is lowest among adults ages 18 and older with a college degree when compared to lower levels of educational attainment (Center for Behavioral Health Statistics and Quality, 2017a). In a study of how co-occurring disorders during adolescence affected life outcomes during emerging adulthood, Vida et al. (2009) found that individuals with a non-comorbid mental health disorder were twice as likely to finish high school than those with a comorbid disorder. Examining the inverse pathway, Lee et al. (2013) found that not completing high school before age 21 was associated with an increase in comorbid substance use and mental health disorder symptoms.

Academic Support

While the combined effects of academic support, substance use, and mental health problems on academic achievement have not been studied in graduate student samples, several studies were found on the relationship between academic support and graduate student success, particularly in regards to advisor and departmental support. Positive relationships with a faculty advisor have been shown to be associated with improved mental health (Hyun et al., 2006), decreased stress (Nelson et al., 2001), and less emotional exhaustion (Hunter & Devine, 2016), and several studies have found that students rank having a knowledgeable and supportive advisor as one of the most important contributors to their academic success (Bain et al., 2011; Golde, 2005). In a study of graduate psychology students, Nelson et al. (2001) found that students with higher psychological distress were more likely to report stress due to relationships with their supervisors and little contact with mentors or professors. Hunter & Devine (2016) found a similar relationship between more frequent meetings with an advisor and less emotional exhaustion, and Nielson et al. (2016) examined graduate business students and found a significant association between instructor support and well-being. In a comprehensive look at the factors contributing to attrition from graduate degree programs, Lovitts & Nelson (2000) found that students who complete their Ph.D. are twice as likely to be satisfied with their faculty advisor than students who drop out of the program. When examining differences by degree type and academic discipline, Hardre & Hackett (2015) found that doctoral students had higher overall satisfaction with their advisors than master's students, and students in natural science programs (e.g. biology,

chemistry, and engineering) had higher overall satisfaction with their advisors than students in social science programs (e.g., psychology, political science, education).

In addition to relationships with faculty, program climate also appears to play a role in graduate student success. Pyhalto et al. (2009) found that students who felt like a member of their scholarly community were more satisfied with and showed more interest in their studies. In a study on attrition from Ph.D. programs, Lovitts & Nelson (2000) found that 85% of students who completed a Ph.D. shared an office with other graduate students in comparison to 46% of students who did not finish their Ph.D., suggesting a correlation between program community and degree completion. Lovitts & Nelson posited that lack of integration into the departmental community was the most influential factor contributing to graduate school attrition.

Literature Gaps

Research on the behavioral health of graduate students has largely been restricted to samples of students from one academic discipline, particularly medical or other health professional students. Existing prevalence estimates of mental health and substance use problems among graduate students should be interpreted with caution, given the wide variation in estimates depending on the sample, the outcome of interest, and the measurement instrument used. The majority of research that has been conducted on the mental health of graduate students has examined general psychological distress, and more information is needed on clinically significant or diagnosed mental health problems, particularly anxiety. The current literature also lacks information on the combined influence of mental health and substance use problems on graduate student functioning,

and more information is needed on substance use behaviors outside of alcohol consumption, including marijuana use and the nonmedical use of prescription drugs.

Research on the association between behavioral health and achievement has been primarily conducted among high school and undergraduate students. Graduate school represents a developmentally different time than high school and college, and graduate students are a very diverse population. Additional research is warranted to see if the well-established relationship between behavioral health and academic success also exists among graduate students.

Chapter 3: Manuscript #1: Graduate degree completion: Prospective associations with substance use and mental health problems

Introduction

The long-term consequences of substance use and mental health problems during college are a major public health concern and have been the focus of a growing body of research. The majority of college students drink alcohol, with almost 80% drinking in the past year and about two thirds drinking in the past 30 days. Marijuana is the most commonly used illicit drug among college students, with an annual prevalence of 39% and a 30-day prevalence of 22% (Schulenberg et al., 2017). College is also a high-risk time for the development of substance use disorders (Kessler et al., 2005), and about 11% of young adults meet criteria for an alcohol use disorder and 5% meet criteria for a marijuana use disorder (Center for Behavioral Health Statistics and Quality, 2017b). Substance use is associated with a multitude of negative consequences during the college years, including health problems, risky sexual behaviors, social and interpersonal problems, injury, impaired driving, and academic impairment (Merrill & Carey, 2016; Pearson et al., 2017; White & Hingson, 2013).

Longitudinal research has shown that the negative consequences associated with alcohol and marijuana use are observed even into the post-college years. Heavy drinking and marijuana use during college are associated with post-college substance abuse and dependence (Jennison, 2004), unemployment (Schulenberg et al., 2005), under-employment (Jennison, 2004), and delayed time to college graduation and subsequent lower incomes (Wilhite et al., 2017). Marijuana use during college and the immediate post-college years, particularly heavy use, is associated with several negative health

outcomes at ages 24 and 27, including emotional problems, injury, illness, and decreased quality of life (Arria et al., 2016b; Caldeira et al., 2012).

Mental health problems are also a growing concern on college campuses. A large multi-campus study found that 17% of college students meet criteria for depression and 10% meet criteria for anxiety (Eisenberg et al., 2013). Evidence suggests that mental health problems among college students are increasing (Twenge et al., 2010). Anxiety and depression among college students are associated with decreased academic achievement (Eisenberg et al., 2009; Hysenbegasi et al., 2005), substance use (Cranford et al., 2009; Weitzman, 2004), and suicidal ideation (Arria et al., 2009).

Non-completion of educational milestones has been found in relation to substance use in longitudinal studies of high school and college students. High school students who used alcohol, tobacco, and marijuana in ninth grade were less likely to complete high school than non-users (Kelly et al., 2015). Integrating data from three longitudinal studies, Silins et al. (2014) examined the association between marijuana use before age 17 and completing high school and college, and found that daily marijuana use during adolescence was significantly associated with decreased odds of both high school and college completion. In a study of college students, frequent marijuana use during college was associated with increased likelihood of dropping out (Suerken et al., 2016).

Early mental health problems, particularly anxiety and depression, are also associated with degree non-completion. Kessler et al. (1995) found that students with anxiety disorders were about 1.5 times less likely to graduate from high school and college, and students with mood disorders were almost three times less likely to graduate from college once enrolled. More recent studies have confirmed this finding, with early

onset anxiety and depression predicting increased odds of high school dropout (Leach & Butterworth, 2012; Quiroga et al., 2012). Mojtabai et al. (2015) examined the long-term effects of mental health disorders on educational attainment and found that fear and anxiety-misery disorders (i.e., simple phobia, social phobia, panic disorder, agoraphobia, major depressive disorder, generalized anxiety disorder, and post-traumatic stress disorder) were associated with lower odds of high school graduation, and bipolar disorder was associated with lower odds of college graduation.

Despite this evidence that substance use and mental health problems are prospectively associated with not completing high school and college, the potential impact on graduate degree completion has not been explored. An increasing number of college graduates are enrolling in graduate school, with almost 40% of students who complete a bachelor's degree enrolling in a graduate degree program within four years of college graduation (Baum & Steele, 2017). However, the proportion of students who enroll and complete a degree is suboptimal. Completion estimates range from 50% to 75% of those who enter graduate school, with differences by degree type and academic discipline (Ali & Kohun, 2006; Baum & Steele, 2017; Lovitts & Nelson, 2000).

Existing theories that have been developed to explain attrition among undergraduate student populations posit that attrition is influenced by individual, institutional, and social factors (Aljohani, 2016). Institutional factors include program characteristics, administrative policies, and academic requirements. Social factors include peer culture, faculty/staff interactions, and social integration. At the individual level, demographic characteristics, skills and abilities, goals and expectations, external commitments, and academic history can all contribute to the likelihood of degree

completion. Largely missing from theories of student attrition are health status and health behavior factors, particularly mental health and substance use prior to enrollment in an undergraduate or graduate degree program.

The relationship between substance use, mental health, and graduate degree completion is likely influenced by demographic characteristics. Both heavy drinking and marijuana use are more common among college males than females (Schulenberg et al., 2017). Drug dependence is associated with being male, non-Hispanic white, and unmarried (Anthony et al., 1994; Haberstick et al., 2014). Anxiety is significantly higher among female college students as compared to males, and depression is higher among non-white college students as compared to those of other racial and ethnic groups. Students who are married have a lower risk for mental health problems compared with those who are single (Eisenberg et al., 2013). Demographic characteristics are also associated with graduate school completion, with burnout and attrition highest among women (Baum & Steele, 2017; Dahlin et al., 2007), African-American/black students (Lovitts & Nelson, 2000), domestic students (Most, 2008), and students enrolled in master's degree programs (Baum & Steele, 2017).

Aims and Hypotheses

This study has two distinct aims: (1) characterize alcohol consumption and marijuana use patterns during college, and (2) assess the relationship between alcohol consumption, marijuana use, anxiety, and depression during college and graduate degree completion among students who enroll in graduate school. It is hypothesized that less substance use during the college years, as well as lower levels of anxiety and depression,

are significantly associated with degree completion among graduate students after adjustment for potentially confounding variables.

Methods

Study Sample

The College Life Study (Arria et al., 2008a; Vincent et al., 2012) is a longitudinal study of young adults who were recruited from a large, mid-Atlantic university. During the first stage of sampling, a brief survey to determine eligibility for follow-up was administered to all incoming first-time, first-year students ages 17 to 19 years old. Questions were asked regarding demographic characteristics and tobacco, alcohol, and other drug use behaviors. During the second stage of sampling, the sample was stratified by race, gender, and substance use history. To ensure a sample of students who had a greater risk of using drugs during follow-up, students who had tried a drug or used a prescription drug nonmedically at least once prior to college entry were oversampled. A random sample was chosen for longitudinal follow-up, and 1,253 students completed a baseline interview (Year 1; modal age 18). Follow-up assessments were then administered annually from Years 2 through 8 and then in Years 10 and 12 (modal age 29). Whenever possible, face-to-face interviews were administered; otherwise, phone interviews or online assessments were used. Follow-up rates were high, ranging from 91% ($n = 1,142$) in Year 2 and 73% ($n = 908$) in Year 12. The university's Institutional Review Board approved the study, and informed consent was obtained.

From the original sample of 1,253 young adults, 541 participants (43%) enrolled in a degree-seeking graduate program by Year 10 of the study. Of these participants, 21

participants were excluded from analyses either because they listed graduate school enrollment by mistake or because specific graduate degree type could not be determined. In addition, to ensure participants had adequate time to complete their degree, 15 participants who first enrolled in a doctorate or professional degree program in Year 10 were excluded, giving a final analytic sample of 520 participants.

Measures

Dependent Variable

Degree completion. Completion of a graduate degree was assessed in Years 7, 8, 10, and 12. In Year 7, participants indicated if they had completed an M.A., M.S., M.B.A., M.P.H., M.S.W., J.D., or other degree. In Year 8, additional options for completed degrees were added (M.Ed., M.A.T., M.P.S., J.D., D.P.T., Pharm.D., or joint/double degree). In Years 10 and 12, participants indicated their highest completed academic degree, with graduate degree options including master's degree, doctoral degree, J.D., M.D., or other degree. 'Joint/double degree' and 'other degree' responses were individually analyzed and coded. A dichotomous variable was created to represent whether or not participants completed their graduate degree by Year 12.

Independent Variables

Alcohol consumption. Alcohol consumption was assessed using standard measures in Years 1-4. To assess frequency of alcohol consumption, participants were asked, "During the past 30 days, on how many days did you drink alcohol?". To assess quantity of alcohol consumption, participants were asked the number of drinks they

would have on a typical drinking day. Two categorical variables were created to represent the alcohol consumption quantity and alcohol consumption frequency patterns (see *Statistical Analyses*) of participants during their college years.

Marijuana use. Marijuana use was measured annually in Years 1-4. To assess frequency of marijuana use, participants were asked, “During the past 30 days, on how many days did you use marijuana?”. A categorical variable was created to represent marijuana use frequency patterns (see *Statistical Analyses*) of participants during their college years.

Alcohol abuse/dependence. Annually, participants who drank at least five days in the past year were asked a series of questions corresponding to DSM-IV criteria for alcohol abuse or dependence (American Psychiatric Association, 2000), based on questions from the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b). Alcohol dependence was defined as meeting three of six criteria, and alcohol abuse was defined as meeting at least one of four criteria without being dependent. A dichotomous variable was created for meeting criteria for alcohol abuse/dependence at any point during Years 1-4.

Marijuana abuse/dependence. Annually, participants who used marijuana five or more times in the past year were asked a series of questions corresponding to DSM-IV criteria for marijuana abuse or dependence (American Psychiatric Association, 2000), based on questions from the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b). A dichotomous variable was created for meeting criteria for marijuana abuse/dependence at any point during Years 1-4.

Anxiety symptoms. Anxiety symptoms were measured using the Beck Anxiety Inventory (BAI) (Beck et al., 1988b) in Years 1-4. The scale consists of 21 symptoms of anxiety, and participants rank how much each symptom has bothered them in the past week using a four-point scale ranging from 0 (not at all) to 3 (severely, can barely stand it). Possible scores range from 0 to 63, with higher scores indicating higher levels of anxiety. A single score was computed from the mean of the scores from Years 1-4.

Depression symptoms. Depression symptoms were measured using the Beck Depression Inventory (BDI) (Beck et al., 1996) in Years 1-4. The scale consists of 21 statements about how participants have been feeling over the past few days. Possible scores range from 0 to 63, with higher scores indicating increased symptoms of depression. A single score was computed from the mean of the scores from Years 1-4.

Lifetime diagnosis of anxiety. In Years 3 and 4, participants were asked if they had ever been diagnosed with anxiety by a health professional in their lifetime. A dichotomous variable was created to represent whether participants had been diagnosed with anxiety by Year 4.

Lifetime diagnosis of depression. In Years 3 and 4, participants were asked if they had ever been diagnosed with depression by a health professional in their lifetime. A dichotomous variable was created to represent whether participants had been diagnosed with depression by Year 4.

Covariates

Demographic Characteristics. Gender was coded by the interviewer in Year 1 as either male or female. Race/ethnicity was measured in Year 3, and response options

included white, black/African-American, American Indian or Alaskan Native, Native Hawaiian, other Pacific Islander, Asian, and Hispanic, Latino, or Spanish. Participants could also write in an alternative response or choose “Don’t Know/Refuse to Answer”. Given that the majority of the sample (68%) was non-Hispanic white, race was dichotomized into white and non-white groups. Marital status was measured in Years 4-8, Year 10, and Year 12. Participants indicated whether they were married, divorced, widowed, separated, in a civil union or domestic partnership, or never married. A dichotomous variable (married; never married) was created to represent whether participants were married at any point during Years 4 through 12. The number of children participants had was measured in Years 4-8, Year 10, and Year 12. A dichotomous variable was created to represent whether participants ever had children by Year 12.

Program characteristics. Degree type was coded as the highest level of program participants enrolled in by Year 10. Due to a relatively low number of graduate students enrolled in doctoral programs, a dichotomous variable was created to represent enrollment in either a master’s program or a doctorate/professional degree program. Possible master’s degrees included M.A., M.S., M.B.A., M.P.H., M.S.W., M.Ed., M.A.T., M.P.S., and other master’s degree, and possible doctoral/professional degrees included Ph.D., Psy.D., M.D., J.D., D.P.T., O.D., Pharm.D., and other doctoral/professional degree. Year of enrollment was computed based on the first year participants indicated enrollment in any graduate program. Variable response options were Year 5 (modal age 22), Year 6, Year 7, Year 8, and Year 10 (modal age 27).

Statistical Analyses

Group-based trajectory modeling (Jones & Nagin, 2007; Nagin, 1999) was used to measure the rates of change in alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency during the first four years of the participants' undergraduate degree. Using this procedure, discrete subgroups were identified to represent the varying types of change for alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency. The group-based trajectory modeling procedure yielded possible solutions of one to seven trajectory groups, and each of these were evaluated. The best-fitting models for each substance use variable were selected using the Bayesian Information Criterion (BIC) and the Bayes factor (Jones et al., 2001; Nagin, 1999), as well as conceptual understanding and interpretation of the proposed subgroups. Once the best fitting models were selected, results of these analyses allowed for the creation of three categorical variables, where the response options were trajectory group membership for (a) alcohol consumption quantity; (b) alcohol consumption frequency; and (c) marijuana use frequency for Years 1-4. This procedure has been used previously to analyze data from this sample (Arria et al., 2013c).

Descriptive statistics (e.g., frequencies, means, and standard deviations) were used to analyze the distributions of all study variables, and the associations between mental health and substance use independent variables were examined. The magnitude of the associations between categorical variables were assessed using Cramer's V and were interpreted as medium (0.3) or large (0.5) effects. The magnitude of the associations between categorical and continuous variables were assessed using Cohen's d values and were interpreted as medium (0.5) or large (0.8) effects. The magnitude of the associations

between continuous variables were assessed using Spearman's ρ values and were interpreted as medium (0.3) or large (0.5) effects (Cohen, 1988). Among mental health variables, there was a significant large association between anxiety symptoms and lifetime history of anxiety disorder and a significant medium association between depression symptoms and lifetime history of depression. Among substance use variables, there was a significant large association between alcohol abuse/dependence and both alcohol consumption quantity and frequency, and there was a significant large association between marijuana abuse/dependence and marijuana use frequency. To avoid potential multicollinearity in regression models, only anxiety symptoms, depression symptoms, alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency were included as independent variables in further analyses.

Logistic regression models were used to analyze the relationships between all covariates and independent variables with graduate degree completion without adjusting for any other study variables. Three multivariate logistic regression models were then fit to assess (1) the relationships between mental health variables and graduate degree completion after adjusting for demographic and program characteristics; (2) the relationships between substance use variables and graduate degree completion after adjusting for demographic and program characteristics; and (3) the relationships between mental health and substance use variables and graduate degree completion after adjusting for all other study variables.

SAS Version 9.4 was used for group-based trajectory modeling, and SPSS Version 24.0 was used for all additional analyses. The alpha level was set at 0.05 for all analyses.

Results

Sample Characteristics

A majority of the sample was female (61%) and non-Hispanic white (68%), with 42% of participants getting married and 14% of participants having children by Year 12 (see Table 3.1). About two-thirds (69%) had enrolled in master's degree programs and 31% had enrolled in doctorate or professional degree programs, with Year 5 (modal age 22) being the most common year to begin graduate school. The majority of the sample (82%) completed their graduate degree by Year 12.

With the exception of having children and degree type, all demographic and program characteristic variables were significantly ($p < 0.05$) associated with graduate degree completion without adjusting for any other study variables. As seen in Table 3.3, gender, marital status, and first year of graduate school enrollment remained significantly associated with graduate degree completion after adjusting for demographic and program characteristics, mental health, and substance use. Female students were almost twice as likely to complete their graduate degree than males, and married students were more than twice as likely to complete their graduate degree than those who had never been married. In comparison to students who began their graduate degree in Year 10 (modal age 27), students entering graduate school in Years 5 (modal age 22), 6 (modal age 23), and 7 (modal age 24) were significantly more likely to complete their graduate degree.

Mental Health During College

As seen in Table 3.2, 13% of participants reported that they had been diagnosed with anxiety by Year 4 (modal age 21), 14% reported that they had been diagnosed with

depression, and 8% reported being diagnosed with both. Mean scores on the Beck Anxiety Inventory (BAI) from Years 1-4 ranged from 0 to 33, with a sample mean of 6.50. Mean BAI score was significantly higher among students who had been diagnosed with anxiety (11.57) than those who had not (5.73). Mean BAI score was slightly higher among students who completed their graduate degree (6.52) than among students who did not complete their graduate degree (6.38), but this difference was not statistically significant.

Mean scores on the Beck Depression Inventory (BDI) from Years 1-4 ranged from 0 to 21, with a sample mean of 4.36. Having been diagnosed with depression was significantly associated with higher BDI scores (6.93 vs. 3.94). Mean BDI score was slightly higher among students who did not complete their graduate degree (4.76) than among students who completed their graduate degree (4.27), but this difference was not statistically significant.

Substance Use During College

Four distinct trajectories were identified for alcohol consumption quantity: (1) low/none (about one drink per typical drinking day), (2) moderate (about three drinks per typical drinking day), (3) binge (about five drinks per typical drinking day), and (4) high-intensity (about nine drinks per typical drinking day). The majority of participants were in the moderate (34%) and binge (42%) groups during college. Five trajectories were identified for alcohol consumption frequency in the past 30 days for Years 1-4: (1) minimal/no use, (2) infrequent use, (3) frequent use, (4) increasing use, and (5) near daily use. Participants in the minimal/no use, infrequent, frequent, and near daily use groups

drank on about one, three, eight, and 15 days in the past 30 days, respectively.

Participants in the increasing use group went from drinking about five days in the past 30 days in Year 1 to about 17 days in the past 30 days in Year 4. The majority of participants were in the infrequent use (30%) and frequent use (32%) groups during college.

Five trajectories were identified for marijuana use frequency in the past 30 days for Years 1-4: (1) minimal/no use, (2) infrequent use, (3) decreasing use, (4) increasing use, and (5) chronic use. Participants in the minimal/no use, infrequent, and chronic groups used on about zero, two, and 23 days in the past 30 days, respectively.

Participants in the increasing use group went from using marijuana about three days in the past 30 days in Year 1 to about 15 days in the past 30 days in Year 4. Participants in the decreasing use group went from using marijuana on about 15 days in the past 30 days in Year 1 to about three days in the past 30 days in Year 4. The majority of participants (65%) were in the minimal/no use group.

As seen in Table 3.2, 60% of the sample met criteria for alcohol abuse or dependence and about a third met criteria for marijuana abuse or dependence during Years 1-4.

Participants in the moderate alcohol consumption quantity group during college were significantly more likely to complete a graduate degree than those in the low/none group, but this relationship was not robust to the inclusion of potential covariates.

Similarly, participants in the frequent alcohol consumption frequency group during college were significantly more likely to complete a graduate degree than those in the minimal/no use group, but the statistical significance of this relationship was attenuated

after adjusting for potential covariates. No other significant relationships between college student substance use and graduate degree completion were found.

Discussion

This study examined whether substance use and mental health during college were associated with graduate degree completion. Results showed no evidence of a potential prospective relationship, despite prior longitudinal evidence that alcohol use, marijuana use, anxiety, and depression are associated with degree non-completion among high school and college students (Kelly et al., 2015; Kessler et al., 1995; Leach & Butterworth, 2012; Mojtabai et al., 2015; Quiroga et al., 2012; Silins et al., 2014; Suerken et al., 2016). Graduate degree completion in this sample was associated with being female, which is inconsistent with prior findings that graduate school attrition is highest among women (Baum & Steele, 2017; Dahlin et al., 2007), and being married, which is consistent with research suggesting that marriage might have a protective effect against graduate school dropout (Lott et al., 2009).

Several explanations exist for the lack of an observed prospective relationship between mental health and substance use during college and graduate degree completion. First, substance use and symptoms of anxiety and depression might have declined during the post-college period to levels that were not severe enough to negatively impact academic performance in graduate school. Mental health problems appear to be more prevalent during the college years, with evidence from a study of 81 colleges and universities indicating that about 36% of undergraduate students meet criteria for a

mental health problem in comparison to 26% of master's students and 27% of doctoral students (Lipson et al., 2016).

This study did not account for substance use during the period between college and graduate school, and many college students “mature out” of their hazardous alcohol consumption levels during the post-college years (Arria et al., 2016a; Jackson et al., 2001). Previous research has also found that marijuana use significantly declines in the years after college graduation (Arria et al., 2017a). The entrance into a graduate school program might act as a developmental milestone that marks a decrease in heavy drinking and drug use, similar to college graduation (Arria et al., 2016a), marriage (Eitle et al., 2010), and parenthood (Kerr et al., 2011; Oesterle et al., 2011). Heavy substance use might not be compatible with or accepted in their graduate school environment.

A possible selection effect might be another explanation for the lack of an association, where those who enrolled in graduate school had less mental health problems and engaged in less alcohol and marijuana use during college than those who did not go on to enroll in graduate school. Alcohol use, marijuana use, anxiety, and depression might have led to disengagement from the academic environment during college which could make it more difficult to apply to and be accepted into a graduate program. Additional analyses of this sample revealed that those who enrolled in graduate school had lower scores on the Beck Anxiety Inventory and the Beck Depression Inventory as well as lower prevalence of both alcohol and marijuana abuse and dependence when compared to those who did not go on to pursue a graduate degree, but these differences were not statistically significant. Compared to students without an alcohol use disorder, students with an alcohol use disorder are significantly less likely to have plans to attend

graduate school and are less likely to enroll in graduate school even when they have definite plans to do so (Arria et al., *in preparation*).

A strength of this study was the use of longitudinal cohort data spanning twelve years of young adulthood. However, because the sample was originally from a single university, findings might not be generalizable to other populations of young adults. Additionally, graduate degree completion in this sample was 82%, which is higher than the national average of around 65% (Baum & Steele, 2017). Completion of a graduate degree was only analyzed through Year 12, and students might have completed their graduate degree later on in adulthood. This study also did not account for several factors that might have influenced the relationship between college mental health and substance use and graduate degree completion, particularly variables during the gap before graduate school enrollment and during graduate school, including academic discipline, academic support, and post-college mental health and substance use patterns.

This study contributes to the literature examining the prospective relationship between substance use and mental health during college and graduate school experiences. Results suggest that there are likely a multitude of factors influencing graduate degree completion besides college substance use and mental health. Future studies should continue to explore this relationship, particularly in regards to academic and occupational achievement during the post-college years. Research is needed to examine the continuity of substance use and mental health from college to graduate school as well as how these factors might influence the academic success of graduate students. Of particular value would be multi-campus studies that capture undergraduate and graduate student populations from a wide range of degree types and academic disciplines.

Table 3.1. Sample characteristics, by graduate degree completion

	Completed (<i>n</i> = 424)	Not Completed (<i>n</i> = 96)	Total (<i>n</i> = 520)
	<i>n</i> (Row %)	<i>n</i> (Row %)	<i>n</i> (Column %)
Gender			
Male	152 (74.5)	52 (25.5)	204 (39.2)
Female	272 (86.1)	44 (13.9)	316 (60.8)
Race			
White, Non-Hispanic	299 (84.9)	53 (15.1)	352 (67.7)
Non-White	125 (74.4)	43 (25.6)	168 (32.3)
Marital Status			
Married	196 (89.5)	23 (10.5)	219 (42.1)
Never Married	228 (75.7)	73 (24.3)	301 (57.9)
Children			
Yes	62 (84.9)	11 (15.1)	73 (14.0)
No	362 (81.0)	85 (19.0)	447 (86.0)
Graduate Degree Type			
Masters	287 (80.2)	71 (19.8)	358 (68.8)
Doctorate/Professional	137 (84.6)	25 (15.4)	162 (31.2)
First Year of Graduate School Enrollment			
Year 5 (Modal Age 22)	176 (92.6)	14 (7.4)	190 (36.5)
Year 6 (Modal Age 23)	83 (79.8)	21 (20.2)	104 (20.0)
Year 7 (Modal Age 24)	72 (82.8)	15 (17.2)	87 (16.7)
Year 8 (Modal Age 25)	51 (77.3)	15 (22.7)	66 (12.7)
Year 10 (Modal Age 27)	42 (57.5)	31 (42.5)	73 (14.0)

Note: “Year” refers to study year, where Year 1 was the first year of undergraduate study.

Table 3.2. Behavioral health during college, by graduate degree completion

	Completed (<i>n</i> = 424)	Not Completed (<i>n</i> = 96)	Total (<i>n</i> = 520)
	<i>n</i> (Row %)	<i>n</i> (Row %)	<i>n</i> (Column %)
Alcohol Abuse/Dependence			
Yes	258 (82.4)	55 (17.6)	313 (60.2)
No	166 (80.2)	41 (19.8)	207 (39.8)
Marijuana Abuse/Dependence			
Yes	121 (80.7)	29 (19.3)	150 (28.8)
No	303 (81.9)	67 (18.1)	370 (71.2)
Alcohol Consumption Quantity			
Low/None	56 (72.7)	21 (27.3)	77 (14.8)
Moderate	150 (85.7)	25 (14.3)	175 (33.7)
Binge	178 (81.7)	40 (18.3)	218 (41.9)
High-Intensity	40 (80.0)	10 (20.0)	50 (9.6)
Alcohol Consumption Frequency			
Minimal/No Use	58 (72.5)	22 (27.5)	80 (15.4)
Infrequent Use	125 (80.1)	31 (19.9)	156 (30.0)
Frequent Use	144 (86.2)	23 (13.8)	167 (32.1)
Increasing Use	45 (83.3)	9 (16.7)	54 (10.4)
Near daily Use	52 (82.5)	11 (17.5)	63 (12.1)
Marijuana Use Frequency			
Minimal/No Use	275 (81.4)	63 (18.6)	338 (65.0)
Infrequent Use	82 (82.0)	18 (18.0)	100 (19.2)
Decreasing Use	19 (90.5)	2 (9.5)	21 (4.0)
Increasing Use	30 (81.1)	7 (18.9)	37 (7.1)
Chronic Use	18 (75.0)	6 (25.0)	24 (4.6)
Lifetime History of Anxiety			
Yes	58 (85.3)	10 (14.7)	68 (13.1)
No	366 (81.0)	86 (19.0)	452 (86.9)
Lifetime History of Depression			
Yes	58 (79.5)	15 (20.5)	73 (14.0)
No	366 (81.9)	81 (18.1)	447 (86.0)
	Mean ± SD	Mean ± SD	Mean ± SD
Anxiety Symptoms (BAI Score)	6.52 ± 5.32	6.38 ± 4.70	6.50 ± 5.21
Depression Symptoms (BDI Score)	4.27 ± 3.86	4.76 ± 3.59	4.36 ± 3.81

Note: All quantity and frequency estimates are for past 30-day use. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory.

Table 3.3. Logistic regression models predicting graduate degree completion ($n = 520$)

		Unadjusted Associations		Model 1 ^a		Model 2 ^b		Model 3 ^c	
		OR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Demographic and Graduate Program Characteristics	Gender = Female	2.12	(1.35, 3.31)**	1.88	(1.14, 3.11)*	1.82	(1.08, 3.07)*	1.82	(1.07, 3.10)*
	Race = Non-Hispanic White	1.94	(1.23, 3.05)**	1.62	(0.98, 2.70)	1.36	(0.79, 2.36)	1.35	(0.77, 2.35)
	Marital Status = Married	2.73	(1.65, 4.53)**	1.99	(1.11, 3.57)*	2.10	(1.16, 2.80)*	2.08	(1.15, 3.78)*
	Children = Yes	1.32	(0.67, 2.62)	0.70	(0.32, 1.56)	0.72	(0.32, 1.62)	0.73	(0.32, 1.66)
	Degree Type = Doctorate/Professional	1.36	(0.82, 2.23)	0.72	(0.40, 1.30)	0.71	(0.39, 1.29)	0.71	(0.39, 1.29)
	First Year of Graduate School Enrollment								
	Year 5 (Modal Age 22)	9.23	(4.54, 18.97)**	8.65	(3.82, 19.59)**	9.22	(4.00, 21.28)**	9.19	(3.96, 21.34)**
	Year 6 (Modal Age 23)	2.92	(1.50, 5.68)**	2.80	(1.35, 5.82)**	2.72	(1.29, 5.74)**	2.74	(1.30, 5.78)**
	Year 7 (Modal Age 24)	3.54	(1.72, 7.31)**	3.76	(1.74, 8.13)**	3.76	(1.71, 8.29)**	3.80	(1.72, 8.39)**
	Year 8 (Modal Age 25)	2.51	(1.20, 5.26)*	2.34	(1.07, 5.12)*	2.11	(0.95, 4.69)	2.13	(0.95, 4.75)
	Year 10 (Modal Age 27)	Reference		Reference		Reference		Reference	
Mental Health in College	Anxiety Symptoms	1.01	(0.96, 1.05)	1.02	(0.96, 1.08)	-	-	1.01	(0.95, 1.07)
	Depression Symptoms	0.97	(0.92, 1.02)	0.97	(0.90, 1.04)	-	-	0.99	(0.91, 1.07)
Substance Use in College	Alcohol Quantity			-	-				
	Low/None	Reference		-	-	Reference		Reference	
	Moderate	2.25	(1.17, 4.34)*	-	-	1.47	(0.49, 4.37)	1.46	(0.49, 4.36)
	Binge	1.67	(0.91, 3.06)	-	-	0.98	(0.29, 3.33)	0.97	(0.28, 3.31)
	High-Intensity	1.50	(0.64, 3.53)	-	-	0.94	(0.22, 4.05)	0.93	(0.21, 4.01)
	Alcohol Frequency			-	-				
	Minimal/No Use	Reference		-	-	Reference		Reference	
	Infrequent Use	1.53	(0.82, 2.87)	-	-	1.19	(0.40, 3.49)	1.19	(0.40, 3.51)
	Frequent Use	2.38	(1.23, 4.59)*	-	-	2.56	(0.73, 8.96)	2.52	(0.71, 8.87)
	Increasing Use	1.90	(0.80, 4.52)	-	-	1.71	(0.44, 6.66)	1.69	(0.43, 6.61)
	Near Daily Use	1.79	(0.79, 4.05)	-	-	2.23	(0.54, 9.32)	2.20	(0.52, 9.23)
	Marijuana Frequency			-	-				
	Minimal/No Use	Reference		-	-	Reference		Reference	
	Infrequent Use	1.04	(0.59, 1.86)	-	-	1.02	(0.52, 2.01)	1.03	(0.52, 2.02)
	Decreasing Use	2.18	(0.49, 9.59)	-	-	1.45	(0.30, 6.94)	1.48	(0.31, 7.17)
	Increasing Use	0.98	(0.41, 2.34)	-	-	1.10	(0.42, 2.89)	1.10	(0.42, 2.89)
	Chronic Use	0.69	(0.26, 1.80)	-	-	0.71	(0.24, 2.14)	0.72	(0.24, 2.17)

* $p < 0.05$; ** $p < 0.01$; ^aRelationships between mental health variables and graduate degree completion after adjusting for demographic and program characteristics;

^bRelationships between substance use variables and graduate degree completion after adjusting for demographic and program characteristics; ^cRelationships between mental health and substance use variables and graduate degree completion after adjusting for all other study variables

Chapter 4: Manuscript #2: Substance use and mental health problems among graduate students: Individual and program-level correlates

Introduction

Substance use and mental health problems are associated with significant burdens to individuals and their families (Baggio et al., 2015; Danielsson et al., 2015; Fergusson & Boden, 2008; Fergusson et al., 2015; Kawakami et al., 2012; Lee et al., 2015; Rehm et al., 2010; Viner & Taylor, 2007; World Health Organization, 2012). Young adulthood is a peak stage for the development of behavioral health problems, including generalized anxiety disorder and major depression (Kessler et al., 2005), as well as alcohol and marijuana use disorders (Haberstick et al., 2014). Several studies have focused on the prevalence of substance use and mental health problems among undergraduate students (Lipson et al., 2015; Schulenberg et al., 2017). Our understanding of the magnitude and correlates of behavioral health issues among graduate students is more limited, despite the overlap between typical age at graduate school enrollment and age of onset for many behavioral health problems. However, there is a growing interest in understanding the service needs of graduate students (Evans et al., 2018), considering the possible impact on academic achievement (Kelly et al., 2015; Kessler et al., 1995; Mojtabai et al., 2015; Suerken et al., 2016), as well as social and occupational functioning.

Each year, about three million students are enrolled in graduate programs in the US, and enrollment is projected to increase to 3.3 million students by 2026 (McFarland et al., 2017). Although they share the commonality of wanting to pursue further academic study, graduate students are highly diverse in terms of demographic characteristics (Okahana & Zhou, 2017). Furthermore, the number of fields for which one can pursue a

master's or doctoral degree is vast and growing. The degree to which these individual and program-level characteristics are associated with behavioral health outcomes is largely unknown. Gaining a deeper understanding of these correlates might help in identifying particular subgroups of students who are at high risk for behavioral health problems or in need of additional services.

Graduate students might be at lower risk for substance use and mental health difficulties because they have a history of succeeding academically, an outcome less likely for those struggling with behavioral health issues (Kelly et al., 2015; Kessler et al., 1995; Mojtabai et al., 2015; Suerken et al., 2016). However, many graduate students face interpersonal challenges related to questioning the self-efficacy of achieving traditionally “important” positions in society. While task demands differ by program, graduate students are challenged to think critically, work autonomously, and take on a multitude of service and teaching responsibilities in addition to their academic studies that can contribute to high levels of stress, anxiety, social isolation, and self-doubt (Lovitts, 2001). While transitioning to adult roles and responsibilities, such as marriage and parenthood, appears to reduce the risk for substance use (Eitle et al., 2010; Haberstick et al., 2014; Kerr et al., 2011; Oesterle et al., 2011; Stone et al., 2012), it is unclear whether graduate school enrollment also acts as one of these developmental transitions and has a similar association with decreased substance use.

Different disciplines and degree types might attract students with different predispositions for behavioral health problems, and each program has its own unique set of stressors. A handful of studies have been done on the association between academic discipline and graduate student mental health. Stress, depression, and anxiety appear to

be more prevalent among students in the fields of business or humanities compared with medicine and other health professional programs (Dahlin et al., 2011; Hyun et al., 2006; Lipson et al., 2016). However, limitations of these studies include the evaluation of only two academic disciplines (Dahlin et al., 2011), the assessment of only general emotional distress (Hyun et al., 2006), or the exclusion of diagnosed mental health disorders (Lipson et al., 2016).

The majority of existing research on graduate student substance use has utilized small samples of students from a small range of academic disciplines, with little comparison across degree types or areas of study. Higher prevalence estimates of past-year alcohol consumption have been found in studies of medical and pharmacy students (Bidwal et al., 2015; English et al., 2011; Shah et al., 2009) as compared with studies that also included students from other academic disciplines (Kernan et al., 2011), suggesting that alcohol consumption might be more common among health professional students than those in other programs. Marijuana use has typically been studied among samples of health professional students, with past-year use prevalence estimates of about 12% to 14% (Bidwal et al., 2015; Shah et al., 2009).

The nonmedical use of prescription stimulants has been primarily assessed among samples of medical and other health professional students, with estimated lifetime prevalence ranging from 9 to 15% (Bidwal et al., 2015; Bucher et al., 2013; McNiel et al., 2011; Tuttle et al., 2010; Wasserman et al., 2014). The majority of graduate students cite improving attention, concentration, and academic performance as the most common or important reasons for using prescription stimulants nonmedically (Bidwal et al., 2015; McNiel et al., 2011; Tuttle et al., 2010), suggesting that academic stress and pressure are

primary motivations for use. However, studies among samples of health professional students have found no relationship between stress and nonmedical use of prescription stimulants (McNiel et al., 2011; Wasserman et al., 2014). In contrast, a study by Verdi et al. (2016) surveyed graduate students from a diverse range of academic disciplines and found not only a higher lifetime prevalence of nonmedical use of prescription stimulants (18%) but also a significant correlation between anxiety and stress levels with nonmedical use of prescription stimulants. Further exploration into these possible differences by academic discipline and degree type is needed and the nonmedical use of other classes of prescription drugs, including analgesics, tranquilizers, and sedatives, are important to study given recent increases in past-month prevalence among young adults (Schulenberg et al., 2017).

Besides discipline and degree type, different demographic subpopulations of graduate students might be at increased risk for behavioral health problems, similar to adults in the general population. Being male and non-Hispanic white are associated with substance abuse and dependence among the general population (Anthony et al., 1994; Farmer et al., 2015; Haberstick et al., 2014). Being female and non-Hispanic white are associated with anxiety and mood disorders (Kessler et al., 2005). Similar correlates have been found among graduate students, with being male, younger, and unmarried associated with substance use (English et al., 2011; Jackson et al., 2016; Shah et al., 2009) and being female, non-Hispanic white, older, and unmarried associated with mental health disorders (Eisenberg et al., 2007; Hyun et al., 2006; Levecque et al., 2017).

A closer examination of whether or not students in certain graduate programs are at elevated risk for behavioral health problems is warranted because it can inform the

need for targeted service delivery. This study aimed to evaluate the associations between demographic and program characteristics, particularly degree type and academic discipline, with substance use (i.e., alcohol consumption, marijuana use, and the nonmedical use of prescription drugs) and mental health problems (i.e., lifetime diagnosis of anxiety and depression; and current levels of stress, anxiety, and depression symptoms) among graduate students.

Methods

Study Sample

Sampling frame eligibility consisted of all master's and doctoral students ages 18 and older who were enrolled at two large, public universities in the mid-Atlantic region of the US. Combining both universities, the sampling frame was 56% female and 41% white with 48% of students enrolled in master's programs and 47% enrolled in doctoral programs. The remaining 5% were graduate certificate and advanced special students. When compared with the overall graduate student population in the US (Okahana & Zhou, 2017), this sampling frame was similar with respect to gender but was more racially diverse. In addition, the sampling frame had a much higher prevalence of doctoral students than the overall U.S. graduate student population.

Data Collection Procedures

In the fall of 2017, an online survey consisting of an eligibility screener and 64 survey questions was sent to all currently enrolled graduate students at both universities ($n=16,775$). Data collection was open for one month, and three reminder emails were sent

weekly after the initial recruitment email. Participants could choose to enter themselves into a raffle, and 350 participants were randomly selected to receive a \$10 gift card. Informed consent was obtained online by $n=4,318$ students and 4% were excluded because they did not meet eligibility criteria ($n=643$). There were 2,683 completed responses and 992 partially completed responses, representing a response rate of 23%. The research was approved by the Institutional Review Boards at both participating universities.

Measures

Demographic and Program Characteristics

Demographic Characteristics. Standard measures 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.

Degree Type. 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.). If students were seeking more than one degree, they were asked to choose their highest level of degree program.

Time Enrolled. Participants indicated how many semesters they had been enrolled in their graduate degree program, including the current semester. This variable was recoded into a three-level categorical variable with response options including less than a year, 1-2 years, and more than two years.

Academic Discipline. Based on the characterization of academic areas by Biglan (1973), the academic discipline that participants originally reported was recoded into a

four-level variable: 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).

Student Status. Participants indicated whether they were currently enrolled in their program full or part-time.

Anticipated Program Length. The expected number of years for completion of their graduate degree was reported and recoded into a three-level categorical variable: 1-2 years, 3-5 years, and six or more years.

Mental Health

Lifetime Diagnosis of Anxiety. Participants self-reported if they had ever been diagnosed with anxiety by a health professional in their lifetime.

Anxiety Symptoms. The 21-item Beck Anxiety Inventory [BAI; (Beck et al., 1988a)] was used to assess current anxiety symptoms. Participants ranked how much they have been bothered during the past week by each item ranging from 0 (not at all) to 3 (severely, can barely stand it). Possible scores on the BAI range from 0 to 63, with higher scores indicating higher levels of anxiety symptoms. Based on existing clinical cutoffs, BAI scores are classified as no (0 to 7), mild (8 to 15), moderate (16 to 25), or severe (26 or higher) anxiety symptoms (Beck & Steer, 1990). Anxiety symptoms were analyzed as a dichotomous variable representing presence of moderate or severe anxiety symptoms.

Lifetime Diagnosis of Depression. Participants self-reported if they had ever been diagnosed with depression by a health professional in their lifetime.

Depression Symptoms. The Beck Depression Inventory [BDI; (Beck et al., 1996)] was used to assess current depression symptoms using a series of 21 statements about how participants have been feeling during the past few days. Possible BDI scores range from 0 to 63, with higher scores indicating increased depression symptoms. Based on existing clinical cutoffs, BDI scores are classified as minimal (0 to 13), mild (14 to 19), moderate (20 to 28), or severe (29 or higher) depression symptoms (Beck et al., 1996). Depression symptoms were analyzed as a dichotomous variable representing presence of moderate or severe depression symptoms.

Perceived Stress. Stress was assessed using the 10-item Perceived Stress Scale [PSS; (Cohen et al., 1983)], which rates items on a 5-point scale ranging from never (0) to very often (4). PSS scores range from 0 to 40, with higher scores indicating higher levels of stress. Due to non-normality, stress was analyzed as a dichotomous variable. PSS scores were put into approximate quartiles (Redmond et al., 2013), with scores of 24 and higher (the upper quartile) classified as high levels of stress.

Substance Use

Alcohol Consumption. The frequency of alcohol consumption was measured by the number of days during the past 12 months that alcohol was consumed. Participants who had at least one drink during the past 12 months were asked how many drinks they consumed on a typical day when they drank during the past 12 months. A dichotomous variable was computed to represent high-risk alcohol consumption. High-risk drinking

was operationalized as drinking at least once a month during the past 12 months with a typical quantity of five drinks or more for men and four drinks or more for women, which is an adaptation of the definition of binge drinking (Center for Behavioral Health Statistics and Quality, 2017b).

Marijuana Use. The frequency of marijuana use was assessed by the number of days participants had used marijuana during the past 12 months and recoded into a dichotomous variable (use/non-use).

Nonmedical Use of Prescription Drugs. Participants were provided with a definition of nonmedical use as “the intentional use of a medication without a prescription, in a way other than as prescribed, or for the experience or feeling it causes” (National Institute on Drug Abuse, 2018). Four separate questions were used to measure frequency of nonmedical use of each class of prescription drugs (stimulants, analgesics, tranquilizers, and sedatives) by assessing the number of days used during the past 12 months. A dichotomous variable was computed to represent past-year nonmedical use/non-use of prescription drugs.

Statistical Analyses

Analyses for this study utilized the 2,683 completed responses. Missing data were found in 754 of these responses (28%) on at least one variable of interest, and comparisons between complete and non-complete cases revealed that the data were not missing at random. Missing data were handled using multiple imputation of five complete datasets, incorporating all study variables, and statistics were obtained by averaging the results across all imputed datasets.

The distributions of all variables were assessed using descriptive statistics. Multivariate logistic regression models were used to predict high stress levels, anxiety symptoms, depression symptoms, lifetime diagnosis of anxiety, lifetime diagnosis of depression, high-risk alcohol consumption, marijuana use, and the nonmedical use of prescription drugs from each individual demographic and program characteristic variable while adjusting for all other demographic and program characteristics.

SPSS Version 24.0 was used for all analyses, and the alpha level was set at 0.05.

Results

Sample Characteristics

Table 4.1 characterizes the sample of graduate students studied ($n=2,683$). Participants ranged in age from 20 to 65 years old with an average age of 28. The majority of the sample was female (63%), non-Hispanic white (59%), never married (73%), and did not have children (89%). Almost one-fifth were international students (18%). Forty-four percent of the sample was enrolled in a master's degree program, 39% in an academic doctoral program, and 17% in a professional doctoral program. The majority of students were enrolled in their program full-time (85%) and for less than two years (73%). Students who were pursuing a degree in a social-applied discipline comprised the largest proportion of the sample (41%), followed by natural-applied (27%), social-pure (17%), and natural-pure (15%).

Prevalence of Stress, Anxiety, and Depression

Twenty-one percent of students had been diagnosed with anxiety in their lifetime (see Table 4.2), and scores on the BAI were significantly higher among students with a history of an anxiety diagnosis (15.77) versus those with no history of anxiety (8.63; data not shown). Twenty percent of students had been diagnosed with depression, and scores on the BDI were significantly higher among students with diagnosed depression (14.93) versus those with no history of depression (8.54; data not shown).

Almost a quarter (23%) of students had current moderate or severe anxiety symptoms and 13% of students had current moderate or severe depression symptoms. The top quartile of the sample for PSS score ($n=661$) had a mean score of 27.8 (data not shown).

Prevalence of Substance Use

Most of the sample (85%) drank alcohol during the past 12 months. Among drinkers, the average frequency was 71 days with a mean typical quantity of 2 drinks per drinking day (data not shown). High-risk alcohol consumption was fairly uncommon, with only 7% of the sample classified as high-risk drinkers (see Table 4.2). Twenty percent of the sample used marijuana during the past 12 months, albeit infrequently, with a median past-year frequency of 6 days (data not shown). Nonmedical use of prescription drugs was uncommon, with 7% of the sample engaging in any past-year nonmedical use. The most common type of prescription drug used nonmedically was prescription stimulants (4%), followed by tranquilizers (3%), analgesics (2%), and sedatives (2%). Among students who engaged in nonmedical use, the median past-year frequency of

nonmedical use of prescription stimulants, tranquilizers, analgesics, and sedatives among users during the past 12 months was 10 days, 5 days, 5 days, and 10 days, respectively (data not shown).

Variation by Degree Type and Academic Discipline

Tables 4.3 and 4.4 present the adjusted associations between demographic and program characteristics and the mental health and substance use of graduate students. In general, students enrolled in professional doctoral degree programs and those in the social-pure disciplines had the highest prevalence of behavioral health problems. When compared with those enrolled in academic doctoral degree programs, students in professional doctoral degree programs were significantly more likely to have high stress levels and moderate or severe anxiety symptoms as well as engage in marijuana use and high-risk alcohol consumption. Master's students were also more likely to have moderate or severe anxiety symptoms as well as use marijuana when compared with academic doctoral students.

Students in the natural-applied disciplines were used as the reference group for analyses of mental health and substance use variation by academic discipline. Students in the natural-pure disciplines were more likely to have moderate or severe anxiety symptoms and past-year marijuana use. Students in the social-pure disciplines were more likely to have a lifetime diagnosis of both anxiety and depression; high stress; moderate or severe anxiety symptoms; and past-year high-risk alcohol consumption, marijuana use, and nonmedical use of prescription drugs. Students in the social-applied disciplines were

more likely to have a lifetime diagnosis of both anxiety and depression, moderate or severe anxiety symptoms, and past-year marijuana use.

Demographic and Program-Level Correlates

Females were significantly more likely than males to have any mental health problem as well as engage in past-year nonmedical use of prescription drugs, and males were more likely than females to engage in past-year high-risk alcohol consumption and marijuana use. International students were less likely than domestic students to report mental health problems or past-year marijuana use. In general, graduate students who were married or had children had less substance use and mental health problems when compared with unmarried students or students without children.

Stress appeared to increase as time enrolled in a program increased, and students with a higher anticipated program length had increased odds of lifetime mental health diagnoses as well as moderate or severe anxiety symptoms when compared with those who anticipated their program would only take them 1 to 2 years.

Discussion

This cross-sectional study examined the correlates of behavioral health problems among a diverse sample of graduate students. Degree type and academic discipline were frequently associated with mental health and substance use. Students in the social-pure disciplines, which included behavioral and social sciences and arts and humanities, had the highest prevalence of current stress and depression symptoms as well as the highest prevalence of lifetime diagnoses of both anxiety and depression. Explanations for this

difference might be possible genetic and environmental factors that predispose students to certain intellectual interests as well as the development of mental health disorders. Undergraduate students interested in the humanities, similar to students enrolled in social-pure disciplines in the current study, are more likely to report having a family member with major depressive disorder than students in other majors (Campbell & Wang, 2012). A notable study by Lipson et al. (2016) found that master's students in the humanities and art and design programs had the highest prevalence of depression as compared with master's students in other disciplines, and doctoral students in the same fields had the highest prevalence of anxiety as compared with doctoral students in other disciplines. It has been suggested that students in the arts and humanities face a unique set of stressors surrounding making unique contributions to the field and pressure towards creativity, innovation, and originality (Lipson et al., 2016).

Degree type also appears to play a role in differences in mental health and substance use, with professional doctoral students more likely to engage in high-risk alcohol consumption and marijuana use and have current symptoms of stress and anxiety than academic doctoral students. This finding contradicts results from an earlier study that found no differences in alcohol consumption between clinical and non-clinical students and higher prevalence of drug use among non-clinical students (Kernan et al., 2011). Each type of doctoral program has a unique set of stressors that might influence mental health and substance use, and there might also be unknown behavioral health correlates among these graduate student subgroups that were not explored in this and prior studies.

Not surprisingly, female students were more likely to have mental health problems than male students, which is consistent with prior work among general adult (Kessler et al., 2005) and graduate student samples (Eisenberg et al., 2007; Hyun et al., 2006). Male students were more likely to engage in high-risk alcohol consumption and marijuana use than female students, affirming the gender gap in regards to substance abuse and dependence (Anthony et al., 1994; Haberstick et al., 2014). Other studies of graduate student samples have found similar gender effects (English et al., 2011; Frank et al., 2008; Shah et al., 2009).

Marriage and children had a protective effect against mental health and substance use problems, consistent with prior findings that graduate students with children have lower odds of having or developing a psychiatric disorder (Levecque et al., 2017) and that marriage and parenthood are associated with lower levels of substance use (Eitle et al., 2010; Haberstick et al., 2014; Kerr et al., 2011; Oesterle et al., 2011; Stone et al., 2012). This buffering effect is likely due to the incompatibility of substance use with these adult social roles. Other studies that examined the relationship between marriage and children with the substance use of graduate students have found similar results (English et al., 2011; Jackson et al., 2016; Shah et al., 2009).

This study has several strengths, including a large sample of graduate students from a wide range of degree types and academic disciplines. However, results should be interpreted in light of the study's limitations. The study sample included graduate students from only two universities, so results might not be generalizable to other graduate student populations. This sample reported a higher lifetime prevalence of both anxiety and depression diagnoses than other samples of graduate students (Bidwal et al.,

2015; Wyatt & Oswalt, 2013), and marijuana use among this sample was more prevalent than in studies of health professional students (Bidwal et al., 2015; Shah et al., 2009). The current sample also underrepresented graduate students from minority racial and ethnic groups as well as overrepresented students enrolled in doctoral programs, when compared with both the sampling frame and the national graduate student population (Okahana & Zhou, 2017). The response rate for this study was 23%, and there might have been differences between responders and nonresponders on demographic characteristics, program characteristics, and health variables of interest. While validated instruments were used, substance use and mental health estimates were self-reported and subject to social desirability bias (Van de Mortel, 2008).

Information on other substance use and mental health risk factors, such as genetics, family history, personality, emotional regulation, and sensation seeking, were not assessed and therefore not controlled for in this study, which might have affected results and should be the subject of future research. The cross-sectional nature of this study did not allow for assessment of changes in mental health and substance use over time, and future studies should focus on understanding behavioral health patterns throughout the duration of graduate education. These changes might be influenced by stressful life events both internal (e.g., change in advisor, academic struggles) and external (e.g., death in the family, financial problems) to graduate study that might trigger more severe periods of anxiety, depression, and substance use.

This study adds to the literature on individual and program-level correlates of substance use and mental health problems among graduate students. While risky substance use was infrequent and occurred among a minority of the sample, future

research should focus on how to effectively intervene with these high-risk students in order to promote student health and success. The lower estimates of substance use observed in this study might represent a developmental shift toward achieving adult milestones, and only future research that compares the trajectories of same age students, some who go on to pursue graduate studies and others who do not, can answer such questions. The correlates of less severe alcohol consumption, particularly moderate alcohol consumption, should also be explored.

The high levels of stress and the prevalence of anxiety and depression among this sample highlight the need for colleges and universities to address the issue of graduate student mental health throughout the duration of the graduate program and ensure that graduate students are aware of the mental health resources available to them. Results affirm the need for continued research in this area, particularly longitudinal research that examines the effects of substance use and mental health on the academic achievement of graduate students.

Table 4.1. Sample characteristics, by degree type and academic discipline (n=2,683)

	Total Sample	Degree Type			Academic Discipline			
		Master's	Academic Doctoral	Professional Doctoral	Natural-Pure	Natural-Applied	Social-Pure	Social-Applied
Total Sample n (Row %)	2,683 (100.0)	1,187 (44.2)	1,039 (38.7)	457 (17.0)	403 (15.0)	725 (27.0)	459 (17.1)	1,096 (40.8)
	Column %	Column %	Column %	Column %	Column %	Column %	Column %	Column %
Age								
20 to 25 years old	42.8	50.5	27.8	56.7	39.5	54.5	30.5	41.4
26+ years old	57.2	49.5	72.2	43.3	60.5	45.5	69.5	58.6
Sex								
Male	37.4	34.2	43.6	31.9	54.1	44.8	29.8	29.7
Female	62.6	65.8	56.4	68.1	45.9	55.2	70.2	70.3
Race/Ethnicity								
Non-Hispanic white	58.6	54.1	63.1	60.0	66.3	51.1	69.2	56.3
Non-Hispanic other race	31.7	35.9	26.9	31.6	24.7	41.0	19.6	33.2
Hispanic/Latino	4.9	5.5	4.9	3.1	6.0	3.5	4.7	5.5
More than one race/ethnicity	4.8	4.5	5.0	5.3	3.0	4.4	6.5	5.1
International Student								
Yes	17.9	19.7	22.6	2.8	24.8	22.2	12.0	15.1
No	82.1	80.3	77.4	97.2	75.2	77.8	88.0	84.9
Employment Status								
Not currently employed	21.7	25.0	6.4	48.0	7.2	34.9	8.7	23.8
Employed part-time	15.8	21.5	6.0	23.3	3.0	21.3	10.0	19.3
Employed full-time	18.9	25.9	14.4	11.2	11.2	12.6	18.1	26.4
University assistantship	43.6	27.6	73.2	17.5	78.7	31.3	63.2	30.6
Marital Status								
Never married	72.7	75.9	68.0	74.8	73.0	77.5	72.3	69.6
Married	24.9	21.6	29.7	22.5	24.8	20.5	25.3	27.7
Widowed/divorced/separated	2.4	2.5	2.2	2.6	2.2	2.1	2.4	2.7
Household Income								
Less than \$25,000	44.1	48.6	32.1	60.1	36.1	49.5	45.8	42.9
\$25,000-\$50,000	24.4	19.3	34.7	14.1	38.6	25.7	22.2	19.2
\$50,000-\$100,000	18.2	19.0	18.8	14.9	17.1	13.7	22.0	20.0
More than \$100,000	13.2	13.2	14.3	10.9	8.2	11.0	10.0	17.9

	Total Sample	Degree Type			Academic Discipline			
		Master's	Academic Doctoral	Professional Doctoral	Natural-Pure	Natural-Applied	Social-Pure	Social-Applied
Total Sample n (Row %)	2,683 (100.0)	1,187 (44.2)	1,039 (38.7)	457 (17.0)	403 (15.0)	725 (27.0)	459 (17.1)	1,096 (40.8)
	Column %	Column %	Column %	Column %	Column %	Column %	Column %	Column %
Children								
Yes	10.8	10.4	12.3	8.4	7.2	9.4	9.6	13.5
No	89.2	89.6	87.7	91.6	92.8	90.6	90.4	86.5
Degree Type								
Master's degree	44.2	-	-	-	15.4	27.9	34.2	69.9
Academic doctoral degree	38.7	-	-	-	77.9	32.7	58.4	20.1
Professional doctoral degree	17.0	-	-	-	6.7	39.4	7.4	10.0
Time Enrolled								
Less than a year	29.6	40.9	18.1	26.3	18.4	28.8	25.7	35.8
1 to 2 years	43.4	51.4	32.4	47.5	31.8	43.3	37.3	50.3
More than 2 years	27.0	7.7	49.5	26.3	49.9	27.9	37.0	13.9
Academic Discipline								
Natural-Pure	15.0	5.2	30.2	5.9	-	-	-	-
Natural-Applied	27.0	17.0	22.8	62.6	-	-	-	-
Social-Pure	17.1	13.2	25.8	7.4	-	-	-	-
Social-Applied	40.8	64.5	21.2	24.1	-	-	-	-
Student Status								
Full-time	84.9	76.9	91.9	89.9	94.3	90.3	88.0	76.6
Part-time	15.1	23.1	8.1	10.1	5.7	9.7	12.0	23.4
Anticipated Program Length								
1 to 2 years	33.5	71.1	4.1	2.5	9.4	25.2	27.2	50.5
3 to 5 years	49.9	27.8	58.5	87.8	48.1	65.3	41.9	43.7
6 or more years	16.6	1.1	37.4	9.7	42.4	9.5	30.8	5.8

Note. Percentages might not add up to sample totals due to the rounding of pooled estimates.

Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

Table 4.2. Substance use and mental health, by degree type and academic discipline ($n=2,683$)

	Total Sample ($n=2,683$)	Degree Type			Academic Discipline			
		Master's	Academic Doctoral	Professional Doctoral	Natural-Pure	Natural-Applied	Social-Pure	Social-Applied
Total Sample n (Row %)	2,683 (100.0)	1,187 (44.2)	1,039 (38.7)	457 (17.0)	403 (15.0)	725 (27.0)	459 (17.1)	1,096 (40.8)
	Column %	Column %	Column %	Column %	Column %	Column %	Column %	Column %
Mental Health								
High Stress Level	24.6	21.5	25.4	30.9	27.8	23.8	31.8	21.0
Lifetime Anxiety Diagnosis	20.8	21.5	20.2	20.6	17.4	14.6	28.1	23.1
Moderate/Severe Anxiety Symptoms	22.6	24.8	17.9	27.3	20.4	19.5	24.1	24.7
Lifetime Depression Diagnosis	20.0	19.8	21.9	16.1	20.0	12.9	25.1	22.5
Moderate/Severe Depression Symptoms	12.9	12.1	13.2	14.2	14.4	12.1	17.1	11.1
Substance Use								
High-Risk Alcohol Consumption	6.7	8.2	4.2	8.6	4.5	6.3	8.3	7.2
Marijuana Use	20.3	21.5	19.0	20.3	23.3	12.6	27.2	21.4
Nonmedical Use of Prescription Drugs	7.1	6.6	6.6	9.5	5.7	6.2	9.4	7.2

Note. Percentages might not add up to sample totals due to the rounding of pooled estimates.

Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

High Stress Level is defined as a score of 24 or higher on the Perceived Stress Scale; Moderate/Severe Anxiety is defined as a score of 16 or higher on the Beck Anxiety Inventory; Moderate/Severe Depression is defined as a score of 20 or higher on the Beck Depression Inventory.

All substance use variables assess use during the past 12 months.

High-Risk drinkers drank alcohol at least once a month during the past 12 months and had a typical quantity of five or more drinks for men or four or more drinks for women. Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Table 4.3. Results of logistic regression models on the associations between demographic and program characteristics and mental health problems among graduate students ($n = 2,683$)

	High Stress Level	Lifetime Anxiety Diagnosis	Moderate/Severe Anxiety Symptoms	Lifetime Depression Diagnosis	Moderate/Severe Depression Symptoms
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age					
20-25 years old	Reference	Reference	Reference	Reference	Reference
26+ years old	1.16 (0.93, 1.45)	1.40 (1.10, 1.77)*	1.08 (0.86, 1.36)	1.90 (1.49, 2.44)*	1.31 (0.99, 1.74)
Sex					
Male	Reference	Reference	Reference	Reference	Reference
Female	1.50 (1.23, 1.83)*	1.94 (1.55, 2.42)*	1.53 (1.23, 1.89)*	1.54 (1.23, 1.92)*	1.56 (1.20, 2.03)*
Race/Ethnicity					
Non-Hispanic white	Reference	Reference	Reference	Reference	Reference
Non-Hispanic other race	0.96 (0.76, 1.22)	0.46 (0.35, 0.60)*	1.17 (0.92, 1.48)	0.51 (0.39, 0.68)*	0.88 (0.65, 1.19)
Hispanic/Latino	1.00 (0.64, 1.55)	0.68 (0.42, 1.09)	1.31 (0.83, 2.06)	0.70 (0.43, 1.14)	0.81 (0.45, 1.48)
More than one race/ethnicity	1.06 (0.70, 1.62)	0.76 (0.49, 1.18)	0.92 (0.58, 1.46)	0.93 (0.60, 1.43)	1.15 (0.69, 1.91)
International Student					
Yes	Reference	Reference	Reference	Reference	Reference
No	1.44 (1.06, 1.96)*	1.72 (1.17, 2.52)*	1.08 (0.79, 1.46)	2.59 (1.70, 3.92)*	1.01 (0.69, 1.48)
Employment Status					
Not currently employed	Reference	Reference	Reference	Reference	Reference
Employed part-time	1.05 (0.77, 1.42)	0.89 (0.65, 1.23)	1.29 (0.96, 1.73)	1.10 (0.79, 1.55)	1.17 (0.79, 1.73)
Employed full-time	0.92 (0.64, 1.32)	0.66 (0.45, 0.96)*	0.92 (0.64, 1.33)	0.79 (0.54, 1.17)	1.22 (0.78, 1.91)
University assistantship	1.01 (0.76, 1.32)	0.69 (0.51, 0.93)*	0.85 (0.64, 1.12)	0.84 (0.61, 1.14)	0.97 (0.68, 1.39)
Marital Status					
Never married	1.00 (0.76, 1.32)	1.36 (1.01, 1.84)*	0.97 (0.72, 1.30)	1.31 (0.97, 1.76)	1.34 (0.93, 1.94)
Married	Reference	Reference	Reference	Reference	Reference
Widowed/Divorced/Separated	1.74 (0.98, 3.09)	1.35 (0.72, 2.52)	0.89 (0.46, 1.73)	1.96 (1.10, 3.50)*	2.06 (1.06, 4.01)*
Household Income					
Less than \$25,000	1.28 (0.88, 1.86)	0.75 (0.51, 1.08)	1.22 (0.83, 1.79)	0.82 (0.56, 1.20)	1.50 (0.92, 2.46)
\$25,000-\$50,000	1.59 (1.10, 2.29)*	0.88 (0.61, 1.28)	1.42 (0.97, 2.08)	0.91 (0.63, 1.32)	1.52 (0.94, 2.47)
\$50,000-\$100,000	1.26 (0.88, 1.79)	0.89 (0.63, 1.26)	1.26 (0.87, 1.82)	0.87 (0.61, 1.23)	1.22 (0.77, 1.94)
More than \$100,000	Reference	Reference	Reference	Reference	Reference
Children					
Yes	Reference	Reference	Reference	Reference	Reference
No	1.85 (1.27, 2.69)*	1.53 (1.04, 2.23)*	1.95 (1.29, 2.95)*	1.14 (0.80, 1.62)	1.11 (0.70, 1.75)

	High Stress Level	Lifetime Anxiety Diagnosis	Moderate/Severe Anxiety Symptoms	Lifetime Depression Diagnosis	Moderate/Severe Depression Symptoms
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Degree Type					
Master's degree	1.25 (0.90, 1.74)	1.34 (0.96, 1.89)	1.65 (1.18, 2.32)*	1.23 (0.88, 1.73)	1.34 (0.89, 2.01)
Academic doctoral degree	Reference	Reference	Reference	Reference	Reference
Professional doctoral degree	1.60 (1.17, 2.21)*	1.04 (0.74, 1.48)	1.70 (1.21, 2.38)*	0.76 (0.53, 1.09)	1.28 (0.85, 1.92)
Time Enrolled					
Less than a year	Reference	Reference	Reference	Reference	Reference
1-2 years	1.56 (1.24, 1.96)*	1.01 (0.80, 1.28)	1.08 (0.86, 1.34)	0.94 (0.73, 1.20)	1.29 (0.96, 1.73)
More than 2 years	1.60 (1.19, 2.15)*	0.91 (0.66, 1.25)	0.84 (0.61, 1.15)	0.99 (0.72, 1.36)	1.26 (0.87, 1.84)
Academic Discipline					
Natural-Pure	1.25 (0.90, 1.73)	1.20 (0.82, 1.75)	1.52 (1.07, 2.17)*	1.39 (0.95, 2.02)	1.26 (0.83, 1.89)
Natural-Applied	Reference	Reference	Reference	Reference	Reference
Social-Pure	1.45 (1.07, 1.96)*	1.87 (1.34, 2.61)*	1.63 (1.17, 2.26)*	1.56 (1.11, 2.20)*	1.37 (0.94, 1.99)
Social-Applied	0.94 (0.72, 1.23)	1.59 (1.19, 2.12)*	1.42 (1.08, 1.87)*	1.67 (1.24, 2.24)*	0.88 (0.63, 1.23)
Student Status					
Full-time	1.16 (0.84, 1.61)	1.32 (0.93, 1.86)	1.30 (0.92, 1.82)	1.49 (1.05, 2.12)*	1.11 (0.74, 1.67)
Part-time	Reference	Reference	Reference	Reference	Reference
Anticipated Program Length					
1-2 years	Reference	Reference	Reference	Reference	Reference
3-5 years	1.11 (0.82, 1.50)	1.40 (1.02, 1.90)*	1.38 (1.02, 1.88)*	1.52 (1.11, 2.08)*	1.24 (0.85, 1.81)
6+ years	1.46 (0.97, 2.20)	1.83 (1.18, 2.84)*	1.48 (0.96, 2.31)	1.74 (1.12, 2.70)*	1.57 (0.94, 2.64)

* $p < 0.05$

Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

High Stress Level is defined as a score of 24 or greater on the Perceived Stress Scale; Moderate/Severe Anxiety is defined as a score of 16 or greater on the Beck Anxiety Inventory; Moderate/Severe Depression is defined as a score of 20 or greater on the Beck Depression Inventory.

AOR= Adjusted Odds Ratio. Adjusted estimates control for all other demographic and program variables, regardless of unadjusted significance.

Table 4.4. Results of logistic regression models on the associations between demographic and program characteristics and substance use among graduate students ($n = 2,683$)

	High-Risk Alcohol Use	Marijuana Use	Nonmedical Use of Prescription Drugs
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Age			
20-25 years old	Reference	Reference	Reference
26+ years old	0.69 (0.47, 1.00)	1.24 (0.98, 1.56)	1.67 (1.15, 2.44)*
Sex			
Male	Reference	Reference	Reference
Female	0.63 (0.46, 0.87)*	0.72 (0.58, 0.88)*	1.55 (1.10, 2.19)*
Race/Ethnicity			
Non-Hispanic white	Reference	Reference	Reference
Non-Hispanic other race	0.49 (0.31, 0.77)*	0.79 (0.60, 1.02)	0.78 (0.52, 1.17)
Hispanic/Latino	0.54 (0.23, 1.26)	1.17 (0.75, 1.83)	0.74 (0.33, 1.63)
More than one race/ethnicity	0.97 (0.47, 1.99)	1.25 (0.81, 1.93)	1.00 (0.53, 1.89)
International Student			
Yes	Reference	Reference	Reference
No	0.70 (0.40, 1.20)	3.45 (2.30, 5.17)*	1.76 (0.95, 3.25)
Employment Status			
Not currently employed	Reference	Reference	Reference
Employed part-time	0.97 (0.60, 1.58)	1.16 (0.83, 1.63)	0.71 (0.43, 1.16)
Employed full-time	1.19 (0.67, 2.14)	0.78 (0.52, 1.18)	0.61 (0.35, 1.09)
University assistantship	0.80 (0.50, 1.29)	1.13 (0.83, 1.54)	0.64 (0.41, 1.02)
Marital Status			
Never married	1.96 (1.14, 3.37)*	2.42 (1.73, 3.37)*	1.67 (1.05, 2.65)*
Married	Reference	Reference	Reference
Widowed/Divorced/Separated	1.86 (0.61, 5.69)	2.11 (1.08, 4.14)*	2.57 (1.15, 5.77)*
Household Income			
Less than \$25,000	0.55 (0.31, 0.96)*	1.02 (0.68, 1.53)	0.75 (0.41, 1.38)
\$25,000-\$50,000	0.56 (0.31, 1.00)	1.21 (0.81, 1.82)	1.10 (0.61, 1.96)
\$50,000-\$100,000	0.61, 0.34, 1.08)	0.92 (0.61, 1.37)	1.17 (0.67, 2.03)
More than \$100,000	Reference	Reference	Reference
Children			
Yes	Reference	Reference	Reference
No	1.73 (0.78, 3.81)	2.01 (1.24, 3.27)*	1.06 (0.60, 1.86)

	High-Risk Alcohol Use	Marijuana Use	Nonmedical Use of Prescription Drugs
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Degree Type			
Master's degree	1.35 (0.75, 2.42)	1.61 (1.13, 2.29)*	1.36 (0.80, 2.30)
Academic doctoral degree	Reference	Reference	Reference
Professional doctoral degree	2.04 (1.15, 3.63)*	1.48 (1.04, 2.12)*	1.48 (0.89, 2.47)
Time Enrolled			
Less than a year	Reference	Reference	Reference
1-2 years	0.92 (0.64, 1.31)	1.09 (0.86, 1.39)	1.04 (0.71, 1.51)
More than 2 years	0.97 (0.57, 1.64)	1.11 (0.80, 1.53)	1.11 (0.67, 1.84)
Academic Discipline			
Natural-Pure	1.14 (0.61, 2.15)	2.16 (1.49, 3.14)*	1.10 (0.61, 1.99)
Natural-Applied	Reference	Reference	Reference
Social-Pure	2.09 (1.25, 3.49)*	2.65 (1.88, 3.75)*	1.66 (1.00, 2.75)*
Social-Applied	1.31 (0.85, 2.02)	2.10 (1.55, 2.84)*	1.26 (0.82, 2.59)
Student Status			
Full-time	1.07 (0.62, 1.84)	1.23 (0.85, 1.77)	1.50 (0.86, 2.59)
Part-time	Reference	Reference	Reference
Anticipated Program Length			
1-2 years	Reference	Reference	Reference
3-5 years	0.82 (0.49, 1.35)	1.23 (0.90, 1.69)	1.56 (0.94, 2.59)
6+ years	0.49 (0.22, 1.09)	1.34 (0.86, 2.10)	1.32 (0.66, 2.64)

* $p < 0.05$

Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives. AOR= Adjusted Odds Ratio. Adjusted estimates control for all other demographic and program variables, regardless of unadjusted significance.

Chapter 5: Manuscript #3: Graduate student burnout: Substance use, mental health, and the moderating role of academic support

Introduction

Enrolling in graduate school is becoming more common among young adults. Three million students are currently enrolled in some form of graduate program in the United States, and this estimate is projected to increase to 3.3 million students by 2026 (McFarland et al., 2017). It is estimated that only 50-75% of graduate students complete their degree (Ali & Kohun, 2006; Baum & Steele, 2017; Lovitts & Nelson, 2000), highlighting the importance of understanding the factors that contribute to graduate student attrition.

Burnout among graduate students is a potentially important marker for attrition risk. The concept of burnout has been extensively studied and is defined by three dimensions (Maslach & Jackson, 1981; Schaufeli et al., 2002; Schaufeli & Salanova, 2007). 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. Studies have found high levels of burnout among graduate students (Boren, 2013; Cornér et al., 2017; Dyrbye et al., 2008; Kovach Clark et al., 2009; Kurtz & Tangari, 2007), and there is evidence of an association between burnout and intentions to drop out of school among both undergraduate and graduate students (Cornér et al., 2017; Law & Patil, 2015; Moneta, 2011).

Current theoretical models of student retention in higher education have focused on the influence of individual factors (e.g., demographic characteristics, external commitments, and personal goals), academic factors (e.g., grade performance and skills and abilities), institutional factors (e.g., organizational structure and administrative policies), and social factors (e.g., social integration and faculty/staff interactions) (Aljohani, 2016). Few models of student retention have included the possible influence of health status and behaviors, including mental health and substance use, on student dropout. Research is needed on how these behavioral health factors could directly affect burnout and attrition as well as interact with other factors to influence academic success.

Graduate school enrollment frequently coincides with a risky developmental period for the onset of substance use problems. About half of graduate students are less than 30 years old and about 30% are between the ages of 30 and 39 (Bell, 2009). Alcohol and marijuana are the most frequently used substances during young adulthood (Center for Behavioral Health Statistics and Quality, 2017a), and the onset of lifetime dependence peaks at age 23 for alcohol and age 20 for marijuana (Haberstick et al., 2014). While few studies exist on the substance use behaviors of graduate students, studies have found that the majority of graduate students consume alcohol. Prevalence estimates of past-year alcohol consumption range from 47% to 86% and have typically been assessed in samples of health professional students (Bidwal et al., 2015; English et al., 2011; Kernan et al., 2011; Shah et al., 2009). Less information is available on marijuana use and the nonmedical use of prescription drugs among graduate students, but some studies report past-year prevalence estimates of 12-14% for marijuana use (Bidwal et al., 2015; Shah et

al., 2009) and 5-6% for the nonmedical use of prescription stimulants (Bidwal et al., 2015; Verdi et al., 2016).

The relationship between substance use and academic achievement has been well established in studies of high school and undergraduate populations. Alcohol use, marijuana use, and the nonmedical use of prescription drugs have been linked to poor academic performance in high school and college, including lower SAT scores (Meier et al., 2015), skipping class (Arria et al., 2015; Arria et al., 2008b), lower grade point average (Arria et al., 2015; Arria et al., 2008b; Meier et al., 2015), and less time spent studying (Arria et al., 2008b). Excessive drinking and marijuana use are associated with attrition from both high school (Bray, 2000; Kelly et al., 2015; Silins et al., 2014) and college (Maggs et al., 2015; Silins et al., 2014; Suerken et al., 2016). While studies of graduate students from singular academic disciplines, such as those enrolled in medical school and other health professional programs, suggest a similar inverse relationship between substance use and academic performance (English et al., 2011; Jackson et al., 2016; Kernan et al., 2011), more research is warranted in more diverse student samples.

The typical age of graduate school enrollment also overlaps with the median age of onset for many anxiety and depressive disorders, including panic disorder, generalized anxiety disorder, and major depressive disorder (Kessler et al., 2005). Mental health problems are prevalent among graduate students, and prior research has shown that graduate students report higher levels of stress than undergraduate students (Wyatt & Oswalt, 2013) and the general population (Bidwal et al., 2015; Dyrbye et al., 2006; Evans et al., 2018). A study by Eisenberg et al. (2007) of a diverse sample of graduate students found that 13% met criteria for either an anxiety or depressive disorder. A recent multi-

campus study by Evans et al. (2018) found that about 40% of graduate students had moderate or severe anxiety or depression symptoms, which was six times higher than estimates in the general population.

From the studies that have examined academic outcomes related to mental health among graduate students, results suggest that there are academic implications to high stress and exhaustion. More than a quarter of graduate students who feel stressed report that it negatively impacts their academic performance (Kernan et al., 2011). Eisenberg et al. (2009) found an inverse association between depression and graduate student GPA, and Kernan et al. (2011) found that 44% of graduate students with depression or anxiety experienced a negative academic outcome due to their mental health problems, such as a lower grade in a course. When asked about the effects of their mental health on academic performance, graduate students report that depression and anxiety lead to lower grades, incomplete or dropped courses, and disruption in thesis, dissertation, or practicum work (Wyatt & Oswalt, 2013).

Additional factors might influence the magnitude of the relationship between behavioral health issues and academic achievement. Several theories of student retention emphasize that social integration into the program and institutional environment influence a student's commitment to degree obtainment (Aljohani, 2016). The benefits of social support are also asserted in the stress-buffering model, which posits that social support helps to decrease the potential consequences associated with stressful life events, such as the rigors of graduate school (Cohen & Wills, 1985). Faculty/staff interactions in particular impact students' academic and social integration into the higher education environment (Aljohani, 2016; Offstein et al., 2004). These collegial relationships can

affect academic performance and overall student satisfaction as well as buffer the stress associated with activities that are necessary to obtain a graduate degree.

Research has shown that academic and professional support, particularly advisor and departmental support, has a positive association with graduate student success. Positive relationships with a faculty advisor are associated with improved mental health (Evans et al., 2018; Hyun et al., 2006), decreased stress (Nelson et al., 2001), and less emotional exhaustion among graduate students (Hunter & Devine, 2016). Studies have found that graduate students rank having a knowledgeable and supportive advisor as one of the most important contributors to their academic success (Bain et al., 2011; Golde, 2005). Program climate also appears to play a role in achievement in graduate school, and students who feel like a member of their scholarly community are more satisfied with and show more interest in their studies (Pyhalto et al., 2009). Lovitts and Nelson (2000) suggest that lack of integration into the departmental community is the most influential factor contributing to the attrition of graduate students.

The combined effects of academic support, substance use, and mental health problems on academic achievement have been understudied among graduate students. To fill this gap, this study utilized a large, diverse sample of graduate students to: (1) describe the magnitude of academic support and burnout; (2) assess the relationships between mental health problems, substance use, academic support, and burnout; and 3) examine whether academic support moderates the relationships between mental health, substance use, and burnout.

Methods

Study Sample

All currently enrolled graduate students at two large, public universities were invited to participate in the study. The sampling frame consisted of over 16,000 graduate students enrolled in master's, doctoral, advanced special student, and graduate certificate programs. The sampling frame was 56% female and 41% white, with 48% of students enrolled in master's programs and 47% enrolled in doctoral programs. When compared to the overall graduate student population in the U.S. (Okahana & Zhou, 2017), this sampling frame had a similar gender breakdown but was more racially diverse. In addition, this sampling frame had a much higher prevalence of doctoral students than the total U.S. graduate student population.

Students were eligible for participation in the study if they were: 1) 18 years old or older, and 2) currently enrolled in a graduate degree program at the master's or doctorate-level at either university. Students considered advanced special students, students enrolled solely in graduate certificate programs, and students enrolled in majority online programs were not eligible for participation.

Data Collection Procedures

A web-based survey was developed using Qualtrics software (Qualtrics, 2017) that consisted of an eligibility screener and 64 survey questions. The survey was sent to all currently enrolled graduate students at both universities ($n = 16,775$) in the middle of the Fall 2017 semester. Of the $n = 4,318$ students who consented to participate, $n = 643$ did not meet eligibility criteria and were excluded, yielding an overall response rate of

23%. Participants were further excluded if stopped answering questions prior to the end of the survey. The final analytic sample consisted of $n = 2,683$ graduate students.

Data collection was open for one month, and three reminder emails were sent weekly after the initial recruitment email. Each participant provided informed consent, and approval was obtained by the Institutional Review Boards at both participating universities.

Measures

Demographic and Program Characteristics

Demographic Characteristics. Standard measures 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.

Degree Type. 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.). If students were seeking more than one degree, they were asked to choose the highest degree they were seeking. For example, if they were enrolled in a joint master's and doctoral degree program, they were instructed to select doctoral degree.

Time Enrolled. Participants indicated how many semesters they had been enrolled in their graduate degree program, including the current semester. This variable was recoded into a three-level categorical variable with response options including less than a year, 1-2 years, and more than two years.

Academic Discipline. Based on the characterization of academic areas by Biglan (1973), the academic discipline that participants originally reported was recoded into a four-level variable: 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).

Student Status. Participants indicated whether they were currently enrolled in their graduate program full or part-time.

Anticipated Program Length. The expected number of years for completion of their graduate degree was reported and recoded into a three-level categorical variable: 1-2 years, 3-5 years, and six or more years.

Mental Health

Lifetime Diagnosis of Anxiety. Anxiety was assessed by asking participants to indicate whether they had ever been diagnosed with anxiety by a health professional in their lifetime.

Anxiety Symptoms. The Beck Anxiety Inventory (BAI) (Beck et al., 1988b) was used to assess current level of anxiety. The scale consists of 21 symptoms of anxiety, and participants rank how much each symptom has bothered them in the past week using a four-point scale ranging from 0 (not at all) to 3 (severely, can barely stand it). Possible scores range from 0 to 63, with higher scores indicating higher levels of anxiety. BAI scores of 0-7, 8-15, 16-25, and 26 and higher are classified as no, mild, moderate, or severe anxiety symptoms, respectively (Beck & Steer, 1990).

Lifetime Diagnosis of Depression. Participants self-reported if they had ever been diagnosed with depression by a health professional in their lifetime.

Depression Symptoms. The Beck Depression Inventory (BDI) (Beck et al., 1996) was used to assess current level of depression using a series of 21 statements about how participants have been feeling over the past few days. Possible scores range from 0 to 63, with higher scores indicating increased symptoms of depression. BDI scores of 0-13, 14-19, 20-28, and 29 and higher are classified as minimal, mild, moderate, or severe depression symptoms, respectively (Beck et al., 1996).

Perceived Stress. Perceived stress was assessed using the 10-item Perceived Stress Scale (PSS) (Cohen et al., 1983), which rates items on a 5-point 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?”. Scores range from 0 to 40, with higher scores indicating higher stress levels.

Substance Use

Alcohol Consumption. The frequency of alcohol consumption was measured by the number of days in the past 12 months when alcohol was consumed. Participants who had at least one drink in the past 12 months were asked how many alcoholic drinks they consumed on a typical day that they drank during the past 12 months. Alcohol use frequency and quantity were analyzed as continuous variables, but a dichotomous variable was also computed to represent high-risk alcohol use in the past 12 months. High-risk drinkers drank at least once a month in the past 12 months with a typical

quantity of five drinks or more for men and four drinks or more for women, which is an adaptation of the definition of binge drinking from the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b).

Marijuana Use. The frequency of marijuana use was assessed by the number of days participants had used marijuana during the past 12 months. Marijuana use was analyzed both as a continuous variable for frequency as well as a dichotomous variable to represent use/non-use in the past 12 months.

Nonmedical Use of Prescription Drugs. Four classes of prescription drugs were of interest- prescription stimulants, analgesics, tranquilizers, and sedatives. Participants were provided with the definition of nonmedical use as the intentional use of prescription drugs without a prescription, in a way other than prescribed, or for the experience or feeling it causes (National Institute on Drug Abuse, 2018). The frequency of the nonmedical use of prescription drugs was assessed by the number of days participants had used each of the four classes of prescription drugs nonmedically in the past 12 months. A dichotomous variable was computed to assess use/non-use of any class of prescription drug in the past 12 months.

Academic Support

Advisor Satisfaction. A single item was used to assess level of satisfaction with a faculty advisor, and five response options ranged from very dissatisfied to very satisfied (Eduljee & Michaud, 2014). For analytic purposes, advisor satisfaction was recoded into a three-level variable including dissatisfied, neither satisfied nor dissatisfied, and satisfied.

Departmental Support. Perceived level of value and appreciation by department faculty was measured using six items from the Perceived Organizational Support Scale (Eisenberger et al., 2001; Eisenberger & Fasolo, 1990) where “my organization” was replaced with “my department”. Responses to each item range from strongly disagree (1) to strongly agree (7). A total score was computed by averaging the responses to all six items, with higher scores indicating higher levels of departmental support. This scale has been used to measure the relationship between perceived department or faculty support and the intentions of doctoral students to leave academia (Hunter & Devine, 2016).

Program Climate. Sense of community and competition within a degree program was measured using 13 items from the Acadia Institute Project on Professional Values and Ethical Issues in the Graduate Education of Scientists and Engineers (Anderson & Swazey, 1998). Seven items assess community and six items assess competition, with responses including (1) very little or not at all, (2) some extent, and (3) great extent. Two separate scores were computed by averaging the responses to the items associated with each subscale, with higher scores indicating higher levels of community or higher levels of competition. Adapted versions of this scale have been used in prior work involving graduate and postdoctoral students in scientific fields (Louis et al., 2007).

Burnout

Burnout was measured using three subscale scores of the Maslach Burnout Inventory- Student Survey (MBI-SS) (Schaufeli et al., 2002; Schaufeli & Salanova, 2007). The MBI-SS consists of 15 items that are grouped into three scales: exhaustion (five items), cynicism (four items), and inefficacy (six items). An example item assessing

exhaustion is “I feel emotionally drained by my studies”; an examine item assessing cynicism is “I have become less enthusiastic about my studies”; and an example item assessing inefficacy is “In my opinion, I am not a good student”. Each item is scored on a 7-point scale from never to always, with higher scores indicating higher burnout levels. Prior studies have used the MBI-SS in undergraduate and graduate student samples (Capri et al., 2012; Rigg et al., 2013; Salanova et al., 2010; Schaufeli et al., 2002).

Statistical Analyses

Twenty-eight percent of the sample ($n = 754$) were missing data on at least one variable of interest, and comparisons between complete and non-complete cases revealed that the data were not missing at random. Missing data was handled using multiple imputation of five complete datasets in SPSS, incorporating all study variables, and statistics were obtained by averaging results across all imputed datasets.

The distributions of all variables, including demographic and program characteristics, were assessed using descriptive statistics (e.g., frequencies, means, and standard deviations). Associations between burnout and continuous mental health, substance use, and academic support variables were explored using Spearman’s rank-order correlation tests due to a lack of normality among all continuous variables of interest. The magnitude of the associations between continuous variables was interpreted as a medium effect for Spearman’s ρ values of 0.3 or greater and as a large effect for Spearman’s ρ values of 0.5 or greater (Cohen, 1988).

Multivariate logistic and linear regression models were used to assess the associations between academic support variables (advisor satisfaction, departmental support, program community, and program competition) with mental health (stress,

anxiety symptoms, and depression symptoms) and substance use (high-risk alcohol use, marijuana use, and nonmedical use of prescription drugs) while controlling for demographic and program characteristics.

Multivariate linear regression models for the three dimensions of burnout (exhaustion, cynicism, and inefficacy) were fit that included all demographic characteristics, program characteristics, categorical mental health and substance use variables, and continuous mental health and substance use variables that had an association with burnout with at least a medium effect size. Final multivariate linear regression models included all demographic and program characteristics regardless of significance after adjusting for other variables, as well as any mental health, substance use, or academic support variable that was significant after adjusting for all other variables. The R^2 value was used to examine the fit of each final model in explaining the variation in exhaustion, cynicism, and inefficacy.

To evaluate whether or not the relationship between mental health/substance use and burnout was moderated by academic support, all potential interaction effects between mental health/substance use and academic support variables were entered separately into the final models predicting burnout and assessed for statistical significance.

SPSS Version 24.0 was used for all analyses, and the alpha level was set at 0.05.

Results

Sample Characteristics

Table 5.1 describes the sample characteristics ($n = 2,683$). Forty-four percent of the sample was enrolled in a master's degree program, 39% in an academic doctoral program, and 17% in a professional doctoral program, with the majority of students

having been enrolled in their program for less than two years. The most common academic discipline was social-applied, followed by natural-applied, social-pure, and natural-pure.

About 21% of the sample had been diagnosed with anxiety in their lifetime, and 20% had been diagnosed with depression (see Table 5.2). The mean scores on the Perceived Stress Scale, the Beck Anxiety Inventory, and the Beck Depression Inventory were 18.9, 10.1, and 9.8, respectively. Based on existing clinical cutoff scores for BAI and BDI, 28%, 15%, and 7% of students had mild, moderate, and severe levels of anxiety symptoms, respectively, and 15%, 9%, and 4% of students had mild, moderate, and severe levels of depression symptoms, respectively.

The majority of the sample (85%) consumed alcohol in the past 12 months, with a mean frequency of 71 days in the past 12 months and a mean typical quantity of two drinks per drinking occasion among drinkers. Twenty percent of the sample used marijuana in the past 12 months, with a median frequency of only six days in the past 12 months among users. High-risk alcohol use and the nonmedical use of prescription drugs were not highly prevalent in this sample, with only about 7% of students engaging in each behavior in the past 12 months.

Prevalence of Academic Support and Burnout

Two-thirds of students were satisfied with their advisor, about a quarter were neither satisfied nor dissatisfied, and 10% were dissatisfied (see Table 5.2). Students reported high levels of departmental support as well as higher levels of a sense of community when compared to sense of competition in their program. Students were more

likely to report higher levels of exhaustion as compared to cynicism or inefficacy, with mean scores of 2.72, 1.91, and 1.59 out of a maximum score of 6, respectively, on the three dimensions of burnout.

Mental Health Problems, Substance Use, Academic Support, and Burnout

Academic support had a much stronger relationship with mental health than with substance use among this sample of graduate students. As seen in Table 5.3, after controlling for demographic and program characteristics, there were significant inverse relationships between advisor satisfaction, departmental support, and program community and stress, anxiety, and depression symptoms. A significant positive relationship between program competition and these three dimensions of mental health was observed. The only significant relationship found between substance use and academic support was between marijuana use and program competition, with non-users reporting higher levels of program competition than marijuana users.

Without adjusting for any other variables, burnout was higher among graduate students with a lifetime diagnosis of an anxiety disorder, a lifetime diagnosis of depression, and past 12-month high-risk alcohol use, marijuana use, and nonmedical use prescription drugs (see Figures 5.1-5.3). There were significant medium or large effects between Perceived Stress Scale, Beck Anxiety Inventory, Beck Depression Inventory, and Departmental Support scores and all three types of burnout. Given a lack of at least a medium effect between alcohol use frequency, alcohol use quantity, marijuana use frequency, program climate (community), and program climate (competition) with burnout, these variables were not included in further analyses.

After statistical adjustment for demographic and program characteristics and all other predictor variables (see Table 5.4), perceived stress and depression symptoms had significant, positive associations with exhaustion, cynicism, and inefficacy. Lifetime diagnosis of an anxiety disorder had a significant, negative association with both cynicism and inefficacy, and high-risk alcohol use had a significant, positive association with exhaustion. Departmental support and advisor satisfaction were both negatively associated with exhaustion, cynicism, and inefficacy.

Final regression models including all significant predictors and all demographic and program characteristics, regardless of statistical significance, were fit for each dimension of burnout. The final models for exhaustion, cynicism, and inefficacy had R^2 values of 0.503, 0.454, and 0.427, respectively.

While all demographic and program variables were included as control variables in the final adjusted models, only a few were significantly associated with burnout in these models (not shown in a table). Exhaustion was significantly higher among domestic students, professional doctoral degree students, students enrolled for more than a year, and full-time students. Cynicism was significantly higher among male students and students enrolled for more than a year. Inefficacy was significantly higher among younger students ages 20-25 years old, male students, and students in the natural-pure and natural-applied disciplines when compared to those in the social-applied disciplines.

Moderation by Academic Support

Academic support significantly moderated the relationship between mental health and inefficacy. All potential interaction effects between mental health/substance use and

academic support variables were entered separately into the final adjusted models for each type of burnout. While no interaction effects were significant in the models predicting exhaustion or cynicism, the interactions between perceived stress and advisor satisfaction ($\beta = 0.014, p = 0.01$), perceived stress and departmental support ($\beta = -0.004, p = 0.04$), and depression symptoms and advisor satisfaction ($\beta = 0.013, p = 0.004$) were all significant when added individually to the model predicting inefficacy (not shown in a table). Departmental support significantly moderated the relationship between stress and inefficacy such that as departmental support increased, the effect of stress on inefficacy lessened. The effects of perceived stress and depression symptoms on inefficacy were weaker among those who were satisfied with their advisor compared to those who were neither satisfied nor dissatisfied with their advisor.

Discussion

This study examined the relationships between mental health, substance use, academic support, and burnout among a sample of graduate students from a wide range of degree types and academic disciplines. Three dimensions of burnout were examined to capture students' exhaustion from the demands of a graduate program, students' cynical attitudes regarding their studies, and students' feelings of incompetency or inefficacy. While few studies were found that had operationalized graduate student burnout using mean scores of the MBI-SS subscales (Schaufeli et al., 2002; Schaufeli & Salanova, 2007), a study by Rigg et al. (2013) measured the exhaustion dimension of burnout and found a much higher mean score (4.5) as compared to the mean score of exhaustion in the current study's sample (2.7). This sample also reported higher levels of departmental

support than other studies of graduate students (Hunter & Devine, 2016), suggesting that this sample might be experiencing less burnout and more academic support than other graduate students.

There was a clear relationship between mental health and academic support, such that advisor satisfaction and high levels of departmental support and sense of community were associated with decreased symptoms of stress, anxiety, and depression.

Additionally, higher levels of perceived competition were associated with higher levels of stress, anxiety, and depression. These results were as hypothesized and were consistent with prior research on the positive effects of academic and social support on graduate student mental health (Hunter & Devine, 2016; Hyun et al., 2006; Nelson et al., 2001).

No relationship was found between academic support and substance use, with one notable exception. Results showed that program competition was significantly lower among past-year marijuana users as compared to non-users. One explanation for this finding is that marijuana use might be associated with decreased academic motivation (Phillips et al., 2015), making students less engaged in their academic environment and less likely to put themselves in academic situations where they are experiencing high levels of competition with their peers. The lack of relationship between academic support and both high-risk alcohol use and the nonmedical use of prescription drugs might be due to the low prevalence of each of these behaviors in this study sample. While it was hypothesized that students might engage in substance use as a means to cope with the lack of support in their departmental community, it is also possible that students with low levels of support chose alternative means of coping. This notion is consistent with behavioral choice theory, that posits that access to rewarding activities other than

substance use can be protective against using alcohol and drugs as means to elevate mood and decrease anxiety (Moos, 2007). A similar explanation could be applied to the finding that substance use was not significantly associated with burnout, with the exception of a significant, positive relationship between high-risk alcohol use and exhaustion.

While higher levels of stress and depression symptoms were associated with higher levels of burnout, results showed interesting findings surrounding the relationship between anxiety and burnout. Anxiety symptoms were not significantly associated with any of the three dimensions of burnout, and lifetime diagnosis of anxiety had significantly negative associations with cynicism and inefficacy after adjusting for demographic and program characteristics. These findings might indicate potential beneficial effects of anxiety on academic attitudes and success, which has been suggested in the literature. Attentional control theory proposes that anxiety can increase motivation in order to avoid the negative evaluation that can come from academic failure (Eysenck & Derakshan, 2011). A notable study by Voltas et al. (2014) found that generalized anxiety symptoms were positively related to academic achievement, suggesting that anxiety might increase alertness and concentration in students as well as increase the amount of time spent on schoolwork. However, there is a clear relationship between anxiety and decreased cognitive and academic performance that should not be overlooked (Eysenck & Derakshan, 2011), and the advantage of anxiety might only be applicable for those students who have the cognitive ability to cope with the negative effects of having an anxiety disorder (Chuderski, 2015; Owens et al., 2014).

Both advisor satisfaction and departmental support were significantly associated with all three dimensions of burnout. This is consistent with findings from a recent meta-

analysis by Kim et al. (2018) on the relationship between social support and burnout among both undergraduate and graduate student samples. Synthesizing results from 19 studies, the authors concluded that social support is negatively correlated with exhaustion, cynicism, and inefficacy. In a study of graduate students, Rigg et al. (2013) examined the association between social support from family, friends, spouses, and advisors with exhaustion and found that only advisor support had a significant, negative relationship with exhaustion, highlighting the importance of the graduate student relationship with their advisor and other faculty in their department. A positive advisor relationship has also been shown to be related to degree completion, decreased time to graduation, decreased intent to leave a graduate program, and overall program satisfaction and success among graduate students (Cornér et al., 2017; Jairam & Kahl, 2012; Kurtz & Tangari, 2007; Pyhältö et al., 2015; Wao & Onwuegbuzie, 2011).

Academic support, particularly support from the advisor and other department faculty, moderated the relationship between mental health and inefficacy. These results are consistent with prior research that has found that social support acts as a buffer between stress and self-confidence in an academic setting (Rees & Freeman, 2007) and that inefficacy is more strongly related to social support than both exhaustion and cynicism (Kim et al., 2018). It has also been suggested that inefficacy might function differently than exhaustion and cynicism (Lee & Ashforth, 1996) and might be more closely related to engagement rather than burnout (Schaufeli & Salanova, 2007). Inefficacy might also be a more modifiable state of mind as compared to exhaustion or cynicism, in that an advisor can bolster a student's skills and abilities and make them feel more confident and in control when facing the academic rigor of a graduate program. An

earlier study by Koeske and Koeske (1991) also did not find a buffering effect of advisor support on the relationship between graduate student stress and exhaustion, consistent with this study's findings. However, it is possible that other types of social support not examined in this study, such as from friends and family, might moderate the relationship between mental health and the exhaustion and cynicism dimensions of burnout.

By assessing burnout, there is an opportunity to intervene before a student drops out of their degree program. This study identified groups that might be at increased risk for burnout and should be the target of screening and prevention efforts. Burnout was highest among students enrolled in professional degree programs and those in the natural disciplines, suggesting that graduate students in these programs might be at increased risk for dropping out of their program. Burnout also appeared to increase throughout the duration of a degree program, with students enrolled for more than a year reporting higher levels of exhaustion and cynicism than newly enrolled students. Academic pressure and demands might increase as students move through their program, calling for increased resources for graduate students at the later stages of graduate study.

One of the major limitations of this study is its cross-sectional design. This study only assessed students at one point in their graduate school career and did not allow for analysis of the potential influence of mental health, substance use, and academic support on the long-term burnout and retention of graduate students. However, graduate school dropout might be a consequence of the three dimensions of burnout (exhaustion, cynicism, and inefficacy) measured in this study, and prior research among both undergraduate and graduate students has shown an association between burnout and intentions to drop out of school (Cornér et al., 2017; Law & Patil, 2015; Moneta, 2011).

Other limitations of this study should be taken into consideration when interpreting the study findings. The sample included graduate students from only two universities, so results might not be generalizable to other graduate student populations. In addition, comparing these data to national graduate school enrollment data, our sample had a similar gender breakdown but was less racially and ethnically diverse and had a much higher proportion of doctoral students (Okahana & Zhou, 2017). Additionally, this study sample had a higher prevalence of anxiety, depression, and marijuana use (Bidwal et al., 2015; Shah et al., 2009; Wyatt & Oswalt, 2013) and lower prevalence of risky alcohol use than other graduate student samples (Bidwal et al., 2015; Cranford et al., 2009; Rutledge et al., 2016). With a response rate of 23%, there might have been unknown differences between responders and nonresponders on demographic characteristics, program characteristics, and health variables of interest. While validated instruments were used, self-reported mental health and substance use status and behaviors are subject to social desirability bias.

These findings provide further evidence as to the association between mental health and substance use problems with the functioning of graduate students while accounting for the potential influence of demographic and program characteristics. Longitudinal research is needed to examine the relationship between behavioral health and graduate student retention among large samples of graduate students from a range of academic disciplines. Further, this research highlights the need for universities to focus on ways to buffer the effects of mental health and substance use on graduate student burnout, particularly by encouraging a supportive department culture that fosters a sense of community between faculty, staff, and students.

Table 5.1. Sample characteristics ($n = 2,683$)

	Total Sample
	<i>n</i> (Column %)
Age	
20-25 years old	1,148 (42.8)
26+ years old	1,535 (57.2)
Sex	
Male	1,005 (37.4)
Female	1,678 (62.6)
Race/Ethnicity	
Non-Hispanic white	1,572 (58.6)
Non-Hispanic other race	850 (31.7)
Hispanic/Latino	131 (4.9)
More than one race/ethnicity	130 (4.8)
International Student	
Yes	481 (17.9)
No	2,202 (82.1)
Employment Status	
Not currently employed	582 (21.7)
Employed part-time	423 (15.8)
Employed full-time	508 (18.9)
University assistantship	1,169 (43.6)
Marital Status	
Never married	1,950 (72.7)
Married	668 (24.9)
Widowed/divorced/separated	65 (2.4)
Household Income	
Less than \$25,000	1,184 (44.1)
\$25,000-\$50,000	654 (24.4)
\$50,000-\$100,000	489 (18.2)
More than \$100,000	355 (13.2)
Children	
Yes	289 (10.8)
No	2,394 (89.2)
Degree Type	
Master's degree	1,187 (44.2)
Academic doctoral degree	1,039 (38.7)
Professional doctoral degree	457 (17.0)
Time Enrolled	
Less than a year	793 (29.6)
1-2 years	1,165 (43.4)
More than 2 years	725 (27.0)

	Total Sample
	<i>n</i> (Column %)
Academic Discipline	
Natural-Pure	403 (15.0)
Natural-Applied	725 (27.0)
Social-Pure	459 (17.1)
Social-Applied	1,096 (40.8)
Student Status	
Full-time	2,279 (84.9)
Part-time	404 (15.1)
Anticipated Program Length	
1-2 years	899 (33.5)
3-5 years	1,339 (49.9)
6+ years	445 (16.6)

Ns and percentages might not add up to sample totals due to the rounding of pooled estimates. Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

Table 5.2. Mental health, substance use, academic support, and burnout among graduate students ($n = 2,683$)

		Total Sample <i>n</i> (Column %)
Mental Health	Lifetime Anxiety Diagnosis	558 (20.8)
	Lifetime Depression Diagnosis	536 (20.0)
		Mean \pm SD
	Perceived Stress Scale (0-40)	18.9 \pm 6.9
	Beck Anxiety Inventory (0-63)	10.1 \pm 9.1
	Beck Depression Inventory (0-63)	9.8 \pm 8.3
Substance Use		<i>n</i> (Column %)
	High-Risk Alcohol Use	181 (6.7)
	Marijuana Use	545 (20.3)
	Nonmedical Use of Prescription Drugs	190 (7.1)
		Mean \pm SD
	Alcohol Use Frequency (Days) ^a	71.1 \pm 80.5
Academic Support	Alcohol Use Quantity (Typical # of Drinks) ^a	2.2 \pm 1.7
	Marijuana Use Frequency (Days) ^a	50.4 \pm 94.5
		<i>n</i> (Column %)
	Satisfied with Advisor	1,766 (65.8)
		Mean \pm SD
	Departmental Support (1-7)	5.12 \pm 1.2
Burnout	Program Climate- Community (1-3)	2.09 \pm 0.3
	Program Climate- Competition (1-3)	1.81 \pm 0.4
	Exhaustion (0-6)	2.72 \pm 1.4
	Cynicism (0-6)	1.91 \pm 1.4
	Inefficacy (0-6)	1.59 \pm 1.0

^aAmong past 12-month users.

All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Table 5.3. Results of linear and logistic regression models on the associations between academic support and the mental health and substance use of graduate students ($n = 2,683$)

	Perceived Stress Scale	Beck Anxiety Inventory	Beck Depression Inventory	High-Risk Alcohol Use	Marijuana Use	Nonmedical Use of Prescription Drugs
	Adjusted β (95% CI)	Adjusted β (95% CI)	Adjusted β (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Satisfied with Advisor^a	-4.04 (-4.89, -3.20)*	-3.48 (-4.61, -2.36)*	-5.78 (-6.81, -4.75)*	0.95 (0.56, 1.61)	0.89 (0.64, 1.23)	0.65 (0.41, 1.02)
Departmental Support	-1.78 (-2.00, -1.57)*	-1.32 (-1.62, -1.03)*	-2.23 (-2.56, -2.04)*	1.03 (0.90, 1.19)	0.98 (0.90, 1.07)	0.90 (0.79, 1.02)
Program Climate-Community	-3.16 (-3.96, -2.37)*	-1.59 (-2.70, -0.48)*	-4.06 (-5.01, -3.10)*	0.96 (0.59, 1.55)	0.95 (0.69, 1.31)	0.91 (0.56, 1.48)
Program Climate-Competition	2.91 (2.21, 3.61)*	3.89 (2.96, 4.82)*	3.58 (2.73, 4.43)*	0.96 (0.62, 1.51)	0.67 (0.50, 0.89)*	1.50 (0.99, 2.26)

* $p < 0.05$

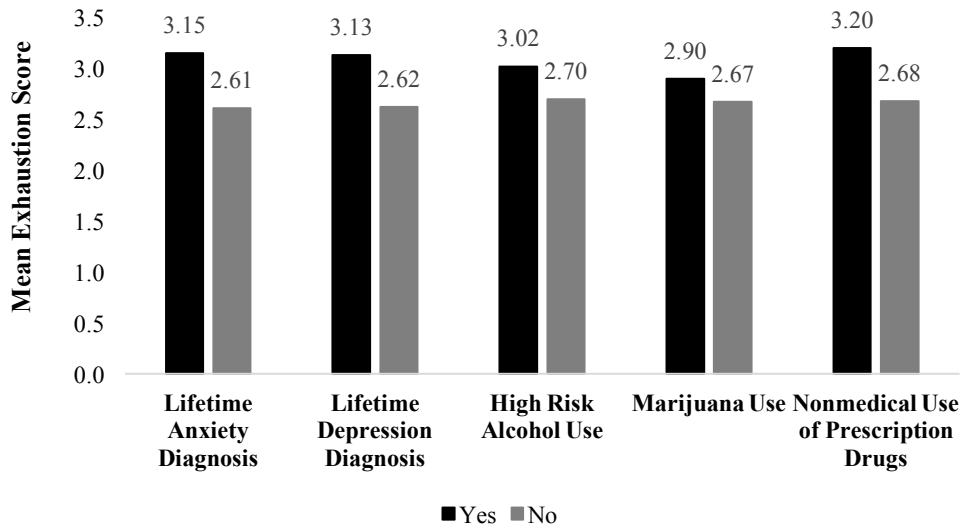
^a 'Satisfied with advisor' is compared to 'dissatisfied with advisor'; the 'neither satisfied nor dissatisfied' category is not included in these analyses.

All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

AOR= Adjusted Odds Ratio. Adjusted estimates control for all demographic and program characteristics, regardless of unadjusted significance.

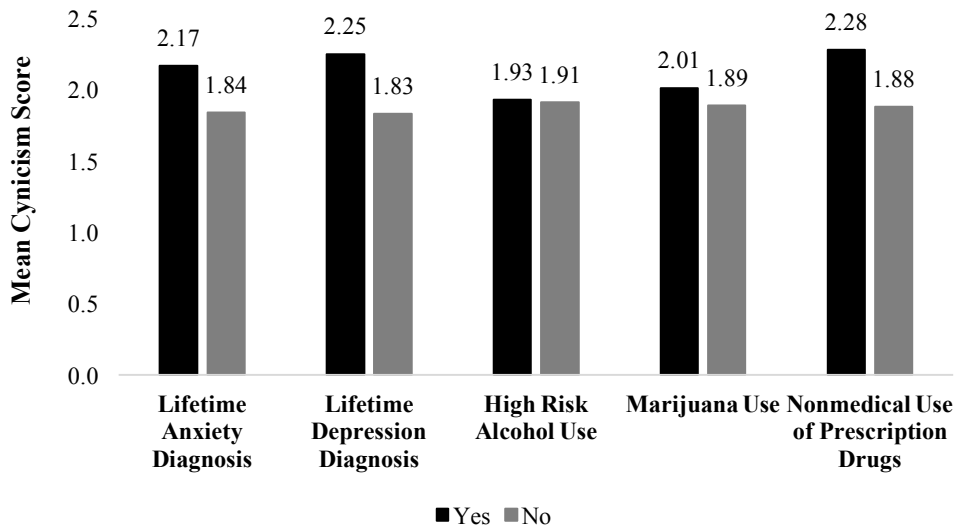
Figure 5.1. Exhaustion of graduate students, by mental health and substance use ($n = 2,683$)



All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

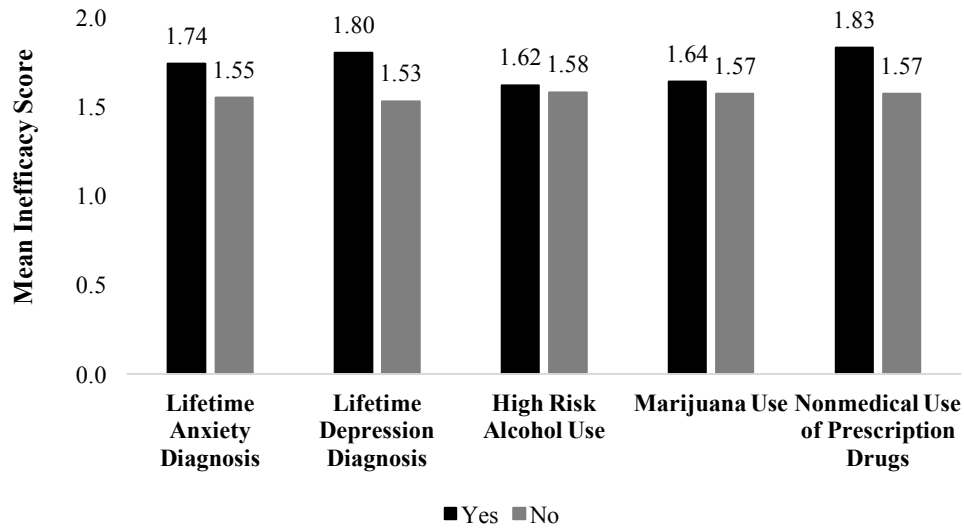
Figure 5.2. Cynicism of graduate students, by mental health and substance use ($n = 2,683$)



All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Figure 5.3. Inefficacy of graduate students, by mental health and substance use ($n = 2,683$)



All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Table 5.4. Linear regression models examining the main effects of mental health, substance use, and academic support on the burnout of graduate students ($n = 2,683$)

		Exhaustion		Cynicism		Inefficacy	
		Multivariate Associations	Final Adjusted Model	Multivariate Associations	Final Adjusted Model	Multivariate Associations	Final Adjusted Model
		β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Mental Health	Lifetime Anxiety Diagnosis	-0.05 (-0.16, 0.06)	-	-0.17 (-0.29, -0.05)*	-0.19 (-0.30, -0.09)*	-0.14 (-0.23, -0.05)*	-0.15 (-0.22, -0.07)*
	Lifetime Depression Diagnosis	-0.09 (-0.20, 0.02)	-	-0.05 (-0.17, 0.07)	-	0.00 (-0.09, 0.08)	-
	Perceived Stress Scale	0.07 (0.06, 0.08)*	0.07 (0.06, 0.08)*	0.04 (0.03, 0.05)*	0.04 (0.03, 0.05)*	0.04 (0.03, 0.05)*	0.04 (0.03, 0.05)*
	Beck Anxiety Inventory	0.01 (0.00, 0.01)	-	0.00 (-0.01, 0.01)	-	0.00 (-0.01, 0.00)	-
	Beck Depression Inventory	0.04 (0.03, 0.05)*	0.04 (0.04, 0.05)*	0.05 (0.04, 0.06)*	0.05 (0.04, 0.05)*	0.04 (0.03, 0.04)*	0.04 (0.03, 0.04)*
Substance Use	High-Risk Alcohol Use	0.17 (0.01, 0.32)*	0.16 (0.01, 0.31)*	-0.04 (-0.21, 0.12)	-	-0.08 (-0.20, 0.04)	-
	Marijuana Use	-0.03 (-0.12, 0.07)	-	-0.06 (-0.17, 0.04)	-	-0.04 (-0.11, 0.04)	-
	Nonmedical Use of Prescription Drugs	-0.04 (-0.19, 0.11)	-	0.01 (-0.16, 0.17)	-	0.01 (-0.11, 0.13)	-
Academic Support	Advisor Satisfaction						
	Satisfied	Reference	Reference	Reference	Reference	Reference	Reference
	Neither Satisfied Nor Dissatisfied	0.15 (0.06, 0.25)*	0.16 (0.06, 0.25)*	0.16 (0.05, 0.26)*	0.16 (0.06, 0.26)*	0.15 (0.07, 0.23)*	0.15 (0.07, 0.23)*
	Dissatisfied	0.19 (0.06, 0.33)*	0.19 (0.06, 0.33)*	0.47 (0.32, 0.62)*	0.47 (0.32, 0.62)*	0.17 (0.06, 0.28)*	0.17 (0.06, 0.28)*
	Departmental Support	-0.16 (-0.20, -0.12)*	-0.16 (-0.19, -0.12)*	-0.31 (-0.35, -0.26)*	-0.31 (-0.35, -0.27)*	-0.16 (-0.19, -0.13)*	-0.16 (-0.19, -0.13)*
R²			0.503		0.454		0.427

* $p < 0.05$

All substance use variables are for the past 12 months.

High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

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 variables (degree type, time enrolled, academic discipline, full-time student status, and anticipated program length), regardless of unadjusted significance.

Chapter 6: Summary

Overview and Summary

The negative consequences associated with mental health and substance use problems are well-known, and a growing body of literature has explored the relationship between these behavioral health problems and functional outcomes among young adults, particularly undergraduate students. However, questions still remain regarding these relationships among graduate students, who are becomingly an increasingly large proportion of the young adult population. This dissertation was comprised of two separate but interrelated studies that aimed to: 1) examine the prospective relationship of substance use and mental health problems during the college years and graduate degree completion later in young adulthood; 2) describe the prevalence and correlates of substance use and mental health problems among a sample of graduate students from a wide range of academic disciplines; and 3) assess the associations between substance use, mental health problems, academic support, and burnout among graduate students. Findings from each study shed light on the magnitude of substance use and mental health problems among graduate students, as well as the complex relationship between behavioral health and graduate student functioning and success.

The first study conducted as part of this dissertation analyzed secondary longitudinal data from a cohort of young adults ($n = 520$) who were assessed annually beginning with their first year of undergraduate study. Trajectory modeling was used to examine patterns of alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency during the first four years of college. Multivariate logistic regression models were developed to examine the relationship between these substance

use trajectories as well as anxiety and depression during the undergraduate college years and graduate degree completion. Being female, married, and enrolling in graduate school earlier in young adulthood were significantly associated with increased odds of graduate school completion. Interestingly, no prospective relationship was found between college mental health and substance use and completion of a graduate degree. The absence of a statistically significant association could be the result of the ways in which the behavioral health variables were operationalized, a possible decrease in mental health and substance use problems during the post-college period, and/or a possible selection effect whereby students with behavioral health issues during college were less likely to enroll in graduate school.

The second study involved collection of primary data from 2,683 graduate students currently attending two large, public universities to assess the prevalence, correlates, and associations between mental health, substance use, academic support, and burnout. One analysis showed that professional doctoral students and students enrolled in programs in the humanities and social sciences were at increased risk for behavioral health problems compared to students in other disciplines. High-risk alcohol use and higher levels of stress and depression symptoms were associated with burnout, and advisor and departmental support buffered the relationship between both stress and depression with inefficacy. While directionality of the relationships could not be determined because of the cross-sectional design of this study, results showed a clear relationship between mental health and substance use problems and burnout, as well as a decrease in the magnitude of this relationship among students receiving high levels of professional support.

Implications

This dissertation research was novel in its focus on graduate student behavioral health, but additional research is necessary to fully understand this topic (see *Future Research Directions*). Because individuals who hold graduate degrees are critical members of society, addressing graduate student health while students are still enrolled could potentially decrease the likelihood of escalation of substance use and mental health problems post-graduation. Healthier graduate students will make for a more functioning young adult population, enabling those with graduate degrees to meet job requirements, hold important societal positions, and experience a high quality of life.

Because graduate education involves a large investment of time, money, and resources for universities, administrators and departmental leaders should encourage dissemination of information about the importance of addressing mental health and substance use among graduate students. Although the finding that a supportive departmental culture could lessen the chances of burnout is in need of replication, it makes intuitive sense that improvements in student-advisor relationships could potentially decrease the likelihood of student burnout and mental health problems.

Researchers focusing on graduate student health have called for action to address the mental health crisis in graduate education (Evans et al., 2018). Prior research as well as the primary data collection in the current research have shown that a substantial minority of graduate students have diagnosed mental health disorders and high levels of stress, anxiety, and depression symptoms. In comparison to several other factors that have been shown to influence student health and success, such as program structure and academic requirements, substance use and mental health are potentially modifiable and

treatable. Universities could enhance access to mental health and substance use treatment for their graduate students by directing students to available health and counseling resources or by incorporating behavioral health into career and professional development programs, such as orientation or graduate student seminars. Graduate faculty and staff should also be educated on the prevalence of behavioral health problems among their students and how they might influence the relationship between mental health and achievement, either through direct contact with students or through appropriate referrals to outside support (Evans et al., 2018). The development and evaluation of tailored screening and intervention approaches for this population are needed to understand whether or not these approaches could improve graduate student health and success.

Findings from this dissertation research also highlighted particular student subgroups that might be at increased risk for mental health and substance use problems, burnout, and attrition during graduate school. Male students had a higher prevalence of high-risk alcohol and marijuana use, higher levels of cynicism and inefficacy, and lower prevalence of graduate degree completion. Female students had higher levels of stress, anxiety, and depression, as well as a higher prevalence of nonmedical use of prescription drugs. While not explored in this study, increased levels of stress and anxiety among female students could be related to their nonmedical use of prescription drugs.

Students enrolled in professional doctoral degree programs had higher levels of substance use and exhaustion, and there was increased stress and higher prevalence of marijuana use among students enrolled in the social-pure academic disciplines. It is worth exploring the particular characteristics of these programs or of the students who are enrolling in these types of programs that might influence substance use, poor mental

health, and decreased academic outcomes. Of particular concern might be program culture, where students in particular programs might feel more stigma surrounding help-seeking behaviors regarding mental health and substance use. These subgroups should be the target of screening and prevention efforts, and administrators should ensure that campus resources are made available to these and all students.

Strengths and Limitations

The main strength of this dissertation research was the use of both existing longitudinal data as well as primary data collection of current graduate students. The sample overall was large and represented a wider array of degree types and academic disciplines than prior samples in the literature. This feature of the sample allowed for examination of subgroup variation. The rationale for the variables selected in this dissertation was rooted in theory; the socio-ecological model was used to identify a multitude of individual and social-related factors that could potentially influence graduate student success. The analytic strategy used allowed for the examination of the associations between behavioral health and student burnout while controlling for the potential influence of other individual and program-level factors.

These dissertation findings should be interpreted in light of the methodological limitations of the research. The first study was conducted with students from a single university, and the second study was conducted from students at two universities. Results might not be generalizable to graduate students at other institutions, and a comparison to national graduate student enrollment data showed that the sample from this work's primary data collection underrepresented students from minority racial and ethnic groups and overrepresented doctoral students (Okahana & Zhou, 2017). Additionally, the

graduate students examined in this dissertation research had higher levels of degree completion than the national average (Baum & Steele, 2017). Students with high levels of mental health and substance use problems might not have taken the survey in the primary data collection portion of this research, and the recruitment procedure might have influenced participation. Recruitment materials indicated that this was a study on graduate student burnout, which might have attracted students who wanted to share their experience or deterred students who felt that the term “burnout” had a negative or potentially stigmatizing connotation.

Another limitation of the primary data collection was its cross-sectional design, which did not allow for the assessment of directionality of the relationship between behavioral health, academic support, and burnout. This research also relied on self-report measures, which might result in findings that underestimate the prevalence of mental health, substance use, and academic difficulties. While validated measures of mental health and substance use were utilized, there are many potential ways to operationalize the variables assessed. The operationalization choices made in this research might have influenced study findings, highlighting the value of future replication of the research.

Many potential factors related to both burnout and degree completion among graduate students were not measured in this dissertation and should be the focus of future research, including factors that have been the pillars of existing theories of student attrition. For example, students’ intentions, goals, and expectations for their graduate education, as well as their level of desire for the degree and understanding of what it will take to achieve it, all might influence perseverance through a program. Moreover, students’ academic ability and performance both prior to and during graduate school were

not measured. Given that skill and ability are crucial for graduate degree completion, these variables would be important to include in future studies. Future research should also capture the influence of institutional factors, such as curriculum, program requirements, and administrative policies, which speak to the rigor of each program.

Because of time constraints and attempts to keep the analyses focused on primary variables of interest, some variables that were assessed during primary data collection were not fully analyzed in relation to academic burnout. These variables, including sleep behavior and quality, social context of substance use, motivation for substance use, and age of onset of mental health disorders, should be explored in future analyses of this data.

Future Research Directions

This dissertation research identified a multitude of factors that might play a role in graduate student burnout and attrition. Given the results of the research, more attention to the behavioral health of graduate students in future studies is certainly warranted.

Nationally representative, multi-campus studies that include graduate students from varied degree types and academic disciplines would be particularly informative, as the majority of existing research studies in this area are single-campus studies of graduate students from specific academic disciplines. The graduate student population is heterogeneous, making research in large, representative samples imperative.

Of highest priority should be longitudinal research to explore the continuity of mental health and substance use problems from college to graduate school as well as the long-term impact of behavioral health on young adult functioning before, during, and after graduate school. Longitudinal research would also enable the identification of risk

factors that precede graduate student attrition, such as the dimensions of burnout, so that intervention could occur prior to program dropout. University communities have a unique structure and set of resources (e.g., health and counseling centers that are student-oriented and the presence of faculty advisors), and graduate school is an opportune time to intervene while these supports are in place. Time-to-event analyses would shed light on particular times in a graduate degree program where students are at increased risk for behavioral health problems, burnout, and attrition. Future studies should also explore factors that influence graduate students' decisions to persist in their degree program, such as dedication and motivation to complete a degree, even in the face of potentially mitigating factors including poor mental health, substance use, and burnout.

Longitudinal research will help clarify the directionality of the relationship between behavioral health and educational achievement to better understand whether mental health and substance use problems increase risk for burnout and attrition or if burnout and attrition increase risk for mental health and substance use problems. While burnout was assessed as the dependent variable in this research, experiencing exhaustion, cynicism, and inefficacy might exacerbate underlying mental health conditions or increase substance use. The potentially mediating effect of burnout on the relationship between behavioral health and graduate student attrition is also of interest.

While burnout and attrition are two important graduate student outcomes studied in this dissertation, future research on additional outcomes that might be related to burnout and attrition, such as academic engagement and productivity, are warranted. Mental health and substance use problems have the potential to affect participation in departmental and campus activities, decreasing graduate students' sense of belonging and

engagement with their academic and social environment. Additionally, behavioral health issues might be associated with markers of decreased academic productivity, such as skipped classes and low GPA, which might be mechanisms through which these health factors influence burnout and attrition from graduate school.

Future research should also explore the relationship between comorbid substance use and mental health problems with graduate student outcomes. Co-occurring disorders are associated with a myriad of negative health, social, and functional outcomes, as well as decreased academic achievement. Given the high prevalence of co-occurrence of substance use and mental health problems, particularly among young adults, future research that examines the combined influence of these problems on graduate student outcomes could be very informative.

Existing theories of student attrition should be expanded and enhanced to include the potential influence of behavioral health factors on graduate student outcomes. Studies that incorporate health-related variables with other individual factors, such as personal goals and academic ability, and institutional factors, such as administrative policies and program design, would create a more comprehensive view of the factors that are associated with graduate student functioning. Collaborations between researchers in the education and public health sectors are vital to enhance our knowledge of the relationship between graduate student health and both success and well-being.

Appendices

Appendix A: Methods

Study Overview

While more attention is being paid to the high rates of attrition in graduate degree programs, the majority of research in this area has focused on program-level factors among samples of graduate students from singular academic disciplines. More information is needed on the influence of health status and behaviors, specifically how substance use and mental health problems work in conjunction with academic support to influence graduate student achievement. Given that graduate education is a significant investment of time, money, and resources for both the student and the institution, it is imperative that information on the correlates of attrition and burnout is provided to individuals as they decide to enroll in graduate school and to institutions as they support students throughout a degree program. This study examined the relationships between three potential factors related to the burnout and degree completion of graduate students: substance use, mental health problems, and academic support.

Study Design

This research included two distinct but interrelated studies. The first study examined the relationship between substance use patterns, mental health, and degree completion of graduate students across time through a secondary analysis of data from the College Life Study (Arria et al., 2008a; Vincent et al., 2012), a longitudinal cohort study of young adults. The second study further explored the various factors associated with burnout by collecting primary data from graduate students.

Analytic Models

Study #1 characterized the longitudinal patterns of alcohol and marijuana use prior to graduate school enrollment and evaluated the relationship between these patterns, mental health, and graduate degree completion. Study #2 evaluated potential factors associated with burnout among graduate students: (1) demographic and program characteristics; (2) mental health; (3) substance use; and (4) academic support. The analytic models for both studies are displayed below in Figures A.1 and A.2.

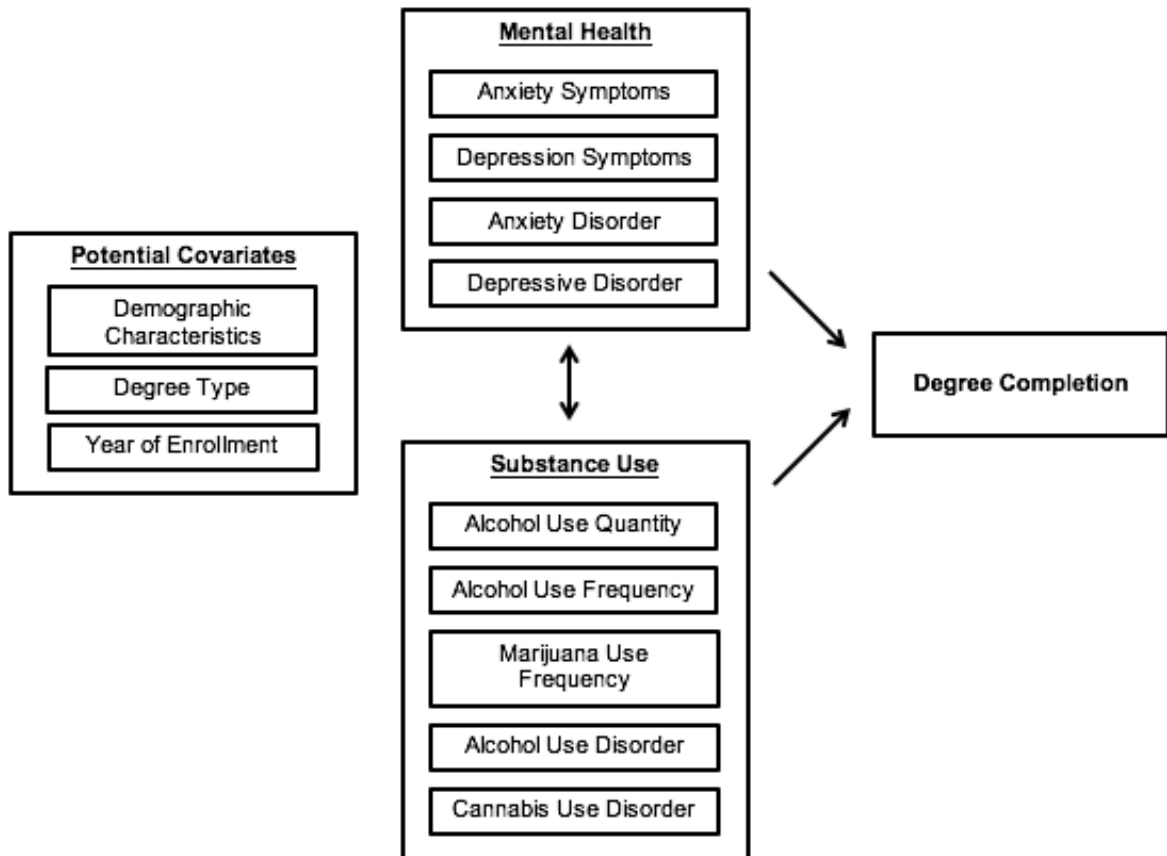


Figure A.1 Analytic model for Study #1

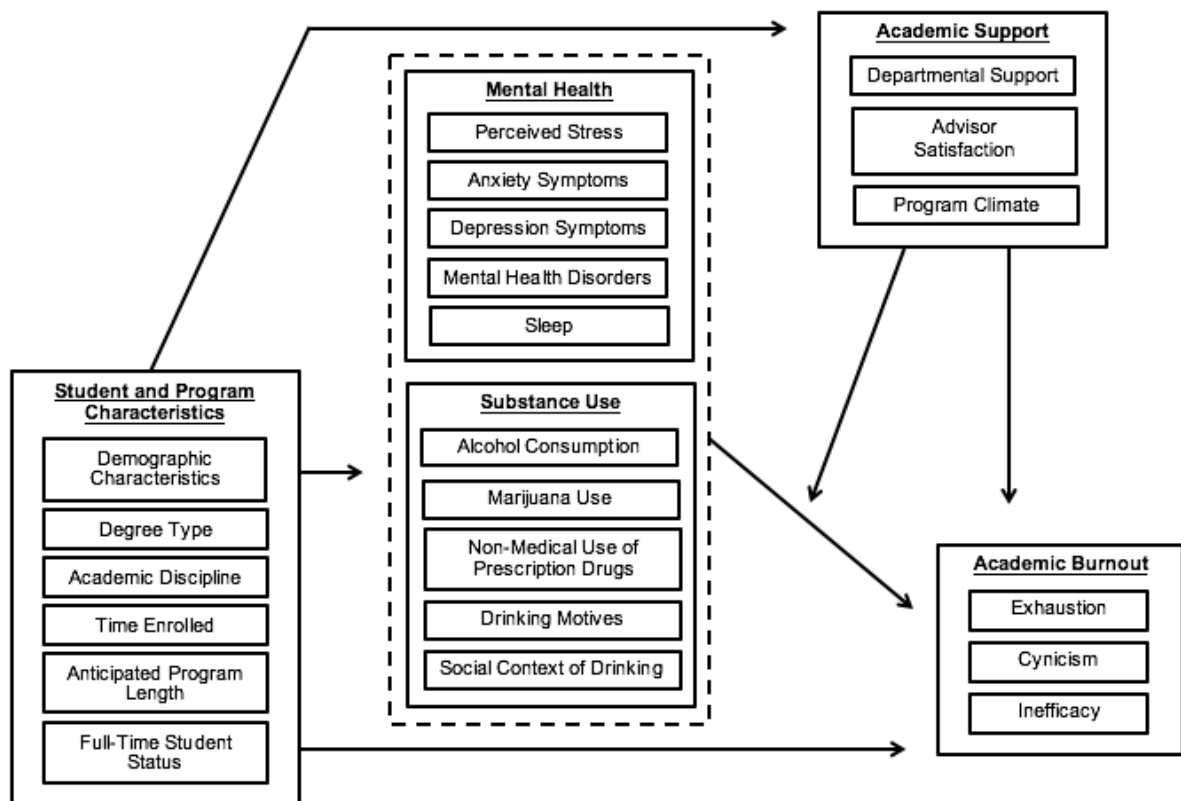


Figure A.2 Analytic model for Study #2

Study #1: Longitudinal Analysis of Graduate Students in the College Life Study

Study Sample

The College Life Study (Arria et al., 2008a; Vincent et al., 2012) is a longitudinal study of young adults who were recruited from a large, mid-Atlantic university. During the first stage of sampling, 3,413 first-year college students were screened during orientation in the summer and fall of 2004. A 10-minute screening survey was administered to all incoming first-time, first-year students ages 17 to 19 years old on demographic characteristics and tobacco, alcohol, and other drug use behaviors. During the second stage of sampling, the sample was stratified by race, gender, and substance

use history. To ensure a sample of students who had a greater risk of using drugs during follow-up, students who had used drugs prior to college entry were purposively oversampled. A random sample of 2,106 students was chosen for longitudinal follow-up, and recruitment of participants occurred on a rolling basis during the 2004-2005 academic year. Out of this sample, 1,253 students completed a baseline interview (Year 1; modal age 18) with the research team. Follow-up assessments were then conducted annually from Years 2 through 8 and then again in Years 10 and 12 (modal age 29) through face-to-face interviews, self-administered surveys, and web-based surveys. Follow-up rates were high, ranging from 91% ($n = 1,142$) in Year 2 and 73% ($n = 908$) in Year 12 (see Table A.1). The university's Institutional Review Board approved the study, and informed consent was obtained from all participants in both stages of sampling.

Table A.1 College Life Study follow-up rates

	Modal Age	Completed	% of 1,253
Year 1	18	1,253	-
Year 2	19	1,142	91.1
Year 3	20	1,101	87.9
Year 4	21	1,097	87.5
Year 5	22	1,019	81.3
Year 6	23	1,000	79.8
Year 7	24	982	78.4
Year 8	25	951	75.9
Year 10	27	932	74.4
Year 12	29	908	72.5

Subsample of Graduate Students

From the original sample of 1,253 young adults, 541 participants (43%) enrolled in a degree-seeking graduate program at some point by Year 10 of the study. Graduate school enrollment was measured in study Years 5, 6, 7, 8, and 10. In Year 5, participants were asked if they were in graduate school and to specify what degree and program they were enrolled in. In Year 6, participants were asked to indicate if they were seeking an M.A., M.S., Psy.D., Ph.D., M.D., J.D., or other degree. Participants were asked a similar question in Year 7, but additional degree options were added (M.B.A., M.P.H., and M.S.W.). Additional options were added in Year 8, including M.Ed., M.A.T., M.P.S., D.P.T., O.D., Pharm.D., and joint/double degree. Participants were able to write in the specific ‘other’ or ‘joint/double’ degree they were seeking. In Year 10, participants indicated if they were currently seeking a master’s degree, doctoral degree, J.D., M.D., or other degree. In all study years, all ‘other’ degrees were individually analyzed and coded, and all ‘joint/double’ degrees were coded as the more advanced degree.

Of the original subsample of 541 participants who listed they were enrolled in graduate school at some point by Year 10, 21 participants were excluded from analyses. Five of these participants were excluded because, upon further examination of other assessment responses, they had listed graduate school enrollment by mistake, and one participant was excluded because information on their specific graduate degree type could not be determined. In addition, to ensure participants had adequate time to complete their degree, 15 participants who first enrolled in a doctorate or professional degree program in Year 10 were excluded, giving a final analytic sample of 520 participants. Sample selection is displayed below in Figure A.3.

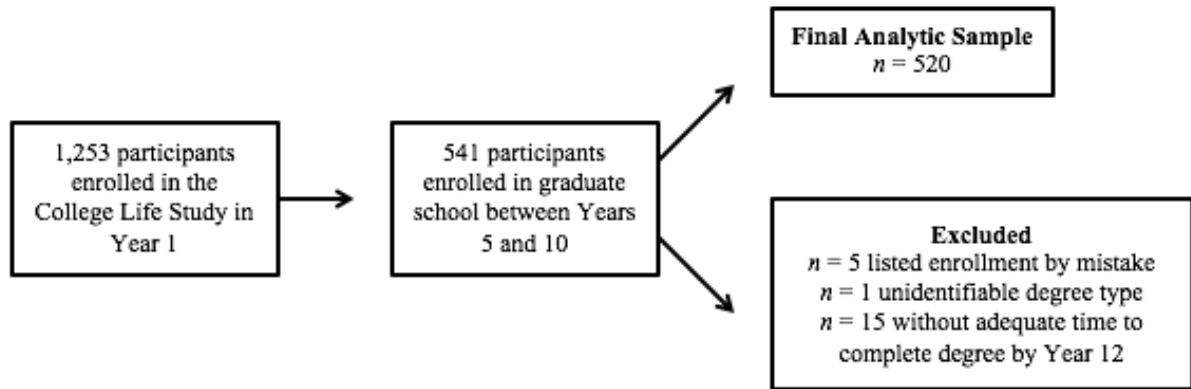


Figure A.3 Sample selection for secondary analysis of participants from the College Life Study

Sample Description

The College Life Study sample ($n = 1,253$) is majority female (52%) and non-Hispanic white (72%). In comparison, the analytic sample for the current research ($n = 520$) is 61% female and 68% non-Hispanic white. Bivariate comparisons of the enrolled and never enrolled subsamples showed that graduate school enrollment was statistically associated with both gender and race/ethnicity. Almost half of females (49%) in the College Life Study enrolled in graduate school by Year 10 in comparison to only 34% of male participants, and 48% of non-white participants enrolled in graduate school compared to only 39% of non-Hispanic white participants.

Measures

Dependent Variable

Degree completion. Completion of a graduate degree was assessed in Years 7, 8, 10, and 12. In Year 7, participants indicated if they had completed an M.A., M.S.,

M.B.A., M.P.H., M.S.W., J.D., or other degree. In Year 8, additional options for completed degrees were added (M.Ed., M.A.T., M.P.S., J.D., D.P.T., Pharm.D., or joint/double degree). In Years 10 and 12, participants indicated their highest completed academic degree, with graduate degree options including master's degree, doctoral degree, J.D., M.D., or other degree. 'Joint/double degree' and 'other degree' responses were individually analyzed and coded. A dichotomous variable was created to represent whether or not participants completed their graduate degree by Year 12.

Independent Variables

Alcohol consumption. Alcohol consumption was measured annually in Years 1-4. To assess frequency of alcohol consumption, participants were asked, "During the past 30 days, on how many days did you drink alcohol?". To assess quantity of alcohol consumption, participants were asked the number of drinks they would have on a typical drinking day. Two categorical variables were created to represent the alcohol consumption quantity and alcohol consumption frequency patterns (see *Statistical Analyses*) of participants during their undergraduate college years.

Marijuana use. Marijuana use was measured annually in Years 1-4. To assess frequency of marijuana use, participants were asked, "During the past 30 days, on how many days did you use marijuana?". A categorical variable was created to represent the marijuana use frequency patterns (see *Statistical Analyses*) of participants during their undergraduate college years.

Alcohol abuse/dependence. A dichotomous variable was created to represent meeting criteria for alcohol abuse/dependence at any point during Years 1-4. Annually,

participants who drank at least five days in the past year were asked a series of questions corresponding to DSM-IV criteria for alcohol abuse or dependence (American Psychiatric Association, 2000), based on questions from the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b). Alcohol dependence was defined as meeting three of six criteria, and alcohol abuse was defined as meeting at least one of four criteria without being dependent.

Marijuana abuse/dependence. A dichotomous variable was created to represent meeting criteria for marijuana abuse/dependence at any point during Years 1-4. Annually, participants who used marijuana five or more times in the past year were asked a series of questions corresponding to DSM-IV criteria for marijuana abuse or dependence (American Psychiatric Association, 2000), based on questions from the National Survey on Drug Use and Health (Center for Behavioral Health Statistics and Quality, 2017b).

Anxiety symptoms. Anxiety symptoms were measured using the Beck Anxiety Inventory (BAI) (Beck et al., 1988b) in Years 1-4. The scale consists of 21 symptoms of anxiety, and participants rank how much each symptom has bothered them in the past week using a four-point scale ranging from 0 (not at all) to 3 (severely, can barely stand it). Possible scores range from 0 to 63, with higher scores indicating higher levels of anxiety. A single score was computed from the mean of the scores from Years 1-4.

Depression symptoms. Depression symptoms were measured using the Beck Depression Inventory (BDI) (Beck et al., 1996) in Years 1-4. The scale consists of 21 statements about how participants have been feeling over the past few days. Possible scores range from 0 to 63, with higher scores indicating increased symptoms of depression. A single score was computed from the mean of the scores from Years 1-4.

Lifetime diagnosis of anxiety. In Years 3 and 4, participants were asked if they had ever been diagnosed with anxiety in their lifetime. A dichotomous variable was created to represent whether participants had been diagnosed with anxiety by Year 4.

Lifetime diagnosis of depression. In Years 3 and 4, participants were asked if they had ever been diagnosed with depression in their lifetime. A dichotomous variable was created to represent whether participants had been diagnosed with depression by Year 4.

Covariates

Demographic Characteristics. Gender was coded by the interviewer in Year 1 as either male or female. Race/ethnicity was measured in Year 3, and response options included white, black/African-American, American Indian or Alaskan Native, Native Hawaiian, other Pacific Islander, Asian, and Hispanic, Latino, or Spanish. Participants could also write in an alternative response or choose “Don’t Know/Refuse to Answer”. Given that the majority of the sample (68%) was non-Hispanic white, race was dichotomized into white and non-white groups. Marital status was measured in Years 4-8, Year 10, and Year 12. Participants indicated whether they were married, divorced, widowed, separated, in a civil union or domestic partnership, or never married. A dichotomous variable (married; never married) was created to represent whether participants were married at any point during Years 4 through 12. The number of children participants had was measured in Years 4-8, Year 10, and Year 12. A dichotomous variable was created to represent whether participants ever had children by Year 12.

Program characteristics. Degree type was coded as the highest level of program participants enrolled in by Year 10. Due to a relatively low number of graduate students enrolled in doctoral programs, a dichotomous variable was created to represent enrollment in either a master's program or a doctorate/professional degree program. Possible master's degrees included M.A., M.S., M.B.A., M.P.H., M.S.W., M.Ed., M.A.T., M.P.S., and other master's degree, and possible doctoral/professional degrees included Ph.D., Psy.D., M.D., J.D., D.P.T., O.D., Pharm.D., and other doctoral/professional degree. Year of enrollment was computed based on the first year participants indicated enrollment in any graduate program. Variable response options were Year 5 (modal age 22), Year 6, Year 7, Year 8, and Year 10 (modal age 27).

Statistical Analyses

Group-based trajectory modeling (Jones & Nagin, 2007; Nagin, 1999) was used to measure the rates of change in alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency during the first four years of the participants' undergraduate degree. Using this procedure, discrete subgroups were identified to represent the varying types of change for alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency. The group-based trajectory modeling procedure yielded possible solutions of one to seven trajectory groups, and each of these were evaluated. The best-fitting models for each substance use variable were selected using the Bayesian Information Criterion (BIC) and the Bayes factor (Jones et al., 2001; Nagin, 1999), as well as conceptual understanding and interpretation of the proposed subgroups. Once the best fitting models were selected, results of these analyses

allowed for the creation of three categorical variables, where the response options were trajectory group membership for (a) alcohol consumption quantity; (b) alcohol consumption frequency; and (c) marijuana use frequency for Years 1-4. This procedure has been used previously to analyze data from this sample (Arria et al., 2013c).

Descriptive statistics (e.g., frequencies, means, and standard deviations) were used to analyze the distributions of all study variables, and the associations between mental health and substance use independent variables were examined. The magnitude of the associations between categorical variables were assessed using Cramer's V and were interpreted as medium (0.3) or large (0.5) effects. The magnitude of the associations between categorical and continuous variables were assessed using Cohen's d values and were interpreted as medium (0.5) or large (0.8) effects. The magnitude of the associations between continuous variables were assessed using Spearman's ρ values and were interpreted as medium (0.3) or large (0.5) effects (Cohen, 1988). Among mental health variables, there was a significant large association between anxiety symptoms and lifetime history of anxiety and a significant medium association between depression symptoms and lifetime history of depression. Among substance use variables, there was a significant large association between alcohol abuse/dependence and both alcohol consumption quantity and frequency, and there was a significant large association between marijuana abuse/dependence and marijuana use frequency. To avoid potential multicollinearity in regression models, only anxiety symptoms, depression symptoms, alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency were included as independent variables in further analyses.

Logistic regression models were used to analyze the relationships between all covariates and independent variables with graduate degree completion without adjusting for any other study variables. Three multivariate logistic regression models were then fit to assess (1) the relationships between mental health variables and graduate degree completion after adjusting for demographic and program characteristics; (2) the relationships between substance use variables and graduate degree completion after adjusting for demographic and program characteristics; and (3) the relationships between mental health and substance use variables and graduate degree completion after adjusting for all other study variables.

SAS Version 9.4 was used for group-based trajectory modeling, and SPSS Version 24.0 was used for all additional analyses. The alpha level was set at 0.05 for all analyses.

Missing Data. Every participant had available data for gender, race/ethnicity, degree type, and year of enrollment. Variables for marital status, number of children, anxiety symptoms, depression symptoms, lifetime history of anxiety or depression, and alcohol and marijuana abuse/dependence were computed using data from multiple annual assessments to ensure that every participant had an available value; therefore, analytic techniques for handling missing data were not necessary. Each participant had data on alcohol consumption quantity, alcohol consumption frequency, and marijuana use frequency for at least one assessment year for Years 1-4, making trajectory modeling possible. The PROC TRAJ procedure in SAS Version 9.4 includes participants with missing data in trajectory analyses, but only available data for each participant is used to assign a participant to a trajectory group.

Power Analysis. Using G*Power 3.1 (Faul et al., 2009), a post-hoc power analysis was conducted using logistic regression with the known sample size of 520 participants. Based on study results, an odds ratio of 2.2 was used as an estimate of the association between near daily alcohol use (compared to minimal/no use) and graduate degree completion. The alpha level was set at 0.05. The achieved power was greater than 0.95 to detect a significant positive association (odds ratio > 1.0).

Study #2: Cross-sectional Analysis of Current Graduate Students

Study Site

In the fall of 2017, University A had over 10,000 graduate students enrolled in 107 master's degree programs, 83 doctoral degree programs, and numerous advanced special student and graduate certificate programs. The graduate student population at University A is 52% male and 38% white with an average age of 29 years old. Thirty-four percent of graduate students at University A have international student status and 76% are enrolled full-time. The majority (55%) of graduate students are pursuing master's degrees and 40% are pursuing doctoral degrees. In fall of 2017, University B had almost 6,000 students enrolled in graduate certificate, master's, doctorate, and specialized degree programs in dentistry, law, medicine, nursing, pharmacy, physical therapy, and social work. The graduate student population at University B is 71% female and 51% white, and the majority of University B graduate students (61%) are pursuing doctorate-level degrees.

The total sampling frame from both institutions was 56% female and 41% white with 48% of students enrolled in master's programs and 47% enrolled in doctoral

programs. When compared to data on the entire U.S. graduate student population, the sampling frame for this research had a similar gender breakdown but included more students of non-white racial groups (Okahana & Zhou, 2017).

Study Sample

Eligibility. Participants were eligible for this study if they were currently enrolled in a graduate degree program at either University A or University B. Students considered advanced special students or students enrolled in graduate certificate programs were not eligible for participation, as their studies do not end with completion of a graduate degree. In addition, students in majority online programs were not eligible for participation due to this study's focus on academic support through in-person interactions with faculty and students.

Recruitment and Informed Consent. Approval was obtained by the Institutional Review Boards at both universities prior to participant recruitment. In September 2017, all currently enrolled graduate students at University A and University B were contacted to participate in the study via email through university listservs. The recruitment email described the purpose of the study as well as included the link to participate in the web-based survey.

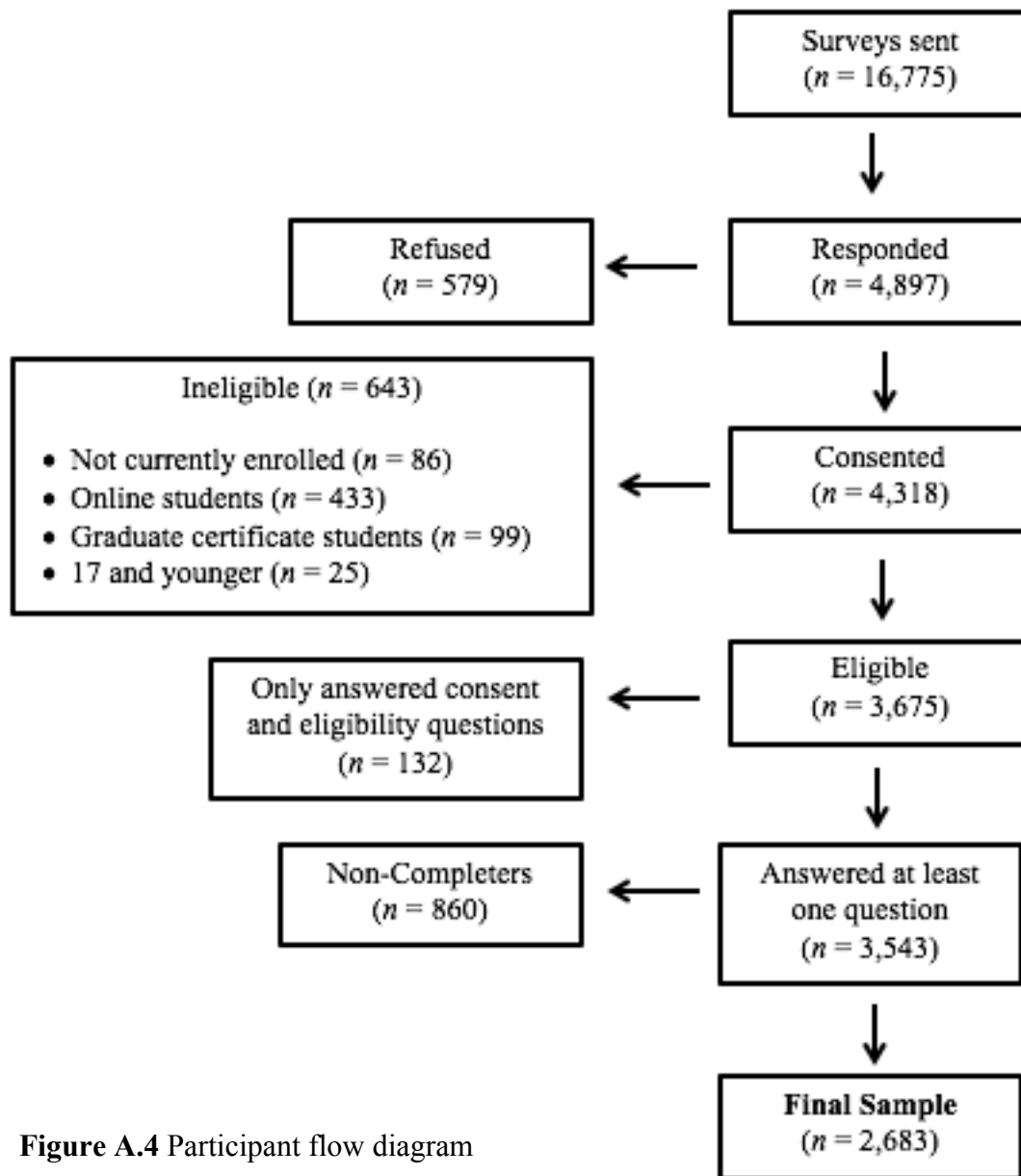


Figure A.4 Participant flow diagram

Data Collection Procedures

In the fall of 2017, an online survey was sent to all currently enrolled graduate students at both universities ($n = 16,775$). Of the $n = 4,318$ students who consented to participate, 38% were excluded because they did not meet eligibility criteria ($n = 643$) or they stopped answering questions prior to the end of the survey ($n = 992$), regardless of skipping individual questions throughout. There was an overall sample size of 2,683,

representing a response rate of 23%. This response rate is similar but slightly lower than other studies of graduate student populations (Hyun et al., 2006; Lipson et al., 2016). Prior to beginning the survey, participants read through the informed consent information and indicated that they voluntarily agreed to participate. As an incentive, participants chose to enter themselves into a raffle where 350 participants each received a \$10 Amazon gift card.

A web-based version of the survey was created using Qualtrics Survey Software (for University A students) (Qualtrics, 2017) and Baseline (for University B students), and the link to take the survey online was provided to participants in the initial recruitment email. 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. If students wanted to enter themselves in a raffle to receive an incentive, they voluntarily provided their email address at the conclusion of the survey. Incentives were distributed in November 2017.

Measures

Demographic and Program Characteristics

Demographic Characteristics. Standard measures 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.

Degree Type. 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.). If students were seeking more than one degree, they were asked to choose their highest level of degree program. For example, if they were enrolled in a joint master's and doctoral degree program, they were instructed to select doctoral degree.

Time Enrolled. Participants indicated how many semesters they had been enrolled in their graduate degree program, including the current semester, using the standard definition of an academic semester lasting 15-18 weeks.

Academic Discipline. Participants chose from a list of 20 academic disciplines based on graduate programs offered at the participating universities, including business, education, engineering, behavioral and social sciences, agriculture and natural resources, computer, mathematical and natural sciences, arts and humanities, architecture, public health, public policy, information studies, journalism, dentistry, law, medicine, nursing, pharmacy, health sciences, physical therapy, and social work.

Student Status. Participants indicated whether they were currently enrolled in their graduate program full or part-time.

Anticipated Program Length. Participants were asked to indicate the expected number of years for completion of their graduate degree.

Mental Health

Lifetime Diagnosis of Anxiety. Anxiety was assessed by asking participants to indicate whether they had ever been diagnosed with anxiety by a health professional in their lifetime.

Anxiety Symptoms. The Beck Anxiety Inventory (BAI) (Beck et al., 1988b) was used to assess current level of anxiety. The scale consists of 21 symptoms of anxiety, and

participants rank how much each symptom has bothered them in the past week using a four-point scale ranging from 0 (not at all) to 3 (severely, can barely stand it). Possible scores range from 0 to 63, with higher scores indicating higher levels of anxiety.

Lifetime Diagnosis of Depression. Participants self-reported if they had ever been diagnosed with depression by a health professional in their lifetime.

Depression Symptoms. The Beck Depression Inventory (BDI) (Beck et al., 1996) was used to assess current level of depression using a series of 21 statements about how participants have been feeling over the past few days. Possible scores range from 0 to 63, with higher scores indicating increased symptoms of depression.

Perceived Stress. Perceived stress was assessed using the Perceived Stress Scale (Cohen et al., 1983). The scale 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?”. Scores range from 0 to 40, with higher scores indicating higher levels of stress.

Sleep. Sleep was assessed using two questions from the Pittsburgh Sleep Quality Index (Buysse et al., 1989) and one question from the School Sleep Habits Survey (Wolfson & Carskadon, 1998). Participants were asked how many hours of sleep they got per night, how they would rate their overall sleep quality, and how often they felt they got enough sleep.

Substance Use

Alcohol Consumption. Alcohol consumption frequency and quantity were measured using four questions: (1) In the past 12 months, on how many days have you drank any drink with alcohol in it?; (2) In the past 30 days, on how many days have you drank any drink with alcohol in it?; (3) On a typical day that you drank in the past 12 months, how many alcoholic drinks did you consume?; and (4) On a typical day that you drank in the past 30 days, how many alcoholic drinks did you consume?

Marijuana Use. Marijuana use frequency was measured using two questions: (1) In the past 12 months, on how many days have you used any type of marijuana?; and (2) In the past 30 days, on how many days have you used any type of marijuana?

Nonmedical Use of Prescription Drugs. Four classes of prescription drugs were of interest- prescription stimulants, analgesics, tranquilizers, and sedatives. Participants were provided with the definition of nonmedical use as the intentional use of prescription drugs without a prescription, in a way other than prescribed, or for the experience or feeling it causes (National Institute on Drug Abuse, 2018). The frequency of the nonmedical use of prescription drugs was assessed by the number of days participants had used each of the four classes of prescription drugs nonmedically in the past 12 months.

Drinking Motives. Drinking motives were assessed using the Drinking Motive Questionnaire Revised Short-Form (DMQ-R SF) (Kuntsche & Kuntsche, 2009). The DMQ-R SF consists of 12 items that participants rank on a three-point scale of never, sometimes, or almost always. The scale consists of four subscales: social motives (three items), enhancement motives (three items), coping motives (three items), and conformity

motives (three items). Each subscale is scored separately, and higher scores indicate higher frequency of that particular motivation for drinking. Example items include “Because it’s fun”, “Because it helps when you feel depressed or nervous”, and “To forget about your problems”.

Social Context of Drinking. Drinking context was assessed using fourteen items. Items were taken from the Social Context of Drinking Scale- College Version (Beck et al., 2008) that were relevant to graduate students and only addressed context (not motives, which were measured separately) as well as from a survey used by Paradis et al. (2011) to measure the relationship between parenthood, alcohol intake, and drinking context. Additional items were added by the researcher based on the graduate school experience. Each item was scored on a scale from 0 (never) to 3 (frequently) and analyzed separately.

Academic Support

Advisor Satisfaction. Three items were used to assess level of satisfaction with a faculty advisor, as adapted from Eduljee and Michaud (2014). Participants were asked how satisfied they were with their faculty advisor (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied), how often they met with their advisor in the past semester (once a week or more, once or twice a month, once or twice during the semester, not at all, this is my first semester), and whether the frequency of meeting with their advisor was too much, not enough, or just about right.

Quality of Student-Advisor Relationship. The quality of the student-advisor relationship was measured using the Advisor Relationship Index (Cronbach’s alpha =

0.85) developed by Hyun et al. (2006) to assess the relationship between a student and their academic advisor. The index includes seven items ranked on a 4-point scale from strongly disagree to strongly agree. Questions include the advisor's satisfaction with student performance, facilitation of collaboration with other researchers, and consideration of the student's personal problems. The survey itself asked students to answer these questions in regards to the person officially assigned to them by their department/program to discuss their coursework and academic progress as well as signing registration forms. This index has been used in prior work among graduate student populations (Hyun et al., 2006).

Departmental Support. Perceived level of value and appreciation by department faculty was measured using six items from the Perceived Organizational Support Scale (Eisenberger et al., 2001; Eisenberger & Fasolo, 1990) where “my organization” was replaced with “my department”. Responses to each item ranged from strongly disagree (1) to strongly agree (7). This scale has been used to measure the relationship between perceived department or faculty support and the intentions of doctoral students to leave academia (Hunter & Devine, 2016).

Program Climate. Sense of community and competition within degree program was measured using 13 items from the Acadia Institute Project on Professional Values and Ethical Issues in the Graduate Education of Scientists and Engineers (Anderson & Swazey, 1998). Seven items assessed community and six items assessed competition, with responses including (1) very little or not at all, (2) some extent, and (3) great extent. Adapted versions of this scale have been used in prior work involving graduate and postdoctoral students in scientific fields (Louis et al., 2007).

Burnout

Burnout was measured using three subscale scores of the Maslach Burnout Inventory- Student Survey (MBI-SS) (Schaufeli et al., 2002; Schaufeli & Salanova, 2007). 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 to always, with higher scores indicating higher levels of burnout. Prior studies have used the MBI-SS in samples of both undergraduate and graduate students (Capri et al., 2012; Rigg et al., 2013; Salanova et al., 2010; Schaufeli et al., 2002).

Statistical Analyses

Overview. SPSS Version 24.0 was used for all analyses, and the alpha level was set at 0.05. Independent variables of interest include mental health (variables for perceived stress, anxiety, depression, and sleep), substance use (variables for alcohol consumption frequency, alcohol consumption quantity, marijuana use frequency, frequency of the nonmedical use of prescription drugs, social drinking motives, enhancement drinking motives, coping drinking motives, conformity drinking motives, and social context of drinking), and academic support (variables for advisor satisfaction, departmental support, quality of student-advisor relationship, and program climate). Dependent variables of interest are exhaustion, cynicism, and inefficacy, as part of the concept of burnout. The distributions of all variables, including demographic and

program characteristics (age, gender, race/ethnicity, international student status, employment status, household income, marital status, number of children, degree type, academic discipline, anticipated program length, time enrolled, and full-time student status) were assessed using descriptive statistics (e.g., frequencies, means, and standard deviations).

Manuscript #2. Unadjusted mental health and substance use differences by demographic and program characteristics were explored using chi-square tests for categorical variables and one-way analysis of variance (ANOVA) for continuous variables. Post hoc analyses of significant chi-square tests were conducted using z-tests to compare proportions, with Bonferroni adjustment for multiple testing. Post hoc analyses of significant ANOVA results were conducted using Bonferroni tests.

Logistic regression models were used to predict high stress, moderate/severe anxiety symptoms, moderate/severe depression symptoms, lifetime diagnoses of anxiety or depression, high-risk alcohol use, marijuana use, and the nonmedical use of prescription drugs from each individual demographic and program characteristic variable. Multivariate logistic regression models for each of these mental health and substance use outcomes that included all demographic and program characteristics were then fit to analyze these relationships while controlling for all other predictor variables.

Manuscript #3. Associations between burnout and continuous mental health, substance use, and academic support variables were explored using Spearman's rank-order correlation tests due to a lack of normality among all continuous variables of interest. The magnitude of the association between continuous variables was interpreted

as a medium effect for Spearman's ρ values of 0.3 or greater and as a large effect for Spearman's ρ values of 0.5 or greater (Cohen, 1988).

Multivariate logistic and linear regression models were used to assess the associations between academic support variables (advisor satisfaction, departmental support, program community, and program competition) with mental health (stress, anxiety symptoms, and depression symptoms) and substance use (high-risk alcohol use, marijuana use, and nonmedical use of prescription drugs) while controlling for demographic and program characteristics.

Multivariate linear regression models for the three dimensions of burnout (exhaustion, cynicism, and inefficacy) were fit that included all demographic characteristics, program characteristics, categorical mental health and substance use variables, and continuous mental health and substance use variables that had an association with burnout with at least a medium effect size. Final multivariate linear regression models included all demographic and program characteristics regardless of significance after adjusting for other variables, as well as any mental health, substance use, or academic support variable that was significant after adjusting for all other variables. The R^2 value was used to examine the fit of each final model in explaining the variation in exhaustion, cynicism, and inefficacy.

To determine whether the relationship between mental health/substance use and burnout was moderated by academic support, all potential interaction effects between mental health/substance use and academic support variables were entered separately into the final models predicting burnout and assessed for statistical significance.

Additional Analyses. Analyses involving quality of student-advisor relationship, sleep, drinking motives, and social context of drinking were not included in the results manuscripts. Associations between burnout and drinking motive subscale scores as well as typical hours of sleep per night were assessed using Spearman's rank-order correlation tests. The magnitude of the association was interpreted as a medium effect for Spearman's ρ values of 0.3 or greater and as a large effect for Spearman's ρ values of 0.5 or greater (Cohen, 1988). Burnout differences by typical hours of sleep per night (categorical), sleep quality, and frequency of getting enough sleep were explored using chi-square tests. Post hoc analyses of significant chi-square tests were conducted using z-tests to compare proportions, with Bonferroni adjustment for multiple testing. Descriptive statistics were used to compare the social context of drinking among participants of different alcohol consumption frequency and quantity groups. Results for these additional analyses are presented in the appendix tables.

Due to the researcher's inclusion of a "Not Applicable" option in the Advisor Relationship Index (Hyun et al., 2006), this data was unable to be analyzed.

Missing Data. To minimize missing data, participants were prompted by an on-screen message if they had skipped a question on the survey. However, participants still had the option to skip questions, creating the possibility for missing data for both single-item questions and scales with multiple items. Twenty-eight percent of the sample ($n = 754$) were missing data on at least one variable of interest, and comparisons between complete and non-complete cases revealed that the data were not missing at random. Missing data was handled using multiple imputation of five complete datasets in SPSS,

incorporating all study variables, and statistics were obtained by averaging results across all imputed datasets.

Power Analysis. Using G*Power 3.1 (Faul et al., 2009), a post-hoc power analysis was conducted using multiple linear regression with the known sample size of 2,683 participants and a maximum of 23 predictors in the regression model. An effect size f^2 of 1.01 was computed from an R^2 value of 0.503 for the regression model predicting exhaustion, and the alpha level was set at 0.05. The achieved power was greater than 0.95, indicating that our study had enough power to detect the hypothesized effects.

Appendix B: IRB Application

INITIAL APPLICATION PART 2

1. Abstract

There is a well-established connection between health and educational attainment, and research has shown that both substance use and mental health problems are associated with underachievement and attrition among high school and undergraduate student populations. The relationships between these health factors and academic success among graduate students have been understudied, and further examination is needed given the high prevalence of substance use and mental health problems during young adulthood. This research aims to fill this gap by assessing how health-related factors are associated with academic burnout and degree completion among graduate students.

In partnership with the University A Graduate School and the University B Office of Academic and Student Affairs, we aim to recruit about 11,000 currently enrolled graduate students from these institutions for this research. We will ask respondents to complete an online survey containing 63 questions on the following domains of interest: individual and degree program characteristics, program satisfaction, mental health, and substance use. The survey should take about 20 minutes to complete. Respondents will receive information about the study and a link to participate via an email sent to their university email accounts from the University A Graduate School and the University B Office of Academic and Student Affairs. Contact information for the primary researcher and her faculty advisors will be provided, and the first page of the survey will be the informed consent form. There is minimal risk and no direct benefits associated with participation in this study.

Participant contact information (name and email address) will only be collected if students choose to (1) enter themselves into a raffle to receive an incentive or (2) request to be contacted for future research studies. For participants who opt to provide their contact information for either of these purposes, they will be directed to a second, separate online survey in order to separate linkages between survey data and identifying contact information. For all participants, email addresses will be used for recruitment purposes only, but will never be linked to their individual survey responses, and will be permanently deleted from all study records, thereby making the survey data effectively anonymous. All data will be stored using password-protected files and computers. No one but the research team will have access to collected data, and once all survey responses have been downloaded to a computer, all online responses will be deleted.

2. Subject Selection

- a. **Recruitment:** A recruitment email will be sent by the University A Graduate School and University B Office of Academic and Student Affairs to all currently enrolled graduate students in September 2017. Data collection will

proceed for one month, with three additional reminder emails sent during this data collection period.

- b. **Eligibility Criteria:** Participants are eligible for this study if they are 18 years or older and currently enrolled in a graduate degree program at either university. Students considered advanced special students, students enrolled in graduate certificate programs, and students enrolled in majority online degree programs are not eligible for participation.
- c. **Rationale:** Students considered advanced special students or students enrolled in graduate certificate programs are not eligible for participation, as their studies do not end with completion of a graduate degree. In addition, students in majority online programs are not eligible for participation due to this study's focus on academic support through in-person interactions with faculty and students.
- d. **Enrollment Numbers:** University A currently has 10,611 students enrolled in their graduate programs and University B currently has 5,484 students enrolled in their graduate programs, giving a total sampling frame of 16,095 graduate students. Assuming a 70% response rate, the final sample would consist of about 11,000 students.
- e. **Rationale for Enrollment Numbers:** This response rate is higher than response rates of online surveys, but we expect higher response rates because this is a graduate student's dissertation research and students might be interested in participating to help out a fellow student. In addition, this topic might be of direct relevance and interest to the subpopulation being studied.

3. Procedures

A recruitment email with study information, a link to the online survey, and contact information for the primary researcher will be sent out by the University A Graduate School and University B Office of Academic and Student Affairs Schools to all currently enrolled graduate students. The survey, attached as a supporting document to this application, will be completed online and will include informed consent information prior to beginning the survey questions. The survey consists of 63 questions about individual and degree program characteristics, program satisfaction, mental health, and substance use, and should take about 20 minutes to complete. Using a separate survey, students will be able to voluntarily provide their name and email address if they would like to be entered into a drawing to receive a \$10 gift card or would like to be contacted for future research studies. Given the proposed enrollment, each participant has about a 1 in 30 chance of winning.

4. Risks

We do not anticipate any major risks or discomforts involved in participating in this research study, however there may be some discomfort when participants answer questions about their mental health and substance use history. In order to mitigate these risks, participants will have the option to skip any questions they do not wish to answer.

5. Benefits

There are no direct benefits to participants for participating in this study. However, we hope that the research will inform future allocation of resources toward graduate student services and/or the provision of programming that might help increase the engagement of graduate students and decrease burnout.

6. Confidentiality

The online survey will be administered via Qualtrics, which employs multiple layers of security protections such as high-end firewall systems and transport layer security encryption (i.e., HTTPS) and meets or exceeds all FIPS PUB 200 requirements. No names, email addresses, or other identifiers will be collected on the initial survey form in Qualtrics or stored with the survey data. Participant contact information (full name and email address) will only be collected if students choose to (1) enter themselves into a raffle to receive an incentive or (2) request to be contacted for future research studies. For participants who opt to provide their contact information for either of these purposes, they will be directed to a second, separate online survey in order to separate linkages between survey data and any identifying contact information.

For all participants, email addresses will be used for recruitment purposes only, but will never be linked to their individual survey responses, and will be permanently deleted from all study records, thereby making the survey data anonymous. Each participant will be given a unique ID number, and all data, including contact information, will be downloaded every 1-2 business days and stored using password-protected files on a password-protected computer. No one but the research team will have access to collected data, and once all survey responses have been collected and downloaded to a computer, all online responses will be deleted. If we write reports or articles about the findings from this research, participant identity will be protected to the maximum extent possible.

Contact information for participants who wish to be contacted for participation in future research studies will remain in a password-protected database on a password-protected computer, accessible only to the PI and her designees. Contact information collected for incentive purposes will be permanently deleted in November 2017 after incentives are distributed.

7. Consent Process

Information regarding consent will be provided online prior to the beginning of the survey. Participants will have the opportunity to review the informed consent information and then indicate that they voluntarily consent to participate. They will be informed that they may print the consent form or contact the Principal Investigator for a copy. After they provide consent by clicking yes to a survey item stating, "I have reviewed the informed consent information and consent to participate in this study", they will be directed to the first page of the survey.

For this consent procedure, we are requesting a waiver of written consent. In support of this alteration of consent guidelines, we submit that (1) this study involves no more than minimal risk to subjects (see section 4 "Risks" above); (2) the web-based adaptation of consent will not adversely affect subjects' rights or welfare because they will receive the same information as in a written consent form; (3) the online survey could not be practicably carried out without the use of a web-based adaptation of consent; and (4) no information will be withheld from participants and therefore post-participation briefing will not be necessary.

8. Conflict of Interest

No conflict of interest.

9. HIPAA Compliance

Not applicable.

10. Research Outside of the United States

Not applicable.

11. Research Involving Prisoners

Not applicable.

Appendix C: Informed Consent

CONSENT TO PARTICIPATE

Project Title	Academic Progress of Graduate Students: A Multivariate Analysis
Purpose of the Study	This research is being conducted by Hannah K. Allen, MS, MHS at two institutions. We are inviting you to participate in this research project because you are currently enrolled in a graduate or professional degree program at one of these institutions. The purpose of this research is to understand factors associated with academic burnout and attrition among graduate students.
Procedures	Participants will be asked to complete an anonymous online survey consisting of 63 questions that asks about program satisfaction, faculty/staff interactions, substance use, and mental health. The survey should take about 20 minutes to complete.
Potential Risks and Discomforts	We do not anticipate any major risks or discomforts involved in participating in this research study, however there may be some discomfort when answering questions about your mental health history and substance use. It is important to know that all responses will not be linked to any identifying information, and you may choose to skip any question you are not comfortable answering.
Potential Benefits	There are no direct benefits to participating in this study. However, we hope that the research will inform future programming and allocation of resources for graduate students.
Confidentiality	Your responses will be anonymous. You will be assigned a unique ID number, and all data will be stored using password-protected files on a password-protected computer. No one but the research team will have access to collected data, and once all survey responses have been collected and downloaded to a computer, all online responses will be deleted. If we write reports or articles about the findings from this project, your identity will be protected to the maximum extent possible. Your contact information will be collected from you if you choose to enter a raffle to receive an incentive or if you are interested in being contacted for future research studies. This information will not be linked in any way to the responses you provide on the survey.

Compensation	<p>You may choose to provide your name and email address to be entered into a raffle to win \$10 cash or cash equivalent for participating in this study. Three hundred and fifty students will be selected to receive an incentive, and each participant will have about a 1 in 30 chance of being selected. You will be responsible for any taxes assessed on this compensation.</p>
Right to Withdraw and Questions	<p>Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify.</p> <p>If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigators:</p> <p>Hannah K. Allen, MS, MHS University of Maryland School of Public Health Department of Behavioral and Community Health 4200 Valley Drive College Park, MD 20742 (301)-405-9754 hallen@umd.edu</p> <p>Amelia M. Arria, PhD University of Maryland School of Public Health Department of Behavioral and Community Health 4200 Valley Drive College Park, MD 20742 (301)-405-9795 aarria@umd.edu</p> <p>Flavius Lilly, PhD, MPH University of Maryland Baltimore Senior Associate Dean, Graduate School Assistant Vice President, Academic & Student Affairs 620 W. Lexington St. Baltimore, MD 21201 (410)-706-7767 flilly@umaryland.edu</p>

<p>Participant Rights</p>	<p>If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:</p> <p>University of Maryland College Park Institutional Review Board Office 1204 Marie Mount Hall College Park, Maryland, 20742 E-mail: irb@umd.edu Telephone: 301-405-0678</p> <p>This research has been reviewed according to the IRB procedures for research involving human subjects at both participating universities.</p>
<p>Statement of Consent</p>	<p>Your consent indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You may print a copy of this consent information for your records.</p> <p>If you agree to participate, please indicate so by answering the question below.</p> <p>I have reviewed the above information and consent to participate in this study.</p> <ul style="list-style-type: none"> • Yes, I agree/consent to participate • No, I do NOT agree/consent to participate

Appendix D: Recruitment Email

Subject Line: Participate in a Brief Survey on Graduate Student Burnout

Dear Graduate Student,

As part of my dissertation research on better understanding the factors associated with graduate student burnout, you are invited to participate in a brief, one-time online survey that should take about 20 minutes to complete.

Participation is voluntary, and all of your responses will be kept completely anonymous. As a thank you for participating, you will have the chance to enter into a raffle to win one of 350 \$10 Amazon gift cards. Data collection will close on Monday, October 16th, so be sure to click this link now to start the survey!

<https://go.umd.edu/gradstudentburnout>

If you have any questions about participation in this study, please feel free to contact me:

Hannah K. Allen, MS, MHS
University of Maryland School of Public Health
Department of Behavioral and Community Health
4200 Valley Drive, Room 1242GG
College Park, MD 20742
(301)-405-9754
hallen@umd.edu

Thank you for taking the time to participate!

Best,

Hannah

Appendix E: Reminder Email

Subject Line: Reminder: Participate in a Brief Survey on Graduate Student Burnout

Dear Graduate Student,

There's still time to participate in a brief, one-time online survey on the factors associated with graduate student burnout. The survey should take about 20 minutes to complete.

Participation is voluntary, and all of your responses will be kept completely anonymous. As a thank you for participating, you will have the chance to enter into a raffle to win one of 350 \$10 Amazon gift cards. Data collection will close on Monday, October 16th, so be sure to click this link now to start the survey!

<https://go.umd.edu/gradstudentburnout>

If you have any questions about participation in this study, please feel free to contact me:

Hannah K. Allen, MS, MHS
University of Maryland School of Public Health
Department of Behavioral and Community Health
4200 Valley Drive
College Park, MD 20742
hallen@umd.edu

Thank you for taking the time to participate!

Best,

Hannah

Appendix F: IRB Approval



1204 Marie Mount Hall
College Park, MD 20742-5125
TEL 301.405.4212
FAX 301.314.1475
irb@umd.edu
www.umresearch.umd.edu/IRB

DATE: August 16, 2017

TO: Hannah Allen, MHS, MS
FROM: University of Maryland College Park (UMCP) IRB

PROJECT TITLE: [1107493-1] Academic Progress of Graduate Students: A Multivariate Analysis

REFERENCE #:
SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: August 16, 2017
EXPIRATION DATE: August 15, 2018
REVIEW TYPE: Expedited Review

REVIEW CATEGORY: Expedited review category # 7

Thank you for your submission of New Project materials for this project. The University of Maryland College Park (UMCP) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

Prior to submission to the IRB Office, this project received scientific review from the departmental IRB Liaison.

This submission has received Expedited Review based on the applicable federal regulations.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of August 15, 2018.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Unless a consent waiver or alteration has been approved, Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others (UPIRSOs) and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Please note that all research records must be retained for a minimum of seven years after the completion of the project.

If you have any questions, please contact the IRB Office at 301-405-4212 or irb@umd.edu. Please include your project title and reference number in all correspondence with this committee.

Appendix G: Survey

ELIGIBILITY SCREENER:

Are you a currently enrolled graduate or professional student at University A or University B?

- Yes
- No (if no, end survey)

Are you currently enrolled in a majority online graduate degree program?

- Yes (if yes, end survey)
- No

What is the highest level of degree program that you are currently enrolled in? For example, if you are enrolled in a joint master's/doctoral degree program, please select doctoral degree.

- Graduate certificate (if selected, end survey)
- Master's degree
- Academic doctoral degree (e.g., Ph.D.)
- Professional doctoral degree (e.g., M.D., J.D.)

What is your current age (in years)? _____ (if less than 18, end survey)

1. Which of the following best describes the academic discipline of your graduate degree program?

- Business
- Education
- Engineering
- Behavioral and Social Sciences
- Agriculture and Natural Resources
- Computer, Mathematical, and Natural Sciences
- Arts and Humanities
- Architecture
- Public Health
- Public Policy
- Information Studies
- Journalism
- Dentistry
- Health Sciences
- Law
- Medicine
- Nursing
- Pharmacy
- Social Work
- Physical Therapy

2. **In total**, how many years do you expect it to take to complete your graduate degree? Please round up to the nearest full year.

Pull-down menu: 1-10+ years

3. How many semesters have you been enrolled in your current graduate degree program (including the current semester)? For this question, a semester is defined as an academic period lasting about 15-18 weeks. The academic year is typically divided into two semesters.

Pull-down menu: 1-16+ semesters

4. Based on your university's definition of part- or full-time student status, are you currently considered a part- or full-time graduate student?

- a. Part-time
- b. Full-time

5. Why did you apply to a graduate degree program? Please choose the **most important** or **most relevant** reason.

- a. I needed a graduate degree to advance in my field of study.
- b. I needed a graduate degree for an entry-level position in my field of study.
- c. I wanted to change my field of study.
- d. I could not find a job, so I decided to go back to school.
- e. A faculty member recommended that I pursue my graduate degree.
- f. I wanted to increase my knowledge in my field of study.
- g. I wanted to pursue personal interests.
- h. I wanted to earn more money, and I expect my earnings will increase with a graduate degree.
- i. Other, please specify: _____

6. To what extent do you agree or disagree with the following statements about the faculty in your department or school?

The faculty in my department/school...							
	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Takes pride in my accomplishments.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Really cares about my wellbeing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Values my contributions to its wellbeing and performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strongly considers my goals and values.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shows little concern for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is willing to help me if I need a special favor.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. To what extent do the following statements describe your graduate program?

	Very little or not at all	Some Extent	Great Extent
Graduate students and faculty care about each other.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A few graduate students get most of the attention and resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate students are treated with respect.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty members are accessible to graduate students.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate students have to compete for faculty time and attention.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty members make sure that graduate students feel like members of the department.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate students are given an active role in departmental decisions that affect them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty members are willing to bend the rules for some graduate students but not for others.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Graduate students and faculty collaborate on publications.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faculty members seem more concerned with furthering their own career than with the wellbeing of the department as a whole.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

People have to compete for departmental resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
There is a sense of solidarity among the graduate students who enter the program at the same time.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
People put their own interests first.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For the following questions, think about the faculty or research advisor that was officially assigned to you by your department/program to oversee your academic progress and sign all required registration forms.

8. Overall, how satisfied/dissatisfied are you with your faculty advisor?

- a. Very satisfied
- b. Satisfied
- c. Neither satisfied nor dissatisfied
- d. Dissatisfied
- e. Very dissatisfied

9. During the past semester, how often did you meet with your faculty advisor?

- a. Once a week or more
- b. Once or twice a month
- c. Once or twice during the semester
- d. Not at all
- e. This is my first semester

10. How would you describe the frequency with which you and your advisor meet?

- a. Too much
- b. Just about right
- c. Not enough

11. To what extent do you agree or disagree with the following statements about your faculty advisor?

My faculty advisor...					
	Strongly disagree	Disagree	Agree	Strongly agree	Not applicable
Discusses the strengths and weaknesses of my research/coursework.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Encourages my intellectual self-confidence.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is satisfied with my performance.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Facilitates cooperation with other faculty members, post-docs, and other research collaborators.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Makes me aware of current job opportunities in my field.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is considerate of my personal problems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Directs me to funding sources to support my graduate education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. How often do you feel the following in relation to your graduate school experience?

	Never	Almost Never	Sometimes	Regularly	Often	Almost Always	Always
I feel emotionally drained by my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I've become more cynical about the potential usefulness of my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I haven't learned any interesting things during my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel used up at the end of a day at the university.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I don't feel stimulated when I reach my study goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, I am not a good student.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have become less interested in my studies since my enrollment in this program.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I feel burned out from my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel tired when I get up in the morning and I have to face another day at the university.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that I don't make an effective contribution to the classes that I attend.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During class I don't feel confident that I am effective in getting things done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I doubt the significance of my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studying or attending a class is really a strain for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can't solve the problems that arise in my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have become less enthusiastic about my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. During the past month, on average, how many hours of actual sleep did you get per night? This may be different than the number of hours you spent in bed.

_____ hours of sleep per night

14. During the past month, how would you rate your sleep quality overall?

- a. Very good
- b. Fairly good
- c. Fairly bad
- d. Very bad

15. How often do you think that you get enough sleep?

- a. Always
- b. Usually
- c. Sometimes
- d. Rarely
- e. Never

16. In your lifetime, has a doctor or medical health professional ever diagnosed you with an anxiety disorder, such as Generalized Anxiety Disorder, OCD, or PTSD?

- a. Yes
- b. No

• If “YES” to #16: At what age were you first diagnosed? _____

17. In the past year, have you been treated for an anxiety disorder?

- a. Yes
- b. No

18. In your lifetime, has a doctor or medical health professional ever diagnosed you with a depressive/mood disorder, such as depression, Bipolar Disorder, or Mania?

- a. Yes
- b. No

• If “YES” to #18: At what age were you first diagnosed? _____

19. In the past year, have you been treated for a depressive/mood disorder?

- a. Yes
- b. No

20. How often have you felt the following during the past 30 days?

	Never	Almost Never	Sometimes	Fairly Often	Very Often
Been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt nervous and stressed?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Felt confident in your ability to handle personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

21. Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by each symptom during the past week, including today.

	Not at all	Mildly (It did not bother me much)	Moderately (It was very unpleasant, but I could stand it)	Severely (I could barely stand it)
Numbness or tingling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling hot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wobbliness in legs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unable to relax	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fear of the worst happening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dizzy or lightheaded	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart pounding or racing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Unsteady	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Terrified	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nervous	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feelings of choking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hands trembling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shaky	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fear of losing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Difficulty breathing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fear of dying	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scared	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Indigestion or discomfort in abdomen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Faint	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Face flushed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sweating (not due to heat)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please select the statement in each group that is most relevant to how you've been feeling over the past few days. If more than one statement applies, select the one closest to the bottom of the group.

22. I do not feel sad.

I feel sad.

I am sad all the time and can't snap out of it.

I am so sad or unhappy that I can't stand it.

23. I am not particularly discouraged about the future.

I feel discouraged about the future.

I feel I have nothing to look forward to.

I feel that the future is hopeless and that things cannot improve.

24. I do not feel like a failure.
I feel I have failed more than the average person.
As I look back on my life, all I can see is a lot of failures.
I feel I am a complete failure as a person.
25. I get as much satisfaction out of things as I used to.
I do not enjoy things the way I used to.
I do not get any real satisfaction out of anything anymore.
I am dissatisfied or bored with everything.
26. I do not feel particularly guilty.
I feel guilty most of the time.
I feel quite guilty most of the time.
I feel guilty all of the time
27. I do not feel I am being punished.
I feel I may be punished.
I expect to be punished.
I feel I am being punished.
28. I do not feel disappointed in myself.
I am disappointed in myself.
I am disgusted with myself.
I hate myself.
29. I do not feel I am any worse than anybody else.
I am critical of myself for my weaknesses or mistakes.
I blame myself all the time for my faults.
I blame myself for everything bad that happens.
30. I do not have thoughts of killing myself.
I have thoughts of killing myself, but I would not carry them out.
I would like to kill myself.
I would kill myself if I had the chance.
31. I do not cry more than usual.
I cry more than I used to.
I cry all the time now.
I used to be able to cry, but now I cannot cry even though I want to.
32. I am no more irritated by things than I ever am.
I am slightly more irritated now than usual.
I am quite annoyed or irritated a good deal of the time.
I feel irritated all the time now.

33. I have not lost interest in other people.
I am less interested in other people than I used to be.
I have lost most of my interest in other people.
I have lost all of my interest in other people.
34. I make decisions as well as I ever could.
I put off making decisions more than I used to.
I have greater difficulty in making decisions than ever before.
I can't make decisions anymore.
35. I don't feel that I look any worse than I used to.
I am worried about looking old or unattractive.
I feel there are permanent changes in my appearance that make me look unattractive.
I believe that I look ugly.
36. I can work about as well as before.
It takes an extra effort to get started at doing something.
I have to push myself very hard to do anything.
I can't do any work at all.
37. I can sleep as well as usual.
I don't sleep as well as I used to.
I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
I wake up several hours earlier than I used to and cannot get back to sleep.
38. I don't get tired more than usual.
I get tired more easily than I used to.
I get tired from doing almost anything.
I am too tired to do anything.
39. My appetite is no worse than usual.
My appetite is not as good as it used to be.
My appetite is much worse now.
I have no appetite at all anymore.
40. I haven't lost much weight, if any, lately.
I have lost more than five pounds.
I have lost more than ten pounds.
I have lost more than fifteen pounds.
41. I am no more worried about my health than usual.
I am worried about physical problems such as aches or pains, upset stomach, or constipation.
I am very worried about physical problems and it's hard to think of much else.
I am so worried about my physical problems that I cannot think about anything else.

42. I have not noticed any recent change in my interest in sex.
 I am less interested in sex than I used to be.
 I am much less interested in sex now.
 I have lost interest in sex completely.

43. During the **past 12 months**, on how many days have you drank any drink with alcohol in it?

_____ /365 days (if 0, skip to Question #49)

44. During the **past 12 months**, how many alcoholic drinks did you have on a **typical day** when you drank alcohol?

_____ drinks

45. During the **past 30 days**, on how many days have you drank any drink with alcohol in it?

_____ /30 days (if 0, skip to Question #47)

46. During the **past 30 days**, how many alcoholic drinks did you have on a **typical day** when you drank alcohol?

_____ drinks

47. During the **past 12 months**, how often did you drink alcohol...

	Never	Sometimes	Almost Always
Because you like the feeling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To fit in with a group you like?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To cheer up when you're in a bad mood?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it's fun?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To be liked?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To forget about your problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it improves parties and celebrations?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

So you won't feel left out?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it helps you enjoy a party?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it helps you when you feel depressed or nervous?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Because it makes social gatherings more fun?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To get high?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

48. During the past 12 months, how often did you drink alcohol...

	Never	Seldom	Occasionally	Frequently
At home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At someone else's home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a restaurant?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a bar or nightclub?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
At a party?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On campus?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On weekdays?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On weekends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alone?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With a small group of friends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With a large group of friends?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With family members?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
With other graduate students?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
While doing schoolwork?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

49. During the past 12 months, on how many days have you used any type of marijuana?

_____ /365 days (If 0, skip to Question #51)

50. During the past 30 days, on how many days have you used any type of marijuana?

_____ /30 days

Non-medical use of prescription drugs is defined as the intentional use of a medication without a prescription, in a way other than as prescribed, or for the experience or feeling that it causes.

51. During the past 12 months, on how many days have you used prescription stimulants non-medically (e.g., Adderall, Concerta, Ritalin, or Provigil)?

_____ /365 days

52. During the past 12 months, on how many days have you used prescription analgesics non-medically (e.g., Percocet, Vicodin, Codeine, or Oxycodone)?

_____ /365 days

53. During the past 12 months, on how many days have you used prescription tranquilizers non-medically (e.g., Xanax or Valium)?

_____ /365 days

54. During the past 12 months, on how many days have you used prescription sedatives non-medically (e.g., Ambien or Lunesta)?

_____ /365 days

55. During your graduate degree program, have you received any instruction or training in substance use disorders, effective treatment for substance use disorders, or pain management?

- a. Yes
- b. No

56. **Would you be interested in receiving more/any instruction or training in substance use disorders, effective treatment for substance use disorders, or pain management?**
- Yes
 - No
57. **What is your sex?**
- Male
 - Female
 - Transgender Male
 - Transgender Female
58. **Which of these best describes your race/ethnicity?**
- Non-Hispanic White
 - Non-Hispanic Black/African American
 - Non-Hispanic Native American or Alaskan Native
 - Non-Hispanic Native Hawaiian or Other Pacific Islander
 - Non-Hispanic Asian
 - Hispanic/Latino
 - More than one race/ethnicity
 - Other, please specify: _____
59. **Are you an international student?**
- Yes
 - No
60. **Which of the following best describes your current employment status?**
- Not currently employed
 - Employed part-time (not an on-campus assistantship or fellowship)
 - Employed full-time (not an on-campus assistantship or fellowship)
 - Employed through a university assistantship or fellowship
 - Other, please specify: _____
61. **What is your current marital status?**
- Married
 - Widowed
 - Divorced or separated
 - Never been married
62. **What is your current combined annual household income (not including income from student loans)?**
- Less than \$25,000
 - \$25,000-\$50,000
 - \$50,000-\$100,000
 - More than \$100,000

63. How many children are under your care and currently living in your home?

Pull-down menu: 0-5+ children

Thank you for taking the time to participate in this survey! Please click the link below for information on participation in future research studies as well as entering yourself into a raffle to win one of 350 \$10 Amazon gift cards.

<https://go.umd.edu/contactinfo>

1. **Would you like to be contacted for participation in future research studies?**
 - a. Yes (if yes, display Question #3 below)
 - b. No
2. **As a thank you for participation, 350 participants will be randomly selected to receive a \$10 Amazon gift card. Would you like to enter yourself into this raffle?**
 - a. Yes (if yes, display Question #3 below)
 - b. No
3. **Please enter your full name and email address.**

First Name: _____

Last Name: _____

Email Address: _____

Appendix H: Additional Tables and Figures

Table A.2. Study variables, by school ($n = 2,683$)

	University A $n = 1,914$	University B $n = 769$
	n (Column %)	n (Column %)
Age		
20-25 years old	754 (39.4)	394 (51.2)
26+ years old	1,160 (60.6)	375 (48.8)
Sex		
Male	830 (43.4)	174 (22.7)
Female	1,084 (56.6)	595 (77.3)
Race/Ethnicity		
Non-Hispanic white	1,114 (58.2)	458 (59.6)
Non-Hispanic other race	619 (32.3)	232 (30.1)
Hispanic/Latino	96 (5.0)	35 (4.6)
More than one race/ethnicity	86 (4.5)	44 (5.7)
International Student		
Yes	451 (23.6)	30 (3.9)
Employment Status		
Not currently employed	256 (13.4)	326 (42.4)
Employed part-time	196 (10.2)	227 (29.5)
Employed full-time	414 (21.6)	94 (12.2)
University assistantship	1,048 (54.8)	121 (15.7)
Marital Status		
Never married	1,372 (71.7)	578 (75.2)
Married	499 (26.1)	169 (22.0)
Widowed/divorced/separated	43 (2.2)	22 (2.9)
Household Income		
Less than \$25,000	773 (40.4)	411 (53.5)
\$25,000-\$50,000	491 (25.7)	163 (21.2)
\$50,000-\$100,000	377 (19.7)	112 (14.6)
More than \$100,000	273 (14.3)	82 (10.7)
Children		
Yes	189 (9.9)	100 (13.0)
Degree Type		
Master's degree	891 (46.6)	296 (38.5)
Academic doctoral degree	925 (48.3)	114 (14.8)
Professional doctoral degree	98 (5.1)	359 (46.7)
Time Enrolled		
Less than a year	536 (28.0)	257 (33.4)
1-2 years	797 (41.6)	368 (47.9)
More than 2 years	581 (30.4)	144 (18.7)

	University A <i>n</i> = 1,914	University B <i>n</i> = 769
	<i>n</i> (Column %)	<i>n</i> (Column %)
Academic Discipline		
Natural-Pure	380 (19.9)	23 (3.0)
Natural-Applied	326 (17.0)	399 (51.9)
Social-Pure	455 (23.8)	4 (0.5)
Social-Applied	753 (39.3)	343 (44.6)
Student Status		
Full-time	1,580 (82.5)	699 (90.9)
Part-time	334 (17.5)	70 (9.1)
Anticipated Program Length		
1-2 years	668 (34.9)	231 (30.0)
3-5 years	844 (44.1)	495 (64.3)
6+ years	402 (21.0)	43 (5.6)
Lifetime Anxiety Diagnosis		
Yes	369 (19.3)	189 (24.6)
Lifetime Depression Diagnosis		
Yes	358 (18.7)	178 (23.2)
Alcohol Risk Group		
Low	280 (14.6)	110 (14.3)
Moderate-Low	920 (48.1)	375 (48.7)
Moderate-High	597 (31.2)	220 (28.6)
High	117 (6.1)	64 (8.4)
Marijuana Use		
Yes	383 (20.0)	162 (21.0)
Nonmedical Use of Prescription Drugs		
Yes	116 (6.0)	74 (9.8)
Advisor Satisfaction		
Satisfied	1,365 (71.3)	401 (52.1)
Neither Satisfied Nor Dissatisfied	353 (18.4)	286 (37.2)
Dissatisfied	197 (10.3)	82 (10.6)
	Mean ± SD	Mean ± SD
Age (20-65)	27.9 ± 5.6	27.5 ± 6.3
Perceived Stress Scale (0-40)	18.6 ± 7.0	19.4 ± 7.3
Beck Anxiety Inventory (0-63)	9.6 ± 8.8	11.5 ± 9.7
Beck Depression Inventory (0-63)	9.5 ± 8.3	10.5 ± 8.2
Alcohol Use Frequency (Days)	63.1 ± 80.9	54.9 ± 72.6
Alcohol Use Quantity (# of Drinks)	1.8 ± 1.7	2.0 ± 1.9
Marijuana Use Frequency (Days)	11.1 ± 49.9	8.2 ± 39.6
Departmental Support (1-7)	5.1 ± 1.1	5.1 ± 1.2
Program Climate- Community (1-3)	2.1 ± 0.3	2.2 ± 0.4

	University A <i>n</i> = 1,914	University B <i>n</i> = 769
	<i>n</i> (Column %)	<i>n</i> (Column %)
Program Climate- Competition (1-3)	1.9 ± 0.3	1.6 ± 0.5
Academic Burnout- Exhaustion (0-6)	2.6 ± 1.3	3.1 ± 1.4
Academic Burnout- Cynicism (0-6)	1.9 ± 1.4	1.9 ± 1.4
Academic Burnout- Inefficacy (0-6)	1.6 ± 1.0	1.6 ± 1.1

Ns and percentages may not add up to sample totals due to the rounding of pooled estimates.

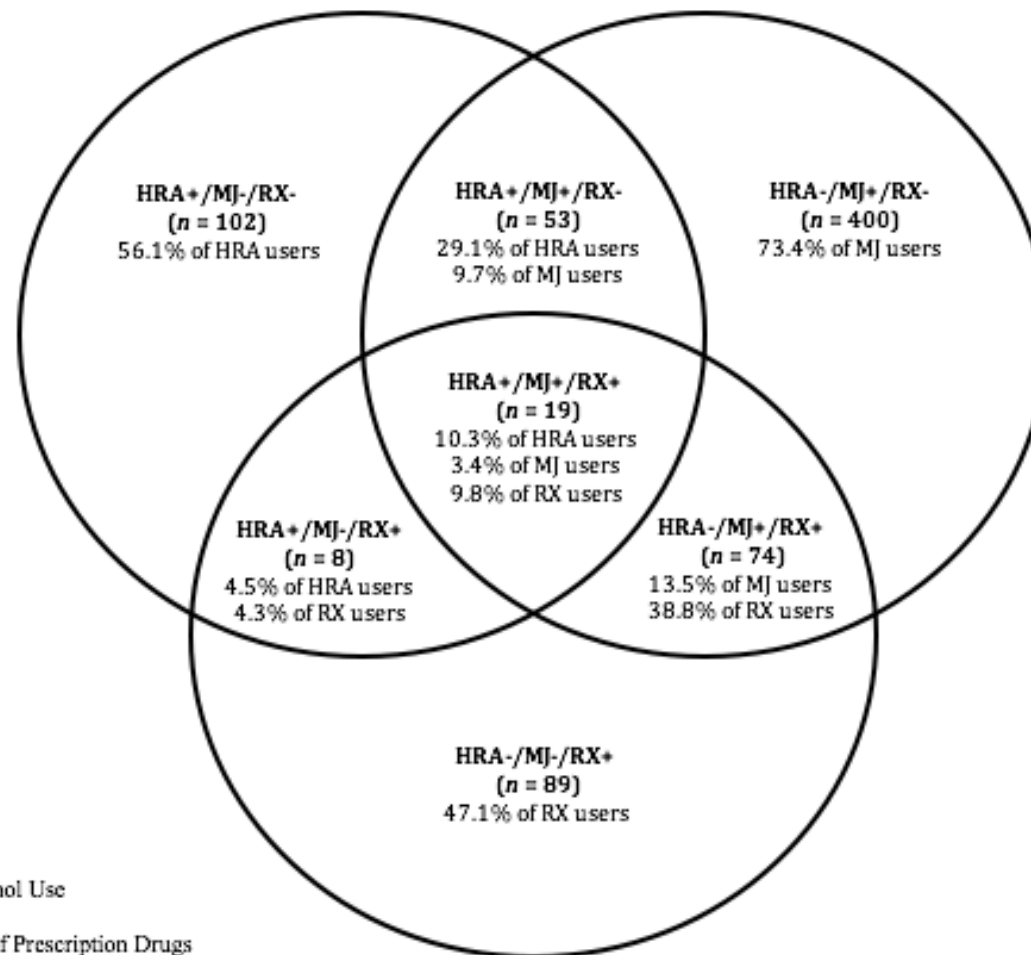
Natural-Pure disciplines include agriculture and natural resources and computer, mathematical, and natural sciences; Natural-Applied disciplines include engineering, dentistry, health sciences, medicine, nursing, pharmacy, and physical therapy; Social-Pure disciplines include behavioral and social sciences and arts and humanities; Social-Applied disciplines include business, education, law, architecture, public health, public policy, information studies, journalism, and social work.

All substance use variables are for the past 12 months.

Low-Risk drinkers did not drink alcohol in the past 12 months; Moderate-Low Risk drinkers drank alcohol less than once a week in the past 12 months; Moderate-High Risk drinkers drank alcohol at least once a week in the past 12 months; High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women).

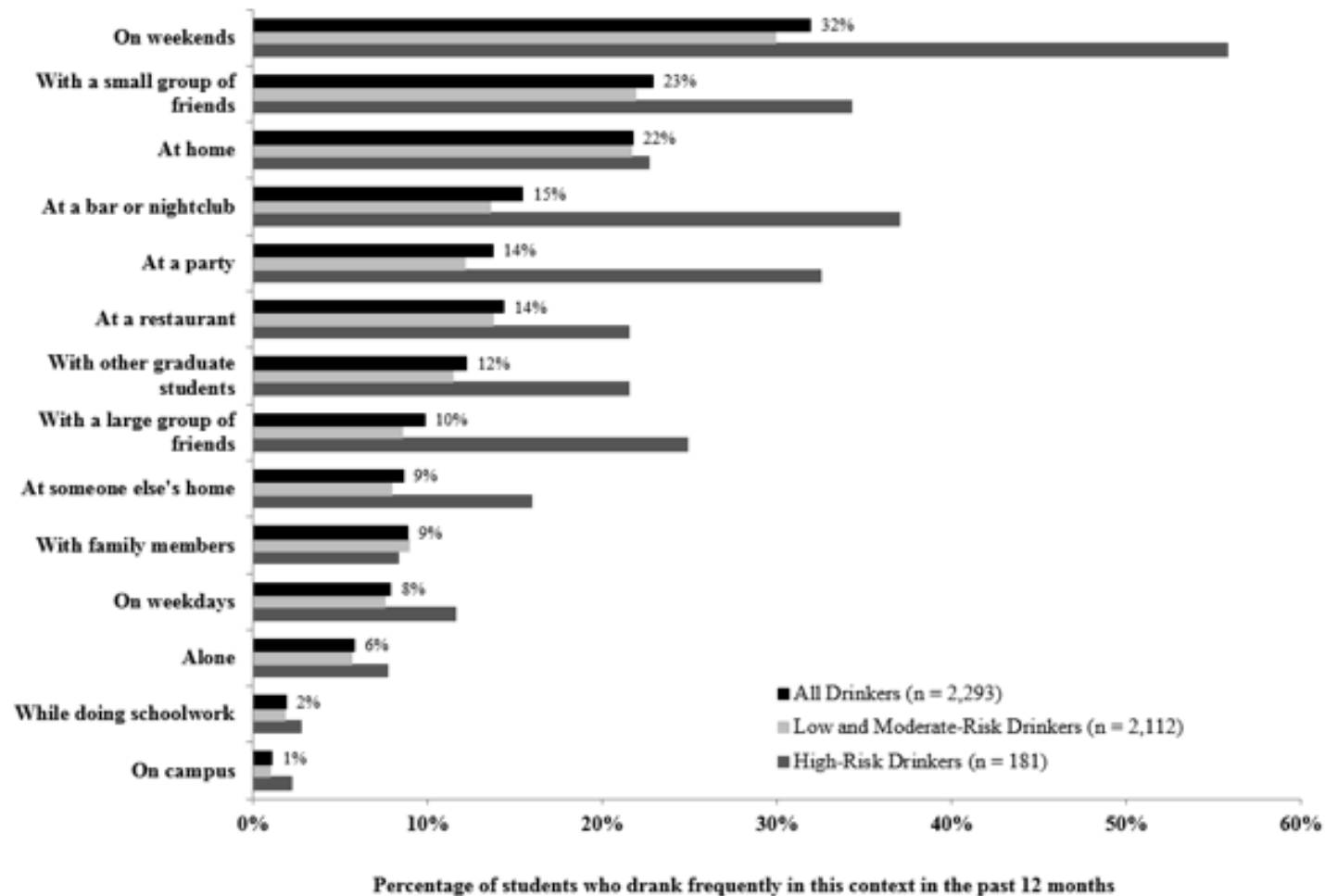
Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Figure A.5. Overlap of past 12-month substance use of graduate students who engaged in at least one of these behaviors ($n = 744$)



Note: Ns and percentages may not add up to sample totals due to the rounding of pooled estimates. High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Nonmedical use of prescription drugs includes the nonmedical use of prescription stimulants, analgesics, tranquilizers, or sedatives.

Figure A.6. Context of alcohol use among graduate students who drank alcohol in the past 12 months ($n = 2,293$)



Note: High-Risk drinkers drank alcohol at least once a month in the past 12 months and had a typical quantity of five or more drinks (for men) or four or more drinks (for women). Low and Moderate-Risk drinkers include all participants in the sample who drank alcohol in the past 12 months who were not classified as High-Risk drinkers.

Table A.3. Academic burnout of graduate students, by sleep behavior ($n = 2,683$)

	Total Sample n (Column %)	Academic Burnout		
		Exhaustion (0-6)	Cynicism (0-6)	Inefficacy (0-6)
		Mean \pm SD	Mean \pm SD	Mean \pm SD
Total Sample	2,683 (100.0)	2.72 \pm 1.4	1.91 \pm 1.4	1.59 \pm 1.0
Typical hours of sleep per night				
5 hours or less	449 (16.7)	3.40 \pm 1.5 _a	2.13 \pm 1.5 _a	1.81 \pm 1.1 _a
6 hours	926 (34.5)	2.88 \pm 1.4 _b	1.91 \pm 1.4 _{a,b}	1.63 \pm 1.0 _b
7 hours	943 (35.1)	2.36 \pm 1.2 _c	1.78 \pm 1.4 _b	1.45 \pm 0.9 _c
8 hours or more	365 (13.6)	2.39 \pm 1.3 _c	1.98 \pm 1.5 _{a,b}	1.54 \pm 1.0 _{b,c}
Sleep Quality				
Very bad	134 (5.0)	4.08 \pm 1.4 _a	2.70 \pm 1.6 _a	2.07 \pm 1.2 _a
Fairly bad	893 (33.3)	3.17 \pm 1.3 _b	2.16 \pm 1.4 _b	1.79 \pm 1.1 _b
Fairly good	1,471 (54.8)	2.42 \pm 1.2 _c	1.74 \pm 1.4 _c	1.47 \pm 0.9 _c
Very good	185 (6.9)	1.91 \pm 1.2 _d	1.54 \pm 1.3 _c	1.21 \pm 0.9 _d
Frequency of getting enough sleep				
Never	100 (3.7)	4.05 \pm 1.5 _a	2.68 \pm 1.7 _a	2.21 \pm 1.3 _a
Rarely	650 (24.2)	3.32 \pm 1.3 _b	2.09 \pm 1.4 _b	1.74 \pm 1.0 _b
Sometimes	981 (36.6)	2.76 \pm 1.3 _c	1.92 \pm 1.4 _{b,d}	1.62 \pm 1.0 _b
Usually	867 (32.3)	2.15 \pm 1.1 _d	1.71 \pm 1.4 _c	1.39 \pm 0.9 _c
Always	85 (3.2)	1.93 \pm 1.3 _d	1.59 \pm 1.5 _{c,d}	1.29 \pm 1.1 _c
	Mean \pm SD	ρ	ρ	ρ
Typical hours of sleep per night	6.44 \pm 1.0	-0.262*	-0.056*	-0.106*

* $p < 0.05$

Ns and percentages may not add up to sample totals due to the rounding of pooled estimates.

Categorical groups with different column subscripts are significantly different ($p < 0.05$) using post-hoc Bonferroni tests.

The correlation between continuous variables was tested using the Spearman's Rank Order Correlation.

Table A.4. Correlation between academic burnout and drinking motives among graduate students who drank in the past 12 months ($n = 2,293$)

	Total Sample	Academic Burnout		
		Exhaustion (0-6)	Cynicism (0-6)	Inefficacy (0-6)
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD
Total Sample		2.74 \pm 1.3	1.92 \pm 1.4	1.58 \pm 1.0
		ρ	ρ	ρ
Enhancement Motives (0-2)	0.76 \pm 0.5	0.059*	0.027	0.033
Social Motives (0-2)	0.84 \pm 0.6	0.077*	0.066*	0.065*
Conformity Motives (0-2)	0.28 \pm 0.4	0.055*	0.089*	0.130*
Coping Motives (0-2)	0.45 \pm 0.5	0.257*	0.189*	0.189*

* $p < 0.05$

Effects between continuous variables are Spearman's ρ values and are interpreted as medium (0.3) or large (0.5) (Cohen, 1988).

Table A.5. Substance use of graduate students, by mental health status ($n = 2,683$)

	Alcohol Consumption Frequency	Marijuana Use Frequency
	Mean \pm SD	Mean \pm SD
Lifetime Anxiety Diagnosis		
Yes	70.93 \pm 84.62	16.98 \pm 59.60
No	58.09 \pm 76.88	8.46 \pm 43.14
Current Anxiety Symptoms		
None	54.22 \pm 72.24	6.92 \pm 39.70
Mild	69.38 \pm 83.68	9.97 \pm 43.65
Moderate	62.48 \pm 85.71	17.94 \pm 63.69
Severe	68.94 \pm 96.68	17.70 \pm 62.91
Lifetime Depression Diagnosis		
Yes	71.56 \pm 84.91	19.24 \pm 64.23
No	58.07 \pm 76.82	7.98 \pm 41.56
Current Depression Symptoms		
Minimal	57.64 \pm 74.62	8.52 \pm 43.05
Mild	68.17 \pm 85.28	9.42 \pm 44.64
Moderate	63.31 \pm 84.39	17.77 \pm 62.81
Severe	85.25 \pm 104.74	27.88 \pm 76.08

Current anxiety symptoms were assessed using the Beck Anxiety Inventory (BAI). BAI scores of 0-7, 8-15, 16-25, and 26-63 are considered no, mild, moderate, and severe symptoms of anxiety, respectively.

Current depression symptoms were assessed using the Beck Depression Inventory (BDI). BDI scores of 0-13, 14-19, 20-28, and 29-63 are considered minimal, mild, moderate, and severe symptoms of depression, respectively.

Alcohol consumption and marijuana use frequency are the number of days participants used each substance in the past 12 months.

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