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Understanding the Interplay of Mental Health Challenges, Discrimination, and Academic Performance Among Racially Minoritized Graduate Students and Possible Mitigating Factors

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Understanding the Interplay of Mental Health Challenges, Discrimination, and Academic  
Performance Among Racially Minoritized Graduate Students and Possible Mitigating Factors

A dissertation submitted in partial satisfaction of the requirements for the degree of Doctor in

Philosophy

in

Clinical Psychology

by

Jessica Carrasco

Committee in charge:

University of California San Diego

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Professor Maria Marquine

San Diego State University

Professor Linda Gallo  
Professor Dustin Thoman

2022



The dissertation of Jessica Carrasco is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California San Diego

San Diego State University

2022

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## PUBLICATIONS

1. Bravin, J.\*, **Carrasco, J.\***, & Kalichman, M. (in press). Research ethics in clinical psychology. *Translational Issues in Psychological Sciences*. [\*Co-first Author]
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3. Lamar, M., León, A., Romo, K., Durazo-Arvizu, R. A., Sachdeva, S., Lipton, R. B., ... & **Carrasco, J.** (2019). The Independent and Interactive Associations of Bilingualism and Sex on Cognitive Performance in Hispanics/Latinos of the Hispanic Community Health Study/Study of Latinos. *Journal of Alzheimer's Disease*, 71(4), 1271-1283.
4. Gregory, M.D., Kippenhan, J.S., Dickinson, D., **Carrasco, J.**, Marray, V.S., Weinberger, D.R., & Berman, K.F. (2016). Regional variations in brain gyrification are associated with general cognitive ability in humans. *Current Biology*, 26(10), 1301-1305.
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6. Jung, R.E., Ryman, S.G., Vakhtin, A.A., **Carrasco, J.**, Wertz, C., & Flores, R. (2014). Subcortical correlates of individual differences in aptitude. *PLoS ONE*, 9(2), E89425.

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## ABSTRACT OF THE DISSERTATION

Understanding the Interplay of Mental Health Challenges, Discrimination, and Academic Performance Among Racially Minoritized Graduate Students and Possible Mitigating Factors

by

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Doctor of Philosophy in Clinical Psychology

University of California San Diego, 2022  
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**Rationale:** Prevalence of mental health challenges (MHC) in graduate students has increased, which may impair academic performance (AP). Graduate students from racially minoritized groups are a growing demographic who may be faced with greater MHC than those from majority groups. This study examined (1) differences in MHC, discrimination, and AP by minoritized status

and sex; (2) interplay of MHC, discrimination, and AP, and (3) roles of resilience, advisor contact, social support in buffering relationships.

**Methods:** Archival data from the Healthy Minds Study 2018-2019 annual survey included self-reported depression severity (PHQ-9), anxiety severity (GAD-7), suicidal ideation (yes/no in past year, SI), mental health burden (diagnoses of depression, anxiety, both), frequency of discrimination (past year), and AP (GPA of A or below A). Analyses included 5,820 graduate students (mean(SE) age = 28(8.2) years, 72% female, and 61% in master's program), categorized into non-Latino White (n=4032) and minoritized (n=1,788) groups, and used generalized linear mixed models.

**Results:** Minoritized graduate students experienced higher levels of discrimination ( $F(1574)=13.9, p<.001$ ) and were more often in the lower AP category compared to majority groups ( $F(5320)=33.3, p<.001$ ); no significant racial/ethnic differences for any MHC were observed ( $p's>.05$ ). Women reported higher anxiety ( $F(3909)=41.9, p<.001$ ), more anxiety diagnoses ( $t(1634)=2.84, p=.004$ ), were more likely to experience discrimination once in a while ( $F(1639)=11.8, p<.001$ ), and had better AP compared to males ( $F(5320)=15.9, p<.001$ ). Non-Latino White men were most likely to report SI ( $F(5159)=12.04, p<.001$ ). Moderate levels of discrimination were associated with higher MHCs ( $p's <.05$ ). Moderate levels of any MHC were associated with lower AP (all  $p's <.005$ ). Race, sex, advisor contact, or social support (all  $p's >.05$ ) did not significantly moderate relationships of MHC with AP or discrimination; resilience buffered relationships of some MHC to discrimination.

**Conclusions:** Replicating previous findings, women were more likely than men to report anxiety symptoms and diagnoses and graduate students with MHC experienced higher levels of discrimination and less-than-perfect AP. While minoritized graduate students do not seem

differentially at risk for MHC and show similar inter-relationships between MHC and both AP and discrimination, resilience interventions might lessen impacts of discrimination on mental health in all students.



## **I. Background**

### **1.1 Importance of Studying Racially Minoritized Graduate Students.**

Nationally, there has been an increase in enrollment of graduate students. In 2018, 1.8 million graduate students were enrolled in the Fall semester across the United States and Canada, of which 533,974 were first-time graduate students and 58.2% were women. This was an increase of 2.2% from Fall 2017. Further, over the last ten years, there has also been an increase of first-time graduate student enrollees (up 1.3% from Fall 2017 to Fall 2018) and these students account for 23.4% of total enrollment (Okahana & Zhou, 2019). Minority students as defined by the U.S. Department of Education include individuals who identify as Alaskan Native, American Indian, Asian-American, Black/African American, Latino, Native Hawaiian, or Pacific Islander (de Brey et al., 2018). Although these groups are used as defined above in the present study, we have labeled them as racially minoritized to emphasize that any potential differences among groups are a result of systemic inequalities and disparities and not a result of inherent characteristics. Even though we are observing a healthy increase in enrollment rates of minoritized students, especially from Latino populations (a 6.8% change from Fall 2017 to Fall 2018), these groups still remain largely underrepresented within STEM fields and within the scientific workforce (Okahana & Zhou, 2019; NCSES, 2021). Given the changing demographics of the U.S. population, the need for diversity within the scientific and academic workforce and higher education is dire. Increasing the representation of racially minoritized individuals among those holding advanced degrees will help to strengthen the U.S. economy and solve complex problems (Okahana, Klein, Allum & Sowell, 2018; Klein & Okahana, 2020).

Across the country, 79,720 doctoral degrees were conferred in 2018 (Okahana & Zhou, 2019). Of these, 55% were earned by non-Latino White students, while 48% of degrees were

conferred to minoritized group members: 5% African American, 9% Latino, 10% Asian, 5% Pacific Islander, 5% American Indian/ Alaska Native, 11% two or more races (U.S. Department of Education, 2019). African American and Latino graduate students were under-represented among doctoral degree earners, as these groups make up 13.4 % and 18.5% of the greater U.S. population, respectively (U.S. Census Bureau, 2019). While eventual completion rates within minoritized graduate students (48%) are close to matching their majority counterparts (52%) once they begin graduate school (Klein & Okahana, 2020), minoritized graduate students are taking longer to enroll in graduate programs after completing undergraduate degrees and rates of completion do not match non-Latino White rates until 10 years post-enrollment (Klein & Okahana, 2020; Sowell & Okahana, 2015). Under-representation and differences in paths to obtaining a higher education degree (e.g., time to enroll in graduate school, time to complete) for minoritized students raises the question of possible barriers and additional challenges faced by these groups.

### **1.2. Mental Health Challenges among Racially Minoritized Graduate Students**

One set of barriers to completion of graduate degrees among minoritized students may be the presence of mental health challenges (MHC). Research on graduate student MHC remains nascent, even though these challenges have been discussed over the past four decades. Recently, an article published in *Nature* (Evans et al., 2018), brought greater awareness to the disproportionate mental health needs of graduate students and labeled the problem a “graduate student mental health crisis”. The authors surveyed 2,279 graduate students from 26 countries and 234 institutions and found that 39% of graduate students reported moderate to severe levels of depression and 41% of graduate students self-reported moderate to severe levels of anxiety (Evans et al., 2018). The authors suggested that these rates were six times higher than seen in the general population (Evans et al., 2018), but some have questioned the general population to which these

students were compared given that this sample was from different countries and a German study was used for the general population statistics (Duffy, Thanhouser, & Derry, 2019). In the US, the overall prevalence of depression in the nation was 7.1% among individuals aged 18-25 and 7.7% for individuals aged 26-49 (Harvard Medical School (1-a), 2017), overall prevalence for any anxiety disorder was 19.1%, and about 31% of U.S. adults experienced an anxiety disorder in their lifetime (Harvard Medical School (1-b), 2017). Thus, compared to US population numbers, the rates of anxiety and depression among graduate students reported in the multi-national study of Evans et al., are concerning; rates of depression are about 5 times higher and anxiety rates are about 2 times higher among graduate students than in the US population of comparable age.

Many of the efforts in understanding graduate student MHC prevalence have happened within single institutions. These studies have all found similar trends: graduate students are suffering from self-reported anxiety and depression at alarming rates (Hyun et al., 2007; Garcia-Williams, Moffitt, & Kaslow, 2014; Daigle et al., 2019; Zivin et al., 2009; Levecque et al., 2017; Bhargav, 2018; Robinson et al., 2016; Assembly, 2014). Given the high rates of depression and anxiety in graduate students, suicidality is also of grave concern. For students reporting high levels of depression and anxiety within the past year, 7% of graduate students had concurrently reported suicidal ideation (Gollust, Eisenberg, & Golberstein, 2008; Garcia-Williams, Moffitt, & Kaslow, 2014). In comparison, the overall prevalence of suicidal ideation was 4.3% in the US general population across all age groups; rates in relevant comparator age ranges for graduate students were 10.5% among individuals aged 18-25 and 4.3% among individuals aged 26-49 (McCance-Katz, 2017).

While these results are concerning, research expanding beyond single institutions is crucial. National data sets allow us larger sample sizes which can better reflect the population of interest.

In particular, results could be more generalizable when examining subgroups such as racially minoritized students and afford the power to observe trends that may be more rare (Khalilzadeh & Tasci, 2017). Two national studies have surveyed graduate students over the last decade and made their data public.

*The American College Health Association (ACHA).* The ACHA-National College Health Association (ACHA-NCHA) is a national survey run by the ACHA that has become one of the most comprehensive datasets on higher education students' physical and mental health (American College Health Association, 2020). Their recently published Spring 2020 report included 9,741 graduate and professional students from 50 U.S. universities. Within this graduate student sample, 21% of students endorsed being diagnosed with depression, 26% of students endorsed an anxiety diagnosis, and 19% of students were positive on a suicidal ideation screening (American College Health Association, 2020).

*Healthy Minds Study.* This research project is part of the bigger Healthy Minds Network and is aimed to survey mental health, service utilization, and related issues among undergraduate and graduate students through an annual web-based survey. The Healthy Minds Study surveyed 62,171 undergraduate, graduate, and professional students in 2019 (Eisenberg & Lipson, 2019). 24% of the n=9,948 graduate and professional students endorsed self-reported anxiety; 27% endorsed depression; and 9% endorsed suicidal ideation.

These aggregate data suggest that MHC are prevalent among graduate students in general, often at much higher rates than in the age-comparable population at large, but much less is known about MHC among racially minoritized graduate students. In analysis of data from the 2012-2015 Healthy Minds Study (Lipson et al., 2018), rates of depression, anxiety, and suicidal ideation were reported by racially minoritized group for combined samples of undergraduate and graduate

students (total N=43,375, including N=9,108 graduate students). Depression was defined as  $\geq 10$  on the Patient Health Questionnaire-9, anxiety was defined as  $\geq 10$  on the General Anxiety Disorder-7, and suicidal ideation was defined based on self-report of ideation. Overall, 16.8% of students had depression, 17.7% had anxiety, and 7.8% had suicidal ideation. When compared to all other students in the sample, significantly fewer White students (15.8%) and significantly more Latino (19.4%), Asian (18.9%), Arab (24.5%), and multiracial (20.2%) students met their criteria for depression; rates among African Americans (17.3%) were comparable to the rest of the sample. For anxiety, rates were significantly lower than the rest of the sample for African Americans (11.9%) and Asians (14.6%), higher for Arab (23.9%) and multiracial (22.2%) students, and not different for Latino (19.3%) and White (17.8%). Finally, rates of suicidal ideation were generally comparable among all race/ethnicity groups (African Americans: 7.2%, Latino: 7.7%, Arab: 6.9%, White: 7.7%), although significantly lower among Asian students (6.8%) and significantly higher among multiracial students (22.2%). Prevalences of MHC among minoritized students have not been examined in the latest set of Healthy Minds data from 2018-2019, and no study has yet focused solely on minoritized graduate students.

### **1.3. Relationship of Mental Health Challenges to Academic Performance**

The high prevalence of MHC in undergraduate and graduate students raises the issue of how MHC impact academic performance and advancement. Depression and anxiety both predict poor academic performance, and depression has a negative relationship with grade point average, predicting higher likelihood of drop-out in undergraduates (Ahmed & Julius, 2015; Eisenberg, Golberstein, & Hunt, 2009; Hart, 2019; Hysenbegasi, Hass, & Rowland, 2005). In a longitudinal study of depression, anxiety and academic performance of undergraduates, 9% of students reported depression and 20% reported clinically significant anxiety mid-academic year even though these

students had not reported psychological distress at the beginning of the school year. Of those students who newly reported depression, their exam performance suffered from their first to second year (Andrews & Wildling, 2004). In those college students reporting psychological distress, high levels of impaired academic performance and suicidal behavior were also reported (Keyes et al., 2012). In a cross-sectional study of undergraduate women, academic performance was negatively correlated with depression and anxiety symptoms. In the ACHA-NCHA study, 23.7% of graduate students reported that anxiety had negatively impacted their academic performance or delayed progress toward their degree, and 18.2% of students reported that depression had impacted their academic performance or delayed progress toward their degree (American College Health Association, 2020). In the Healthy Minds Study, 57% of students (both undergraduate and graduate; n=32,754) reported that emotional or MHC have hurt their academic performance at least 1-5 days within the past month, while 20% of students reported 6 or more days (Healthy Minds Study, 2020).

#### **1.4. Relationship of Discrimination to Mental Health and Academic Performance**

Institutional/systemic racism also can add extensive barriers and stressors to attaining a higher education (Chen, 2012). Discrimination consists in treating people differently based largely on their group membership (Sue, 2003). If the resultant mistreatment is done by another person, it is known as interpersonal discrimination; if the discrimination results from one group creating policies/practices that limit another group, it is known as institutional discrimination (e.g., limiting mobility, resources; Kite & Whitley, 2016). Most research described below examines interpersonal discrimination. Discrimination is one of the most studied aspects of racism (as it is the behavioral manifestation of racism) and has been conceptualized as a chronic life stressor for minoritized populations with 60% experiencing some form of discrimination (Carter et al., 2019; Klonoff &

Landrine, 1995; Causadias & Korous, 2019). Discrimination has also been widely shown to negatively affect mental health among racially minoritized groups (Carter et al., 2019; Pascoe & Smart Richman, 2009; Williams and Mohammed, 2008; Causadias & Korous, 2019). Specifically, higher prevalence of lifetime, or cumulative discrimination, and everyday/or current levels of discrimination have been found to be associated with previously diagnosed depression and anxiety disorders and depressive symptoms, particularly among individuals from racially minoritized populations (Earnshaw et al., 2016; Miranda et al., 2013; Kessler, Mickelson & Williams, 1999).

In a meta-analysis, Carter and colleagues looked across 242 cross-sectional and longitudinal studies that examined the relationship of racial discrimination with various other measures. They found that the relationship between racial discrimination and mental health was stronger than those relationships observed between racial discrimination and general health, substance use, or cultural variables within a combined sample of 143,954 participants (Carter et al., 2019). Additionally, they found that, within the 242 studies, the most common mental health symptoms related to discrimination were anxiety and depression, although 63.4% of studies did not provide information about specific mental health symptoms (Carter et al., 2019).

Similar to general population trends, discrimination has a significant impact on the mental health of college students of color (Del Toro & Hughes, 2020; Chen, Szalacha & Menon, 2014; Prelow, Mosher, & Bowman, 2006; Sanchez & Awad, 2016; Hall et al., 2015; Hwang & Goto, 2008; Billingsley & Hurd, 2018). Most studies examining these associations have been conducted in undergraduate populations. It has been commonly observed in the literature that racially minoritized college students are more likely to experience discrimination compared to White students, with Black students being the most likely to experience discrimination (Stevens, Liu & Chen, 2018). Additionally, in a sample of Black college students, those individuals who reported

perceived racial discrimination also reported academic difficulties (e.g., performance anxiety) and problems with depression and suicide risk (Chao, Mallinckrodt, & Wei, 2012). College students, regardless of race or ethnicity, who perceived more discrimination reported more symptoms of depression, anxiety, and a greater likelihood of suicidal ideation (Del Toro & Hughes, 2020; Hwang & Goto, 2008). Perceived discrimination was also associated with higher odds of suicidal ideation and attempts in racially minoritized student populations (Gomez, Miranda, & Polanco, 2011). Interestingly, some differences among minoritized groups have been observed. Black students have been shown to experience more discrimination when compared to Asian American and Latino populations (Donovan et al., 2012; Cokley, Hall-Clark, & Hicks, 2011) and greater discrimination relates to higher mental health issues in Black and Latino students, but not Asian American peers. In a sample of 443 undergraduates from a public Southwestern university, racially minoritized students were found to have significantly higher levels of perceived discrimination and higher psychological distress compared to students from majority groups (Cokley, Hall-Clark, & Hicks, 2011). The authors were also interested in addressing the possible mediating role of perceived discrimination in the relationship of race/ethnicity with mental health (as assessed by Mental Health Inventory-5) and found that perceived discrimination moderately mediated the relationship between race/ethnicity and mental health (Cokley, Hall-Clark, & Hicks, 2011). The mental health challenges resulting from discrimination are of utmost concern given that over the last couple of years we have witnessed an increase of racial tensions on college campuses given a resurgence of racially-motivated hate crimes during the Trump era (Daftary, Devereux, & Elliot, 2020; Del Toro & Hughes, 2020).

While many studies have focused on the relationship between discrimination and mental health in college students, only a few studies have addressed the roles of discrimination and mental



health in academic performance (Stevens, Liu & Chen, 2018; Del Toro & Hughes, 2020). Most of these studies are cross-sectional and have mixed results as to the role of discrimination, mental health and resulting academic performance. Stevens and colleagues (2018) assessed discrimination and academic performance among minoritized students using the 2015 National College Health Assessment surveying 69,722 U.S. undergraduate students. They found that not only were minoritized students reporting more discrimination relative to their non-Hispanic/Latino counterparts, but they were also reporting negative effects on academic performance (Stevens et al., 2018). However, these effects were not seen across all racial groups. Latinos and Asian Americans who reported more discrimination reported negative effects on their academic performance, while Black students did not differ from White and Multiracial groups in the reported negative influence of discrimination on academic performance (Stevens et al., 2018). Additionally, students who were experiencing both discrimination and worse mental health were more likely to report that their academic performance was negatively affected compared to students who did not experience discrimination or endorse MHC (Hurd et al., 2016; Ying & Han, 2006; Billingsley & Hurd, 2019).

Few longitudinal studies have examined the relationship between discrimination, mental health and academic performance (Del Toro & Hughes, 2019; Levin, Van Laar & Foote, 2006, Cheng et al., 2019). Levin and colleagues examined the relationship between same-ethnicity friendship, discrimination, and academic performance in a longitudinal study with a sample of racially minoritized students (Levin, Van Laar & Foote, 2006). They found that Black students who experienced discrimination reported later enhanced academic motivation, but this was not the case for Asian or Latino students (Levin, Van Laar & Foote, 2006). Del Toro and colleagues were interested in understanding how discrimination perpetrated by professors and peers affected mental

health and academic performance in elite universities (Del Toro & Hughes, 2019). The authors surveyed professor- and peer-discrimination of minoritized college students during the first three years of college (Freshman to Junior year) and assessed within-student trajectories to psychological and academic outcomes during their fourth year. They found that peer-discrimination remained relatively the same through the first three years, but that professor-discrimination increased in the first three years (Del Toro & Hughes, 2019). Additionally, they found that both peer- and professor-discrimination were associated with later unfavorable grades and lower likelihood of graduating on time (Del Toro & Hughes, 2019). Strikingly, the authors found that only peer-discrimination and not professor perpetuated discrimination during only the first year predicted worse depressive symptoms during their fourth year (Del Toro & Hughes, 2019). Finally, Cheng and colleagues (2020) studied Latino college students from a Southwestern U.S. public university and their experiences of discrimination and academic success in a cross-lagged longitudinal study. They found that perceived discrimination at Time 1 predicted academic distress at Time 2 (1 year apart), but that the academic distress at Time 1 did not predict perceived discrimination at Time 2 (Cheng et al., 2019).

Only a few studies have addressed discrimination, mental health, and academic performance specifically among graduate students. Of the studies that have been conducted, they have focused on single groups (typically Black students) and on racial discrimination compared to other types of discrimination (e.g., age, disability, religious, sexual orientation). In a group of Black graduate and postgraduate students who completed a two-week diary in a measurement-burst study of daily discrimination and affective reactivity, students who reported increased negative affect on those days of experienced discrimination also reported elevated depressive

symptoms a year later (Ong & Burrow, 2018). Interestingly, heightened positive affect on days of experienced racism was also associated with more depressive symptoms (Ong & Burrow, 2018).

The interrelationship between discrimination, mental health, and academic performance among graduate students remains understudied. In the ACHA-NCHA study, 11.3% of graduate students reported having experienced discrimination; of these, 87.6% reported moderate or high distress and 28.5% reported that discrimination had impacted their academic performance or delayed progress toward their degree (American College Health Association, 2020). In Lilly and colleagues' study of minoritized graduate students (2018), 98.8% experienced racial microaggressions; distress related to frequency of microaggressions was associated with greater odds of concurrent depression. Miller and Orsillo (2020) found that racial stressors (e.g., microaggressions, discrimination) and feelings of not belonging were positively associated with psychological distress (i.e., depression, anxiety, stress) in a sample of racially minoritized graduate students. There is a need for further examination of how discrimination relates to both mental health and academic performance among graduate students, particularly among students from marginalized groups.

### **1.5. Putative moderators of disparities in MHC, academic performance, and discrimination and their inter-relationship**

**1.5.1. Sex.** It has been a long-standing finding in the literature that women endorse higher levels of depression and anxiety in college samples compared to males (Boggiano et al., 1991; Ramón-Arbués et al., 2020; Gao et al., 2020; Toscos et al., 2018; Gomez et al., 2011). This has also been found to be true in graduate students (Evans et al., 2018; American College Health Association, 2020; Eisenberg & Lipson, 2019). Sex differences in suicidal ideation are less consistent. Some studies show that men are more likely to have thought about suicide than women

in college samples (Mackenzie et al., 2011; Garlow et al., 2008; Kisch et al., 2005). However, a study by Becker and colleagues (2018) examining 1,704 college undergraduate students across two universities found that women were more likely than men to have thought about and attempted suicide. Risk factors for student suicide might be sex-dependent: a study by Lamis and Lester (2013) examining 994 undergraduate students at a large southeastern university found that depression was a significant risk factor for suicidal ideation only in women when compared to men and that family social support and alcohol-related issues were risk factors in men compared to women (Lamin & Lester, 2013). It has also been found that women outperform men academically and that this is observed across their academic careers (Quadlin, N., 2018; Nuñez-Peña et al., 2016). Everyday discrimination has been found to increase psychological distress and lowering self-esteem in women college students (Becerra et al., 2020). Perceived discrimination in young adult Black (20-23 years old) males was predictive of anxiety and depression symptoms later in life (20-32 years old) and has been found to be negatively associated with different long-term effects in male vs female Black youth (Assari et al., 2017). A study by Foster (2000) examined gender discrimination among 262 college women; women who were more likely to make global attributions for discrimination were more likely to experience helplessness (Ford, 2000). Few studies have examined sex differences in MHC, discrimination and academic performance specifically in graduate students, nor have they examined how men and women might differ in the inter-play of these factors. Importantly, an intersectional lens has not been applied to most studies of MHC, academic performance, and discrimination among graduate students.

**1.5.2. Resilience.** A growing number of studies have attempted to understand more about those students who successfully complete graduate school despite their MHC. Research on resilience in college students and its possible moderation of the links between academic

performance, mental health, and discrimination remains nascent. The concept of resilience has largely varied in definition depending on research discipline, with resilience in psychological research defined as the ability to cope with adversity (Hu, Zhang, & Wang, 2015). In the presence of psychopathology, resilience can be approached as the dynamic process by which individuals successfully adapt to adversity over the course of their lives by preventing or attenuating mental health disturbances and swiftly recovering from any adversity that may arise from them (Rutten et al., 2013). College students who reported low levels of resilience also reported lower levels of social support and higher psychological distress (Pidgeon et al., 2014). Psychology and medical students showed similar trends wherein lower levels of resilience were associated with higher psychological distress (Bacchi & Licinio, 2017).

In a meta-analysis by Hu and colleagues (2015), 60 cross-sectional studies on trait resilience and mental health representing 68,720 participants were reviewed. The authors found that those individuals who reported depression and anxiety also reported lower levels of trait resilience. In an undergraduate population (N=181) from a midsized midwestern university, when controlling for resilience, a significant relationship was found between depression and academic performance, but when controlling for depression no relationship was found between resilience and academic performance, suggesting a mediation of depression on resilience and academic performance (Hart, 2019). In this same study, the relationship between ethnicity/race (White vs minoritized (Pacific Islander, Black, Latino, biracial, Native American)), social support, and resilience was tested. Hart found that race/ethnicity was not related to resilience; when controlling for race/ethnicity, social support predicted resilience, but when controlling for social support race/ethnicity did not have a significant impact on resilience (Hart, 2019). In a study of 446 college women pursuing their second year in their undergraduate degree, greater resilience was associated

with lower depression, but not lower anxiety and stress (Ahmed & Julius, 2015). Research focused on resilience of racially minoritized groups, mental health, and academic performance is warranted as it could bring to light unique factors (e.g., intergenerational support, culture) that could be incorporated into the graduate student experience and create a more welcoming and accepting environment for these students. Moreover, programs that teach academic resilience, fostering skills for students to achieve good educational outcomes despite experiencing adversity, have been shown to improve academic performance (Ahmed & Julius, 2015); incorporating minoritized factors into these models could prove invaluable. The current study will be one of few to close the gap in our knowledge by investigating resilience in racially minoritized graduate students and its associations with MHC and academic performance.

**1.5.3. Advising/mentoring.** The relationship with one's graduate advisor is a particularly salient part of graduate school, and the nature of this relationship therefore has the potential to affect MHC and academic performance and interact with discrimination in its relationship to MHC and performance. Mentoring increases minoritized students' academic performance, enrollment and retention (Kendricks, Nedunuri, & Arment, 2013). Evans and colleagues (2018) looked at mentoring as a possible factor influencing mental wellness and found that about half of respondents who reported moderate to severe levels of anxiety or depression did not believe they were receiving proper mentorship. In another study, graduate students reported higher levels of mental health distress compared to undergraduate students due to, in part, to poor relationships with advisors (Hyun et al., 2006). Clinical and counseling graduate students who reported significant clinical levels of depression and anxiety also reported that they were lacking adequate support from the supervisors and faculty compared to students who did not endorse significant levels (Rummell, 2015).

Among 1,219 Black, Latino, Asian American and European American graduate students who completed a web-based survey from March to May of 2005, mentoring was found to be the strongest predictor of school satisfaction and academic performance when considering cultural diversity, academic barriers, and academic supports (Maton et al., 2011). Moreover, regardless of racial group, students who were more satisfied in their program reported greater academic support (i.e., advisors, professors, and school/department staff; Maton et al., 2011). The Benjamin Banneker Scholars program was created at a historically Black university to aid in the retention of racially minoritized students (Kendricks, Nedunuri & Arment, 2013). They found that students enrolled in the program, who were largely Black undergraduates in STEM fields, improved their academic performance through mentorship in which academic, social and cultural experiences were valued and discussed (Kendricks, Nedunuri & Arment, 2013). Further, advisors who humanized the advising relationship, asked beyond academic responsibilities, offered community engagement opportunities, engaged in developing career skills, and provided resources to racially minoritized undergraduate and graduate students increased the students' likelihood of academic success (Museus & Ravello, 2010; Griffin, Baker, & O'Meara, 2020). Additionally, programs aimed at mentoring graduate students of color have been shown to help students in achieving their academic goals (Waitzkin et al., 2006) suggesting that addressing minoritized experiences and stressors are of crucial importance in the academic path. Few of the existing studies, however, have explicitly tested whether mentoring mediates relationships between discrimination, MHC, and academic performance.

**1.5.4. Social support.** Students from racially minoritized groups are at greater risk of social isolation than are non-Latino/Hispanic Whites (Hefner & Eisenberg, 2009). In a general undergraduate population, lower social support, specifically support from family but not from

significant others, was found to significantly relate to depression symptom severity, but not anxiety symptoms. Additionally, those individuals who reported low social support also reported low resilience (Hart, 2019). Social support was found to relate to undergraduates' grade point average and was positively associated with better mental health (Hartley, 2011). Poorer interpersonal relationships (i.e., less contact with friends) was associated with higher levels of distress in one study of graduate students from a large western university during the spring 2004 semester (Hyun et al., 2006). Hefner and Eisenberg (2009) surveyed 1,378 undergraduate and graduate students from a large US public university and found that students who reported lower quality social support were six times more likely to have depressive symptoms than individuals who reported higher quality social support. Further research on the type of support needed by graduate students at the institutional level (e.g., advising, program support) and individual level (e.g. peers, family) is warranted, particularly in how these factors might mediate relationships between MHC, discrimination, and academic performance.

### **1.6 Conceptual model of interrelationship of MHC, academic performance and discrimination and possible mitigating factors**

Given that the literature shows relationships between mental health challenges and discrimination, mental health challenges and academic performance, and between mental health *and* discrimination and academic performance, perhaps to a greater degree among racially minoritized populations, we propose the model in Figure 1. Based on the literature, we predict that students who experience mental health challenges will report poor academic performance; individuals who have experienced higher discrimination will report more mental health challenges, and students who report discrimination will also report poorer academic performance. Our model includes direct relationships of minoritized group status with discrimination, MHC, and academic



performance, as well as interactions of minoritized vs majority status on their inter-relationships. There has been very little prior work addressing whether these inter-relationships are differential among students from minoritized compared to majority groups, but we expect stronger links in minoritized groups due to the assumption that associations might be heightened at the extremes of each factor and that there may be unmeasured structural mitigating factors that buffer relationships in the majority, but not minoritized, group. For example, MHC may be more strongly related to academic performance for those who are struggling academically and perhaps even more so if financial support is tied to academic performance. Structural factors like generational wealth might help to minimize the extent to which MHC impact academic performance in students from majority groups, but these structures may not be as available to students from minoritized groups. Since the literature suggests some differences between men and women in discrimination, MHC, and academic performance and their interactions, as well as possible differential experiences of racially minoritized students depending on sex (i.e., intersectionality), we also explore sex differences in the main study measures and incorporate sex into our model as a moderator. Since the literature suggests that some students still do well academically despite experiencing discrimination and/or mental health challenges, we include some potential protective factors in the model: social support, academic advising, and resilience may each be associated with lower discrimination, mental health challenges, and better academic performance, and moderate relationships between these factors. In this study, we tested this preliminary model using cross-sectional data in order to refine it for testing in future longitudinal studies.

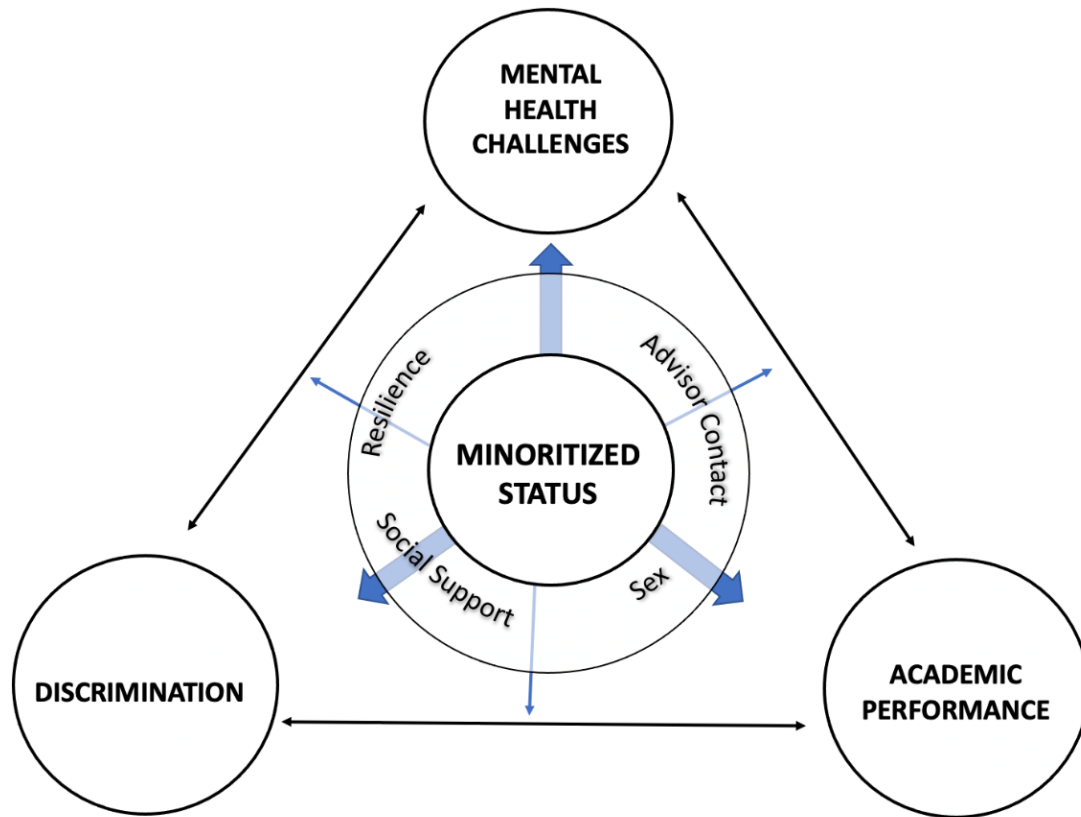


Figure 1. Proposed theoretical model with variables of interest and potential moderators.

### 1.7. Gaps in our knowledge and rationale for study

There are several gaps in the literature in understanding graduate student mental health, specifically in looking at mental health challenges, discrimination, and academic performance or the interplay of these among racially/minoritized graduate students.

First, there is very little work focused on graduate student mental health, and even less so in racially/ethnically minoritized students. Much of the work that has been done is cross-sectional and at single institutions, however, given the low enrollment of racially/minoritized in graduate school, individual graduate programs may only have a few minoritized students or none at all. Therefore, in order to acquire a large enough sample size to address both between and within group differences and generalizable results, a multi-site study is needed.

Secondly, the imperative need for improvement of mental health and well-being in students in higher education has been well known for several decades. Most of the research during this time has focused on the mental health needs of undergraduate students and most institutional efforts and funding have resulted in community engagement, campus activities, and efforts in increasing access to care (as reported above). However, graduate students have not only been largely excluded from these efforts, but they are also often not well-integrated on campuses, are in a different period in life where they may hold additional roles such as parenting, caregiving, and hold higher academic demands as they transition into professional and academic positions. Since the literature has been largely focused on undergraduates, little is known about the unique challenges faced by graduate students, particularly those from minoritized groups, in terms of MHC, discrimination and academic performance.

Third, while the scant research that has been conducted in graduate students shows a prevalence of MHC that is much higher than in the general population, and racially/ethnically minoritized graduate students seem to have greater challenges, little is known about how factors such as discrimination and academic performance may relate to these challenges and whether the nature of the relationship varies among racial/ethnic groups. For example, discrimination has largely been studied within the context of racial discrimination and within a single population so understanding group differences between minoritized groups becomes difficult to assess. Additionally, previous work has not examined possible MHC that arise from cumulative distress of different discrimination types (e.g., racial discrimination + gender discrimination). Furthermore, little is known about the intersection of race and sex in graduate students and more work is needed in order to provide better targeted interventions.

Finally, among graduate students, the role of possible mitigating factors such as resilience, academic advisor contact, and social support have been little studied. It is important to not only highlight potential challenges faced by and deleterious relationships found in minoritized groups, but also to discover factors that can buffer against the effects of systemic oppression. To date, however, the literature addressing the interplay of MHC, discrimination, and academic performance in racially/ethnically minoritized graduate students remains nascent and largely silent about protective factors that could be addressed with targeted interventions. At the time of writing, less than 10 studies had focused on some combination of these within graduate students, and even fewer studied possible mitigating factors.

This study is the first of its kind, to our knowledge, to use a multi-site, national dataset to examine relationships among discrimination, MHC, and academic performance among *racially minoritized compared to majority graduate students*, to examine the intersection of race and sex, and to explore possible mitigating factors to any observed relationships.

## **II. Specific Aims and Hypotheses**

To close gaps in the literature, this dissertation aimed to test elements of the conceptual model presented above. To do so, we used the latest national data from the HMS 2018-2019 annual web-based survey. A total of 62,171 undergraduate and graduate students were sampled from 79 universities; 9% of the overall sample was pursuing a master's degree and 4% were pursuing a Ph.D. We used the subsample of graduate students pursuing a masters or Ph.D. to compare the severity of depression and anxiety symptoms, frequency of diagnosis of depression, anxiety, or both, and the prevalence of self-reported suicidal ideation among racially minoritized graduate students with that among non-Latino White graduate students, and between men and women, and looked for potential interactions of sex and racially minoritized status. We also compared self-reported exposure to discrimination and self-reported grade point average between majority and minoritized groups and between men and women and looked for a potential interaction of sex and racially minoritized status. Secondly, we examined the relationship between discrimination and MHC, the relationship between discrimination and academic performance, and the association of MHC with academic performance and whether relationships differed between majority and minoritized groups, men and women, or between intersectional groups. We explored the simultaneous relationships among discrimination, MHC, and academic performance, specifically whether MHC accounted for any association of discrimination with academic performance. Lastly, we explored the role of possible mitigating factors (i.e., advisor contact, support, resilience) in minoritized vs majority group differences in discrimination, MHC, and academic performance and in the associations among them. For all analyses involving racially/ethnically minoritized compared to majority groups, we explored whether there were particular minoritized groups showing an effect.

**Specific Aim 1.** To examine the role of race/ethnicity in the self-reported prevalence of MHC, discrimination, and academic performance in the most recent national cohort of graduate students (2018-2019).

*Hypothesis 1a.* Racially minoritized graduate students (including Latino, Black, American Indian, Pacific Islanders, Asian Americans, Middle Eastern, multi-racial) will report higher levels of current anxiety and depression symptoms, higher likelihood of reporting both anxiety and depression diagnoses, and higher prevalence of past year suicidal ideation compared to non-Latino White students accounting for other demographic variables.

*Hypothesis 1b.* Racially minoritized graduate students will be more likely to have experienced higher levels of discrimination compared to non-Latino White students.

*Hypothesis 1c.* Racially minoritized graduate students will be more likely to report a GPA that is below the “A” range compared to non-Latino White students.

*Aim 1 Exploratory Analyses.* Differences between racially/ethnically minoritized groups (i.e., Latino, Black, American Indian, Pacific Islanders, Asian Americans, Middle Eastern, multi-racial) and majority students were explored using simple contrasts with Black students as the reference group. Differences between men and women were explored, and the intersectionality of race/ethnicity and sex was examined (comparing minoritized men and women and majority men and women).

**Specific Aim 2.** To examine the relationship between MHC and discrimination, and how that may differ between racially minoritized graduate students and non-Latino White students.

*Hypothesis 2a.* Experiencing higher levels of discrimination will be associated with greater MHC (higher reported levels of anxiety or depression symptoms, greater likelihood of reporting both anxiety and depression, or higher prevalence of suicidal ideation).

**Hypothesis 2b.** The relationships of discrimination to MHC will be stronger among racially minoritized graduate students than among non-Latino White students (race by discrimination interaction effect).

**Aim 2 Exploratory Analyses.** Differences in the nature of the relationship of discrimination and MHC among racially/ethnically minoritized groups (i.e., Latino, Black, American Indian, Pacific Islanders, Asian Americans, Middle Eastern, multi-racial) and majority students were explored using simple contrasts with Black students as the reference group. Possible differential relationships of discrimination and MHC between men and women were explored, and the intersectionality of race/ethnicity and sex was examined (comparing minoritized men and women and majority men and women) as a moderator of the relationship.

**Specific Aim 3.** To examine the relationship of MHC to academic performance, and how that may differ between racially minoritized graduate students and non-Latino White students.

**Hypothesis 3a.** Higher reported levels of anxiety or depression symptoms, greater likelihood of reporting both anxiety and depression, or higher prevalence of suicidal ideation will be associated with lower likelihood of reporting a GPA in the “A” range.

**Hypothesis 3b.** The relationships of MHC to academic performance will be stronger among racially minoritized graduate students than among non-Latino White students (interaction).

**Aim 3 Exploratory Analyses.** Differences in the nature of the relationship of MHC to academic performance between racial groups (i.e., Latino, Black, American Indian, Pacific Islanders, Asian Americans, Middle Eastern, multi-racial, and non-Latino White) were explored. Possible differential relationships of MHC to academic performance between men and women were explored, and the intersectionality of race/ethnicity and sex was examined (comparing minoritized men and women and majority men and women) as a moderator of the relationship.

**Specific Aim 4.** To examine the relationship of discrimination to academic performance, and how that may differ between racially minoritized graduate students and non-Latino White students.

*Hypothesis 4a.* Graduate students who report higher levels of discrimination will be more likely to report a GPA that is below the “A” range.

*Hypothesis 4b.* The relationship of discrimination to academic performance will be stronger among racially minoritized graduate students than among non-Latino White students.

*Aim 3 Exploratory Analyses.* Differences in the nature of the relationship of discrimination to academic performance between racial groups (i.e., Latino, Black, American Indian, Pacific Islanders, Asian American, Middle Eastern, multi-racial, and non-Latino White) were explored. Possible differential relationships of discrimination to academic performance between men and women were explored, and the intersectionality of race/ethnicity and sex was examined (comparing minoritized men and women and majority men and women) as a moderator of the relationship.

**Specific Aim 5 (Exploratory).** To examine whether any relationship between discrimination and academic performance is potentially mediated by MHC, such that the direct relationship between discrimination and academic success will be significantly reduced in a model that includes an indirect path through MHC (Figure 2).

**Specific Aim 6 (Exploratory).** To examine the potential mitigating role of self-reported resilience, support, or advisor contact, in minoritized vs majority group or sex differences in MHC, discrimination, or academic performance. In addition, for all relationships between MHC, discrimination, and academic performance, we explored whether resilience, support or advisor contact moderates those relationships. Finally, we planned to examine whether mitigating factors



moderated differential relationships between MHC, discrimination, or academic performance in minoritized vs non-Latino white students and in men vs women.

### **III. Methods**

#### **3.1 Participants**

Participants were a sub-sample from the larger 2018-2019 Healthy Minds Study (HMS) (Eisenberg & Lipson, 2019). HMS is an annual web-based national survey aimed to assess mental health, service utilization, and related issues among undergraduate and graduate students with 79 participating universities (Supplemental Figure 1) for this cycle. Given that HMS provides a de-identified database to researchers interested in college mental health, and has data focused on racially/ethnically minoritized students, in contrast to access for the ACHA-NCHA, HMS was preferred for the completion of this project. Each institution randomly selected a sample of students currently enrolled over the age of 18 and sent these contact data to HMS. Larger institutions would provide a random sample of 4,000 students, while smaller institutions would provide contact information for all students. Students were invited and reminded of survey completion via email and were sent up to three reminders (2-4 days between reminders) to complete the surveys. Reminders were only sent to students who had started but had not yet completed the surveys. Overall completion rates were 16% for undergraduate and graduate students combined and this most likely biases the data and limits generalizability. Response rates for graduate students in particular were not available. In order to address this limitation and avoid potentially important differences between those who completed vs. those who did not (84%), non-response weights were made available by the surveying group. The following variables, when available, were used to estimate which types of students were more or less likely to respond: gender, race/ethnicity, academic level, and grade point average. However, we accounted for response biases by controlling for school in our models given that weighting reduces the efficiency of estimates when individual-level error terms are clustered within a group (such as school; Solon, Haider, &

Woolridge, 2013). For this study, data from participants who were currently attending either a master's or academic doctoral program (e.g., Ph.D.) were selected, for a total of 5,820 graduate students ranging from 18-73 years old. International students were excluded. Of the total number of students who completed the survey, 9% were enrolled in a master's program and 4% were completing a Ph.D. Our final graduate student sample had an average age of 28 years old (SE=8.24), majority female (4178, 71.8%), and majority master's level students (3565, 61.3%). Most students were non-Latino White (n=4032), followed by multiracial (n=438), Asian (n=431), Latino (n=417), Black (n=400), Middle Eastern (n=73), Native American (n=24) and Pacific Islanders groups (n=5). See Table 1 for complete characteristics of the total sample and Table 2 for characteristics of each subsample.

### **3.2. Measures**

*Race/ethnicity.* A dichotomous group variable of race/ethnicity was created to compare n=1788 minoritized (multiracial, Asian, Latino, Black, Middle Eastern, Native American, and Pacific Islanders) and n=4032 non-Latino White students. In models where the dichotomous group variable was significant, we explored possible differences across all individual race/ethnicity groups with Black students as the reference group.

*Depression Symptoms.* Depression was measured using the Patient Health Questionnaire-9 (PHQ-9). This screener has a total of nine items that are based on the Diagnostic and Statistical Manual for Mental Disorders major depressive episode criteria asking individuals about symptoms within the past two weeks (Spitzer, Kroenke, & Williams, 1999). The PHQ-9 has been demonstrated to be reliable and valid with good sensitivity and specificity for depressive symptoms (Beard et al., 2015) and has been validated in a diverse U.S. college sample (Keum, Miller, &

Inkelas, 2018). Scores range from 0-27, and this variable was treated as a continuous variable in statistical models.

*Anxiety Symptoms.* Self-reported levels of anxiety were measured using the General Anxiety Disorder-7 (GAD-7). This screener is used to assess for generalized anxiety disorder and severity of symptoms within the past two weeks. This measure has been demonstrated to be reliable and valid with optimized sensitivity and specificity (Spitzer, Kroenke, Williams, & Lowe, 2006) and has been found to be psychometrically sound in diverse populations (Sarah et al., 2014; Naeinian et al., 2011). Scores range from 0 to 21, and this variable was used as a continuous variable in statistical models.

*Suicidality.* A single question, separate from the PHQ-9, was asked about suicidal ideation: “In the past year, did you ever seriously think about attempting suicide?” Responses were yes/no and as such, this variable was considered a dichotomous variable in statistical analyses.

*Mental Health Burden.* A new categorical variable was created driven by the most common mental health challenges in the literature (e.g., anxiety and depression) to assess mental health burden of graduate students in their lifetime. Participants were asked: “Were you ever diagnosed with any of the following conditions by a health professional (e.g., primary care, doctor, psychiatrist, psychologist, etc.)?” MHC included: anxiety, depression, bipolar disorder, obsessive-compulsive, trauma and stressor related disorders, neurodevelopmental disorders, eating disorders, personality disorders, substance use disorders, psychotic disorders, and none. This variable was then coded into three groups: anxiety (generalized anxiety disorder, panic disorder, agoraphobia, specific phobia, social anxiety, OCD, PTSD) only, depression only, anxiety plus depression; this was treated as a categorical variable in statistical analyses.

*Discrimination.* Participants were asked: “In the past 12 months, how many times have you been treated unfairly because of your race, ethnicity, gender, sexual orientation, or cultural background?” Participants could respond: 1=Never, 2=Once in a while, 3=Sometimes, 4= A lot, 5= Most of the time, 6= Almost all of the time. This variable was treated as a categorical variable in statistical analyses.

*Academic Performance.* Participants were asked to report their current grade point average on a letter-scale (A+ to D-). Graduate students typically do not have a large range of grades given programmatic restrictions (B= passing). We are interested in characterizing those students who are not performing in the “typical” A range, as such, we created a dichotomous variable (i.e., ‘A’, ‘non-A’). Assessment of academic performance in graduate school has not been well-established in graduate students and GPA continues to be a metric (albeit, a limited one) in assessing academic performance. Examining the distribution of GPAs among the graduate students showed that more than half (63.4%) reported a GPA in the A range.

*Resilience.* Participants were asked to complete the Brief Resilience Scale, a reliable and valid measure of self-reported trait resilience (Smith et al., 2008). This 6-item scale asks individuals to indicate the extent to which they agree with each statement by using the following Likert-scale: 1=strongly disagree to 5=strongly agree; higher scores indicate greater resilience (Smith et al., 2008). Items 2, 4, and 6 are reverse scored and scores are aggregated across the six-items (scores range from 6-30) and divided by number of response (6; Smith et al., 2013). Scores have been recommended to be interpreted as follows: 1.00-2.99 (low resilience); 3.00-4.30 (normal resilience); and 4.31-5.00 (high resilience; Smith et al., 2013). This measure has been found to be psychometrically sound in diverse populations (Salisu & Hashim, 2017). The variable was treated

as continuous in analyses; the cut-off scores above were used to help interpret any significant interactions.

*Advisor contact.* Given the direct and critical role advisors play for graduate students, frequency of advisor contact was examined. Participants were asked how often they interacted with academic advisors on a 6-point Likert-scale: 1= every day or nearly every day, 6= never. We reverse coded this variable so that higher numbers indicated more frequent advisor contact. This variable was treated as a continuous variable in statistical analyses. Follow-up analysis explored whether any associations with advisor contact are stronger among those who selected “Academic Advisor” in response to the following: “If you had a mental health problem that you believed was affecting your academic performance, which people at school would you talk to?”

*Individual Social Support.* Participants were asked: “In the past 12 months have you received counseling or support for your mental or emotional health from any of the following sources:” Options included: 1=Roommate, 2=Friend, 3=Significant Other, 4=Family member, 5= Religious counselor, 6=Support Group, 7=Other, 8= None. Social support was aggregated across all categories so that the total number of support systems was used as a continuous variable in analyses.

*Field of Study.* Participants were asked to identify their current field of study. These included humanities, natural sciences, sociology, dentistry, education, engineering, medicine, music, public health, public policy, social work and other. Responses (including write-ins under “other”) were categorized into one of three groups: humanities, STEM, health professionals and related fields, and used as a categorical variable. Humanities included religion, language, literature, arts, media and cultural studies. STEM fields included, but were not limited to, physical sciences, computer sciences, mathematics, engineering, psychology, and social sciences. Health

professionals and related fields included, but were not limited to, public health, public policy, counseling, and occupational therapy.

*Level of study.* Participants were categorized based on whether they were pursuing master's vs doctoral degrees.

### **3.3. Data Preparation**

Prior to running general linear models, variables were plotted to assess for distribution and outliers. No outliers were identified and therefore all respondents within our subgroup of graduate student were used. Data were assessed for linear relationships between predictors and outcomes. Variables with “other” options were recoded into appropriate groups, including recoding a new multi-racial variable, and field of study (i.e., humanities, STEM, medical and related fields).

We examined any differences in age, year of study, level of study (i.e., master's vs doctoral), and field of study (i.e., humanities, STEM, medical and related fields) between the two main race/ethnicity groups: non-Latino White and racially minoritized. Level of study, year in school, field of study and age were controlled for in group analyses. In addition, we examined age, year of study, level of study (i.e., masters vs doctoral), and field of study (i.e., humanities, STEM, medical and related fields) and their associations to the main variables of interest (i.e., MHC, discrimination, academic performance) as well as potential moderators (i.e., resilience, advisor contact, and support). Variables with significant relationships were included as covariates within the models.

Of importance, the sample size of surveys collected from individual institutions varies widely (lowest n=1; highest=1,103). In addition, the nature of each cohort may vary due to school-related factors (e.g., distribution of available programs of study) resulting in clustered responses.

As such, we accounted for clustering and variability between schools by including school as a random effect in our models.

### 3.4 Statistical Analysis

Descriptive statistics were used to examine the lifetime prevalence of diagnosis of anxiety (e.g., any anxiety disorder, including obsessive-compulsive, trauma or stressor-related disorders), and depression, and prevalence of suicidal ideation over the past year among all graduate students, as well as the lifetime prevalence of other MHC diagnoses (i.e., bipolar disorder, psychotic disorders, neurodevelopmental disorders, eating disorders, personality disorders, substance use disorders, none) to provide context for the analyses, which will focus on anxiety and depression symptoms. Means and standard deviations within each race/ethnicity group for all continuous variables (i.e., age, anxiety and depression symptom levels, resilience levels, social support) and proportions for all discrete variables (i.e., sex, level of study, MHC burden, suicidal ideation, discrimination, academic performance, advisor contact) were calculated.

*Aim 1.* General linear models with anxiety severity (GAD-7) and depression severity (PHQ-9) as outcomes were used to compare non-Latino White vs. racially minoritized groups. Logistic regressions with MHC burden (anxiety plus depression versus anxiety or depression alone), suicidal ideation, discrimination, and academic performance as outcome variables were run to examine racial/ethnic differences. As part of our exploratory analyses, we utilized general linear models and logistic models as outlined above to examine any sex differences. Statistical models were as follows:

$$\text{Model 1} = Y_i^{(*)} = \beta_0 + \beta_1 X_{1i} + \varepsilon_i$$

$$\text{Model 2} = Y_i^{(*)} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$$

Where:



$Y_i$  = depression or anxiety OR  $Y_i^*$ = logistic regression with categorical MHC burden variable, dichotomous suicidal ideation variable, categorical discrimination variable or dichotomous academic performance variable

$X_1$ = group (racially minoritized vs. non-Latino White or men vs women)

$X_2 \dots X_n$ = significant covariates (e.g., age, level of study, field of study)

$\epsilon_i$ =error in model

Model 1 examined the relationships without covariates (as described above); Model 2 included any covariates that were different among the two groups. In addition, post hoc analyses were conducted, with each group compared individually to the Black group. Exploratory analyses with an additional interaction term of sex by racially minoritized status were also conducted.

*Aim 2.* General linear mixed models were used to examine associations between levels of discrimination and MHC. Models included depression and anxiety symptom levels as outcome variables and discrimination as the predictor (“Never” respondents were the reference group). Logistic regressions with suicidal ideation and mental health burden as the outcome variables and discrimination as the predictor were used to assess for associations of discrimination with the likelihood of having both anxiety and depression and of having suicidal ideation. A second model added group (racially minoritized vs non-Latino White or men vs women) and a group x predictor interaction for each outcome and included covariates (e.g., age, level of study, field of study) that were related to the predictor or outcome. Exploratory analyses with an additional interaction term of sex by racially minoritized status were also conducted.

$$\text{Model 1} = Y_i^{(*)} = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \epsilon_i$$

$$\text{Model 2} = Y_i^{(*)} = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i} D_{1i} + \beta_6 X_{3i} D_{2i} + \epsilon_i$$

Where:

$Y_i$ = Depression or anxiety symptom levels OR  $Y_i^*$ = logistic regression with categorical MHC burden variable or dichotomous suicidal ideation variable

$D_{1,2}$ = dummy coded discrimination variable with 5 levels (“Never” respondents are reference group)

$X_3$ = group (dichotomous variable: racially minoritized vs non-Latino White or men vs women)

$X_{4...n}$ = significant covariates

$\epsilon_i$ =error in model

Aim 3. Binary logistic regressions were used to examine separately the relationship of MHC to academic performance. Academic performance (A vs. non-A GPA) was our outcome variable with MHC (depression level, anxiety level, mental health burden, or suicidal ideation) as our predictors. A second model added group (minoritized vs non-Latino White or men vs women) and a group x predictor interaction for each outcome, and included appropriate covariates (i.e., age, Master’s vs. Ph.D.).

$$\text{Model 1} = Y_i^* = \beta_0 + \beta_1 X_{1i} + \epsilon_i$$

OR

$$\text{Model 1.a.} = Y_i^* = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \epsilon_i$$

$$\text{Model 2} = Y_i^{(*)} = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{3i} + \beta_3 X_{4i} + \beta_4 X_{5i} + \epsilon_i$$

$$\text{Model 2.a.} = Y_i^{(*)} = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 X_{3i} + \beta_4 X_{3i} D_{1i} + \beta_5 X_{3i} D_{2i} + \epsilon_i$$

Where:

$Y_i^*$ = academic performance (\*=logistic regression)

$D_{1,2}$ = dummy coded variable with 3 levels (reference group: Both depression and anxiety)

X<sub>1</sub>= depression or anxiety symptom levels

X<sub>3</sub>= group (dichotomous variable: racially minoritized vs non-Latino White or men vs women)

X<sub>4</sub>= X<sub>1</sub>\* X<sub>3</sub>

X<sub>5</sub>= possible covariates

ε<sub>i</sub>=error in model

For all models, follow-up analyses were conducted for any significant group differences. Exploratory analyses with an additional interaction term of sex by racially minoritized status were also conducted.

Aim 4. Binary logistic regressions were used to examine separately the relationship of discrimination to academic performance. Academic performance (A vs. non-A GPA) was our outcome variable with discrimination as our predictor (dummy coded; “Never” reference group). A secondary model included appropriate covariates (i.e., sex, age, Master’s vs. Ph.D.).

$$\text{Model 1} = Y_i^* = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \epsilon_i$$

$$\text{Model 2} = Y_i^* = \beta_0 + \beta_1 D_{1i} + \beta_2 D_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{3i} D_{1i} + \beta_6 X_{3i} D_{2i} + \epsilon_i$$

Where:

Y<sub>i</sub><sup>\*</sup>= academic performance (\*=logistic regression)

D<sub>1,2</sub>= dummy coded discrimination variable with 3 levels (reference group: “Never” respondents)

X<sub>3</sub>= race/ethnicity (dichotomous variable: racially minoritized vs non-Latino White)

X<sub>4...</sub>= significant covariates

ε<sub>i</sub>=error in model

Aim 5 (Exploratory). We planned to explore the possible mediation of any observed relationship of discrimination to academic performance by mental health challenges using PROCESS macro for SPSS (model 4) and to examine the fit of this model and whether the strength of the direct path from discrimination to academic performance was reduced when the indirect path via depression, anxiety, and mental health burden (lifetime history) was included in the model (see Figure 2.) However, as there was no significant association of discrimination and academic performance observed, this analysis could not be conducted.

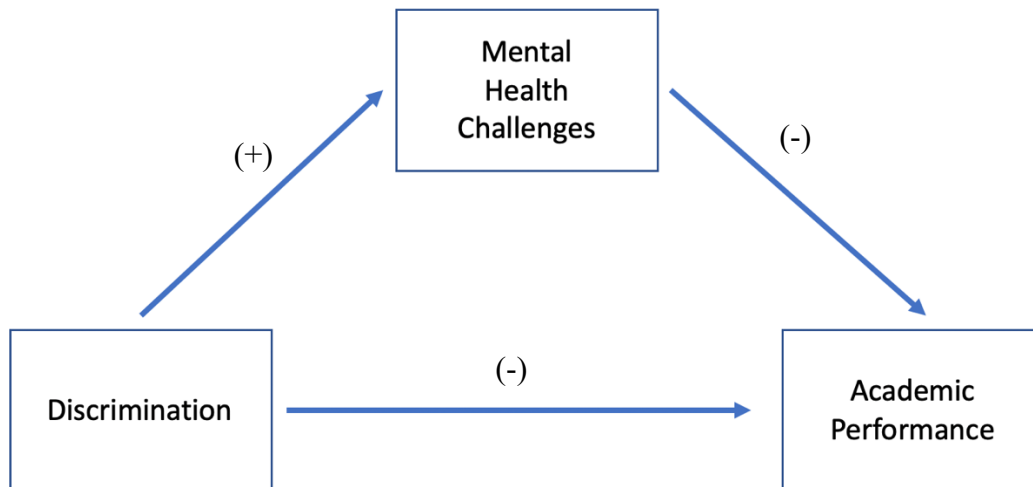


Figure 2. Proposed mediation of relationship between discrimination and academic performance by mental health challenges.

Aim 6 (Exploratory). For all models examining differences between minoritized vs. majority or men vs women in MHC, discrimination, or academic performance in Aim 1, we explored adding resilience, advisor contact, and social support and their interaction with group into the models.

6a. To explore whether resilience, support or advisor contact moderated the inter-relationships of MHC, discrimination, and academic performance, we added each of these and

their interaction with the predictor into the first models from Aims 2-4 (e.g., predicting academic performance from depression severity, resilience, and depression severity x resilience). We had intended to also explore whether resilience, support, or advisor contact influenced group differences (minoritized vs majority students; men vs. women) in the nature of the relationships between MHC, discrimination, and academic performance by adding three-way interactions of each of the potential moderators with group and with each of the predictors (MHC, discrimination, and academic performance) to the second models from Aims 2-4. However, due to the smaller amount of data available for the potential moderators and the small cell sizes for some of the subgroups (e.g., non-Latino White students who frequently experienced discrimination and had a non-A grade), our power to examine the 3-way interactions was low, and therefore we did not carry out these models.

#### **IV. Results**

##### **Sample demographics**

Our final sample comprised 5,820 graduate students with an average age of 28 years old (SE=8.24), majority female (4178, 71.8%), and majority master's level students (3565, 61.3%; see Table 1). Most students were non-Latino White (n=4032), followed by multiracial (n=438), Asian (n=431), Latino (n=417), Black (n=400), Middle Eastern (n=73), Native American (n=24) and Pacific Islanders groups (n=5). Regarding year of study, 38.7% of students were first years, 29.4% were second years, 12.8% were third years, 8.3% were fourth years, 4.3% were fifth years, 2.5% were sixth years, and 2.1% were seven years and above. Field of study was categorized as humanities (26.2%), STEM (28.8%), and health professionals and related fields (38.7%). Individuals were asked if they had been diagnosed with any mental health disorders with 52.5% reporting no diagnoses. Of those with a diagnosis, 29% reported a diagnosis of anxiety, 25.5% depression, 6.5% trauma, 4.1% eating disorders, 3.8% obsessive compulsive disorder, 3.7% neurodevelopmental disorders, 2.3% bipolar disorder, 1.4% substance abuse, 0.5% personality disorders, and 0.3% psychosis disorders. On the mental health burden variable, 9.7% had depression only, 8.7% had anxiety only, and 18% had both anxiety and depression. Our sample was mildly depressed and anxious, without about 8% of the sample endorsing strongly considering suicidal ideation within the past year. Most students reported never experiencing discrimination. More than half of the sample was in the 'A' category. In terms of mitigating factors, on average, students endorsed normal levels of resilience, met with an advisor one to two times a month, and reported 2 sources of support.

Race/ethnicity groups were categorized into non-Latino White and racially minoritized groups (reference group) for main analyses. For follow-up analyses on race/ethnicity variables, only non-Latino White, multiracial, Asian, Latino, and Black groups were utilized given the

relative low sample sizes of Middle Eastern, Native American and Pacific Islander groups. Demographics of the minoritized and non-Latino White groups, men and women, and each race/ethnicity group are shown in Table 2. Race/ethnicity groups did not differ significantly in age ( $\chi^2=53.5$ ,  $p=0.378$ ), sex ( $t(5818)=-.319$ ,  $p=0.749$ ), level of study (Master's vs Ph.D.;  $t(5818)=0.537$ ,  $p=0.464$ ), field of study ( $t(5454)=-0.56$ ,  $p=0.732$ ), or current year in school ( $t(5707)$ ,  $p=.083$ ).

Table 1. *Overall Sample Characteristics*

|                        | <i>n</i> | M (SD)/%  |
|------------------------|----------|-----------|
| Sex                    |          |           |
| Female                 | 4178     | 71.8      |
| Male                   | 1642     | 28.2      |
| Race/Ethnicity         |          |           |
| Non-Latino White       | 4032     | 69.3      |
| Minoritized            | 1788     | 30.7      |
| Black                  | 400      | 6.9       |
| Latino                 | 417      | 7.2       |
| Asian                  | 431      | 7.4       |
| Multi-racial           | 438      | 7.5       |
| Native American        | 24       | .4        |
| Pacific Islander       | 5        | .1        |
| Middle Eastern         | 73       | 1.3       |
| Education Level        |          |           |
| Masters                | 3565     | 61.3      |
| Doctorate              | 2255     | 38.7      |
| Year of Study          |          |           |
| 1                      | 2252     | 38.7      |
| 2                      | 1711     | 29.4      |
| 3                      | 745      | 12.8      |
| 4                      | 485      | 8.3       |
| 5                      | 252      | 4.3       |
| 6                      | 142      | 2.5       |
| 7+                     | 122      | 2.1       |
| Field of Study         |          |           |
| Humanities             | 1527     | 26.2      |
| STEM                   | 1678     | 28.8      |
| Medical and Related    | 2252     | 38.7      |
| Depression severity    | 4277     | 7.2 (5.5) |
| Anxiety severity       | 4233     | 6.7 (5.2) |
| Mental Health Burden   |          |           |
| No Diagnosis           | 2646     | 45.5      |
| Depression only        | 405      | 7.0       |
| Anxiety only           | 360      | 6.2       |
| Depression and Anxiety | 748      | 12.9      |
| Suicidal Ideation      |          |           |
| No                     | 5112     | 91.4      |
| Yes                    | 480      | 8.6       |
| Discrimination         |          |           |
| Never                  | 1023     | 58.4      |
| Once in a While        | 464      | 26.5      |
| Sometimes              | 178      | 10.2      |
| A lot                  | 54       | 3.1       |
| Most of the time       | 20       | 1.1       |
| All of the time        | 12       | .7        |
| Academic Performance   |          |           |
| A group                | 3656     | 63.4      |
| A - and below          | 2112     | 36.4      |
| Resilience             | 2154     | 3.4 (.80) |



Table 1. *Overall Sample Characteristics, continued.*

|                 | <i>n</i> | M (SD)/%  |
|-----------------|----------|-----------|
| Advisor Contact |          |           |
| Never           | 9        | 3.8       |
| 1-2/semester    | 21       | 8.9       |
| 1-2/month       | 25       | 10.5      |
| 1/week          | 36       | 15.2      |
| 2-3/week        | 92       | 38.8      |
| Everyday        | 54       | 22.8      |
| Social Support  | 5820     | 1.7 (1.0) |

*Note.* *n*=number in sample; M= mean; SD= standard deviation; %= percentage in sample.

Table 2. Sample characteristics by sex, racially minoritized vs majority groups, and individual racial/ethnic groups

| Variables of Interest      | Sex      |               |          |               | Race        |            |                  |               |
|----------------------------|----------|---------------|----------|---------------|-------------|------------|------------------|---------------|
|                            | Female   |               | Male     |               | Minoritized |            | Non-Latino White |               |
|                            | <i>n</i> | M/<br>SD/%    | <i>n</i> | M/<br>SD/%    | <i>n</i>    | M/<br>SD/% | <i>n</i>         | M/<br>SD/%    |
| Depression                 | 3102     | 7.3<br>(5.7)  | 1175     | 7.1<br>(5.8)  | 1333        | 7.3 (5.6)  | 2944             | 7.2<br>(5.4)  |
| Anxiety                    | 3076     | 7.1<br>(5.3)  | 1157     | 5.7<br>(5.1)  | 1311        | 6.6 (5.4)  | 2922             | 6.7<br>(5.2)  |
| Mental Health Burden       |          |               |          |               |             |            |                  |               |
| No Diagnoses               | 1868     | 61.8          | 778      | 68.6          | 825         | 64.1       | 1821             | 63.4          |
| Depression Only            | 283      | 9.4           | 122      | 10.8          | 118         | 9.2        | 287              | 10            |
| Anxiety Only               | 313      | 10.3          | 47       | 4.1           | 110         | 8.5        | 250              | 8.7           |
| Depression and Anxiety     | 561      | 18.5          | 187      | 16.5          | 235         | 18.2       | 513              | 17.9          |
| Suicidal Ideation          |          |               |          |               |             |            |                  |               |
| No                         | 3708     | 88.8          | 1404     | 85.5          | 141         | 7.9        | 3548             | 88            |
| Yes                        | 317      | 7.6           | 163      | 9.9           | 1564        | 87.5       | 339              | 8.4           |
| Discrimination             |          |               |          |               |             |            |                  |               |
| Never                      | 658      | 52.9          | 365      | 71.9          | 169         | 41.8       | 854              | 63.4          |
| Once in a While            | 381      | 30.7          | 83       | 16.3          | 127         | 31.4       | 337              | 25            |
| Sometimes                  | 141      | 11.3          | 37       | 7.3           | 70          | 17.2       | 108              | 8             |
| A lot                      | 43       | 3.5           | 11       | 2.2           | 24          | 5.9        | 30               | 2.2           |
| Most of the time           | 15       | 1.2           | 5        | 1.0           | 9           | 2.2        | 11               | .8            |
| Almost all of the time     | 5        | .4            | 7        | 1.4           | 5           | 1.2        | 7                | .5            |
| Academic Performance       |          |               |          |               |             |            |                  |               |
| 'A' category               | 2726     | 65.2          | 930      | 56.6          | 1021        | 57.1       | 2635             | 65.4          |
| 'A-' and below             | 1411     | 33.8          | 701      | 42.7          | 749         | 41.9       | 1363             | 33.8          |
| Resilience                 | 1542     | 3.35<br>(.79) | 612      | 3.52<br>(.81) | 546         | 3.4 (.81)  | 1608             | 3.39<br>(.79) |
| Advisor Contact            |          |               |          |               |             |            |                  |               |
| Never                      | 6        | 3.8           | 3        | 3.8           | 0           | 0          | 9                | 4.7           |
| 1-2/semester               | 11       | 7.0           | 10       | 12.5          | 3           | 6.8        | 18               | 9.3           |
| 1-2/month                  | 16       | 10.2          | 9        | 11.3          | 5           | 11.4       | 20               | 10.4          |
| 1/week                     | 23       | 14.6          | 13       | 16.3          | 10          | 22.7       | 26               | 13.5          |
| 2-3/week                   | 64       | 40.8          | 28       | 35            | 17          | 38.6       | 75               | 38.9          |
| Everyday                   | 37       | 23.6          | 17       | 21.3          | 9           | 20.5       | 45               | 23.3          |
| Social Support             | 4178     | 1.78<br>(1.0) | 1642     | 1.41<br>(.88) | 1788        | 1.6 (.99)  | 4032             | 1.71<br>(1.0) |
| Education Level            |          |               |          |               |             |            |                  |               |
| Masters                    | 2686     | 64.2          | 881      | 53.7          | 1138        | 63.6       | 2427             | 60.2          |
| Ph.D.                      | 1494     | 35.8          | 761      | 46.3          | 650         | 36.4       | 1605             | 39.8          |
| Year of Study              |          |               |          |               |             |            |                  |               |
| 1                          | 1662     | 40.4          | 590      | 36.8          | 741         | 42.4       | 1511             | 38.1          |
| 2                          | 1242     | 30.2          | 469      | 29.2          | 546         | 31.3       | 1165             | 29.4          |
| 3                          | 523      | 12.7          | 2222     | 13.8          | 190         | 10.9       | 555              | 14.0          |
| 4                          | 336      | 8.2           | 149      | 9.3           | 132         | 7.6        | 353              | 8.9           |
| 5                          | 167      | 4.1           | 85       | 5.3           | 64          | 3.7        | 188              | 4.7           |
| 6                          | 92       | 2.2           | 55       | 3.4           | 40          | 2.3        | 107              | 2.7           |
| 7+                         | 87       | 2.1           | 35       | 2.2           | 33          | 1.9        | 89               | 2.2           |
| Field of Study             |          |               |          |               |             |            |                  |               |
| Humanities                 | 1183     | 30.3          | 344      | 22.1          | 460         | 27.8       | 1067             | 28.1          |
| STEM                       | 887      | 33.8          | 791      | 50.7          | 449         | 27.1       | 1229             | 32.3          |
| Medical and related fields | 1828     | 46.9          | 424      | 27.2          | 746         | 45.1       | 1506             | 39.6          |

Table 2. *Sample characteristics by race continued.*

| Variables of Interest  | Black    |           | Latino   |           | Asian American |           | Multiracial |           | Native American |           | Pacific Islander |           | Middle Eastern |           | Non-Latino White |            |
|------------------------|----------|-----------|----------|-----------|----------------|-----------|-------------|-----------|-----------------|-----------|------------------|-----------|----------------|-----------|------------------|------------|
|                        | <i>n</i> | M/SD/%    | <i>n</i> | M/SD/%    | <i>n</i>       | M/SD/%    | <i>n</i>    | M/SD/%    | <i>n</i>        | M/SD/%    | <i>n</i>         | M/SD/%    | <i>n</i>       | M/SD/%    | <i>n</i>         | M/SD/%     |
| Depression             | 245      | 7.2 (6.1) | 348      | 7.1 (5.4) | 338            | 6.8 (5.3) | 324         | 7.8 (5.8) | 17              | 7.5 (4.8) | 4                | 5.5 (3.3) | 57             | 8.1 (6.1) | 2944             | 7.2 (5.4)  |
| Anxiety                | 244      | 5.9 (5.4) | 336      | 6.8 (5.3) | 331            | 6.0 (5.1) | 325         | 7.3 (5.5) | 16              | 7.3 (6.7) | 4                | 3.0 (1.4) | 55             | 8.1 (5.6) | 2922             | 6.7 (5.2)  |
| Mental Health Burden   |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| No Diagnoses           | 158      | 66.9      | 212      | 63.9      | 227            | 69.2      | 181         | 57.1      | 10              | 52.6      | 4                | 80        | 34             | 61.8      | 1821             | 63.4       |
| Depression Only        | 21       | 8.9       | 31       | 9.3       | 32             | 9.8       | 28          | 8.8       | 2               | 10.5      | 0                | 0         | 4              | 7.3       | 287              | 10         |
| Anxiety Only           | 14       | 5.9       | 30       | 9.0       | 25             | 7.6       | 37          | 11.7      | 1               | 5.3       | 0                | 0         | 4              | 7.3       | 250              | 8.7        |
| Depression and Anxiety | 43       | 18.2      | 59       | 17.8      | 44             | 13.4      | 71          | 22.4      | 6               | 31.6      | 0                | 0         | 13             | 23.6      | 513              | 17.9       |
| Suicidal Ideation      |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| No                     | 344      | 86        | 366      | 87.8      | 380            | 88.2      | 381         | 87        | 21              | 87.5      | 0                | 0         | 67             | 91.8      | 3548             | 88         |
| Yes                    | 37       | 9.3       | 28       | 6.7       | 32             | 7.4       | 41          | 9.4       | 3               | 12.5      | 5                | 100       | 3              | 4.1       | 339              | 8.4        |
| Discrimination         |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| Never                  | 34       | 37.8      | 55       | 52.9      | 23             | 30.7      | 49          | 46.2      | 2               | 22.2      | 0                | 0         | 7              | 9.6       | 854              | 63.4       |
| Once in a While        | 28       | 31.1      | 30       | 28.8      | 31             | 41.3      | 29          | 27.4      | 3               | 33.3      | 0                | 0         | 6              | 8.2       | 337              | 25         |
| Sometimes              | 17       | 18.9      | 13       | 12.5      | 15             | 20        | 16          | 15.1      | 3               | 33.3      | 0                | 0         | 6              | 8.2       | 108              | 8          |
| A lot                  | 7        | 7.8       | 4        | 3.8       | 4              | 5.3       | 7           | 6.6       | 1               | 11.1      | 0                | 0         | 2              | 2.7       | 30               | 2.2        |
| Most of the time       | 3        | 3.3       | 0        | 0         | 2              | 2.7       | 4           | 3.8       | 0               | 0         | 0                | 0         | 0              | 0         | 11               | .8         |
| Almost all of the time | 1        | 1.1       | 2        | 1.9       | 0              | 0         | 1           | .9        | 0               | 0         | 0                | 0         | 0              | 0         | 7                | .5         |
| Academic Performance   |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| 'A' category           | 222      | 55.5      | 235      | 56.4      | 249            | 57.8      | 255         | 58.2      | 12              | 50        | 5                | 100       | 43             | 58.9      | 2635             | 65.4       |
| 'A-' and below         | 174      | 43.5      | 176      | 42.2      | 178            | 41.3      | 179         | 40.9      | 12              | 50        | 0                | 0         | 30             | 41.1      | 1363             | 33.8       |
| Resilience             | 108      | 1.4 (.93) | 150      | 3.4 (.85) | 111            | 3.5 (.75) | 143         | 3.3 (.79) | 11              | 3.8 (.86) | 0                | 0         | 24             | 3.4 (.67) | 1608             | 3.39 (.79) |
| Advisor Contact        |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| Never                  | 0        | 0         | 0        | 0         | 0              | 0         | 0           | 0         | 0               | 0         | 0                | 0         | 0              | 0         | 9                | 4.7        |
| 1-2/semester           | 1        | 12.5      | 0        | 0         | 0              | 0         | 2           | 13.3      | 0               | 0         | 0                | 0         | 0              | 0         | 18               | 9.3        |
| 1-2/month              | 2        | 25.0      | 0        | 0         | 1              | 9.1       | 2           | 13.3      | 0               | 0         | 0                | 0         | 0              | 0         | 20               | 10.4       |
| 1/week                 | 3        | 37.5      | 0        | 0         | 1              | 9.1       | 4           | 26.7      | 1               | 25        | 0                | 0         | 1              | 25        | 26               | 13.5       |
| 2-3/week               | 1        | 12.5      | 1        | 50        | 5              | 45.5      | 6           | 40        | 1               | 25        | 0                | 0         | 3              | 75        | 75               | 38.9       |
| Everyday               | 1        | 12.5      | 1        | 50        | 4              | 36.4      | 1           | 6.7       | 2               | 50        | 0                | 0         | 0              | 0         | 45               | 23.3       |
| Social Support         | 400      | 1.4 (.93) | 417      | 1.6 (1.0) | 431            | 1.6 (1.0) | 438         | 1.7 (1.0) | 27              | 1.4 (.88) | 5                | 1.6 (1.9) | 73             | 1.5 (.92) | 4032             | 1.71 (1.0) |
| Education Level        |          |           |          |           |                |           |             |           |                 |           |                  |           |                |           |                  |            |
| Masters                | 292      | 73        | 288      | 69.1      | 251            | 58.2      | 239         | 54.6      | 14              | 51.9      | 5                | 100       | 51             | 69.9      | 2427             | 60.2       |
| Ph.D.                  | 108      | 27        | 129      | 30.9      | 180            | 41.8      | 199         | 45.4      | 13              | 48.1      | 0                | 0         | 22             | 30.1      | 1605             | 39.8       |

Table 2. *Sample characteristics by race continued.*

| Variables of Interest      | Black    |        | Latino   |        | Asian American |        | Multiracial |        | Native American |        | Pacific Islander |        | Middle Eastern |        | Non-Latino White |        |
|----------------------------|----------|--------|----------|--------|----------------|--------|-------------|--------|-----------------|--------|------------------|--------|----------------|--------|------------------|--------|
|                            | <i>n</i> | M/SD/% | <i>n</i> | M/SD/% | <i>n</i>       | M/SD/% | <i>n</i>    | M/SD/% | <i>n</i>        | M/SD/% | <i>n</i>         | M/SD/% | <i>n</i>       | M/SD/% | <i>n</i>         | M/SD/% |
| Year of Study              |          |        |          |        |                |        |             |        |                 |        |                  |        |                |        |                  |        |
| 1                          | 172      | 43.7   | 182      | 44.7   | 168            | 40.1   | 175         | 40.9   | 11              | 42.3   | 3                | 75     | 32             | 45.1   | 1511             | 38.1   |
| 2                          | 130      | 33     | 133      | 32.7   | 122            | 29.1   | 134         | 31.3   | 5               | 19.2   | 1                | 25     | 21             | 29.6   | 1165             | 29.4   |
| 3                          | 43       | 10.9   | 44       | 10.8   | 45             | 10.7   | 48          | 11.2   | 3               | 11.5   | 0                | 0      | 8              | 11.3   | 555              | 14.0   |
| 4                          | 24       | 6.1    | 24       | 5.9    | 38             | 9.1    | 36          | 8.4    | 3               | 11.5   | 0                | 0      | 7              | 9.9    | 353              | 8.9    |
| 5                          | 8        | 2.0    | 12       | 2.9    | 27             | 6.4    | 16          | 3.7    | 0               | 0      | 0                | 0      | 1              | 1.4    | 188              | 4.7    |
| 6                          | 10       | 2.5    | 8        | 2.0    | 8              | 1.9    | 10          | 2.3    | 2               | 7.7    | 0                | 0      | 2              | 2.8    | 107              | 2.7    |
| 7+                         | 7        | 1.8    | 4        | 1.0    | 11             | 2.6    | 9           | 2.1    | 2               | 7.7    | 0                | 0      | 0              | 0      | 89               | 2.2    |
| Field of Study             |          |        |          |        |                |        |             |        |                 |        |                  |        |                |        |                  |        |
| Humanities                 | 152      | 38     | 113      | 27.1   | 65             | 16     | 102         | 24.9   | 10              | 37.0   | 2                | 40     | 16             | 22.9   | 1067             | 28.1   |
| STEM                       | 57       | 14.2   | 82       | 19.7   | 148            | 36.5   | 128         | 31.2   | 6               | 22.2   | 0                | 0      | 29             | 41.4   | 1229             | 32.3   |
| Medical and related fields | 148      | 37     | 190      | 45.6   | 193            | 47.5   | 180         | 43.9   | 8               | 29.6   | 3                | 60     | 25             | 35.7   | 1506             | 39.6   |

*Note.* *n*=number in sample; M= mean; SD= standard deviation; %= percentage in sample.

*Covariates.* To identify covariates for our models, we ran generalized linear mixed models for all variables of interest with school as a nested variable and age, year in school, level of study and field of study as possible covariates. **Depression symptoms** were significantly associated with field of study ( $F(4020)=819.6, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(4275)=1229.1, p<0.001$ ), year in school ( $F(4191)=347.5, p<0.001$ ), and age ( $F(4277)=20.12, p<0.001$ ). Depression scores were highest for students who were in school for 7+ years and lowest for students during their fifth year compared to all other years; were higher for master's students compared to Ph.D.s; were highest for STEM students compared to humanities and medical related fields; and were higher in younger students. **Anxiety symptoms** were significantly associated with field of study ( $F(3975)=696.5, p<0.001$ ),  $p=.54$ ), year in school ( $F(4158)=283.4, p<0.001$ ), and age ( $F(4232)=46.5, p<0.001$ ), but not level of study (Master's vs. Ph.D.;  $F(4230)=.376$ ). Anxiety scores were highest for first year students and lowest for students in the program for 7+ years compared to all other years; were highest among humanities fields compared to STEM and medical related fields; and were higher in younger students. **Suicidal ideation** was significantly associated with field of study ( $F(5413)=, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(5592)=674.1, p<0.001$ ), year in school ( $F(5664)=11.37, p<0.001$ ), and age ( $F(5591)=596.7, p<0.001$ ). Third years were most likely to think about suicide in the past year compared to all other years; STEM students were most likely to think about suicide compared to humanities and medical related fields; master's students were more likely to think about suicide compared to Ph.D.s; and younger students were more likely to think about suicide. **Lifetime mental health burden** was significantly associated with field of study ( $F(5248)=433.6, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(5590)=674.1, p<0.001$ ), year in school ( $F(5494)=172.6, p<0.001$ ), and age ( $F(5592)=596.7, p<0.001$ ). For the depression only group: Second year students were the most likely to have a

depression diagnosis compared to all other years; medical related fields were most likely to have a depression diagnosis compared to STEM and Humanities; and Ph.D. students were more likely to have a depression diagnosis compared to master students; and younger students were more likely to have a depression diagnosis. For the Anxiety only group: Third year students were more likely to have an anxiety only diagnosis; medical related fields were more likely to have an anxiety only diagnoses compared to STEM and Humanities; Ph.D. students were most likely to have an anxiety only diagnosis compared to master's students; and anxiety only diagnosis was more common in younger students. For the combined anxiety and depression group: Fourth year students were more likely to have a dual diagnosis compared to all other years; medical related fields were more likely to have a dual diagnosis compared to STEM and Humanities; masters students were more likely to have a dual diagnosis compared to Ph.Ds; and a dual diagnosis was more common in younger students. **Discrimination** was significantly associated with field of study ( $F(1667)=45.8, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(1751)= 80.1, p<0.001$ ), year in school ( $F(1720)=22.5, p<0.001$ ), and age ( $F(1751)=124.6, p<0.001$ ). Those who endorsed experiencing discrimination once in a while were more likely to be 7+ years to compared to all other years; were more likely from medically related fields, were more likely Ph.D.s compared to masters students, and were younger. For those students who endorsed experiencing discrimination sometimes: they were more likely in school for 7+ compared to all other years; were more likely to be in the medically related fields compared to STEM and Humanities; were more likely to be Ph.Ds; and were younger. For students who endorsed a lot of discrimination: were more likely to be in the 7+ years, were more likely to be in the medically related fields compared to STEM and Humanities, were more likely to be Ph.Ds; and were older. Students who endorsed discrimination most of the time were more likely to be in the sixth year, were more likely

to be in a medically related field, were more likely to be Ph.D.s; and were older. Students who endorsed discrimination almost all of the time were more likely to be in their fourth year compared to all other years, were more likely to be in medically related fields, were more likely to be a master's student and were older. **Academic performance** was significantly associated with field of study ( $F(5413)=69.2, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(5590)=674.1, p<0.001$ ), year in school ( $F(5487)=172.6, p<0.001$ ), and age ( $F(5591)=596.7, p<0.001$ ). Those in their 7+ year were more likely to be in the A- and below category compared to all other years, those in STEM fields were more likely to be in the A- and below category compared to Humanities and medical related fields, master students were more likely to be in the A- and below compared to Ph.D.s; and younger students were more likely to have A- or below grades. **Sex** was significantly associated with field of study ( $F(5457)=175.6, p<0.001$ ), level of study (Master's vs. Ph.D.;  $F(5820)=77.7, p<0.001$ ), and year in school ( $F(5714)=18.9, p<0.001$ ), but not age ( $F(5820)=0.28, p=0.56$ ). Those in their sixth year were more likely to be males, those in the STEM fields were more likely to be males compared to humanities and medically related fields, and those in Ph.D versus Master's were more likely to be males.

Although minoritized students did not differ from non-Latino white students in field of study, level of study, year in school, and age, all the other main variables of interest were significantly associated with these variables. The only exception in these relationships was a lack of relationship between anxiety and level of study and between sex and age, however, given the significant relationships with most variables of interest, these will be included in all our models.

### **Mental Health Challenges, Discrimination, Academic Performance and Race & Sex**

**Specific Aim 1.** To examine the role of race/ethnicity, and explore the role of sex, in the self-reported prevalence of MHC, discrimination, and academic performance in the most recent

national cohort of graduate students (2018-2019). Table 2 shows the severity of self-reported depression symptoms, severity of anxiety symptoms, frequency of provider-diagnosed depression, anxiety or both, frequency of endorsing past year suicidal ideation, frequency of each level of reported discrimination, and frequency of each GPA level (A vs A- or below) for minoritized compared to majority graduate students and for each individual racial/ethnic group, as well as for men and women in the sample.

### **Race/Ethnicity Differences**

All generalized linear mixed models were run with school as a nested variable covarying out age, year in school, level of study, field of study to examine race/ethnicity differences across MHC.

**Depression and Race.** When examining depression severity and race we did not observe any significant effects ( $F(4277)=.49, p=0.48$ ) when running a model without covariates. There was also not a significant omnibus effect of minoritized students vs non-Latino White students on depression scores ( $F(3949)=1.23, p=0.27$ ) when running a model covarying out age, year of study, field of study, and level of study. Given the nuance of race/ethnicity and potential for missing the possible pattern of mean differences across race/ethnicity groups, simple contrasts were run to analyze minoritized students (Black, Latino, Asian, Multiracial) and non-Latino White groups and corrected for multiple comparisons (Bonferroni correction,  $p<0.01$ ). No significant differences in depression scores were observed across individual race/ethnicity groups (all  $p's>0.01$ ).

**Anxiety and Race.** In a model examining anxiety scores and race in a model without covariates we did not observe any significant group differences ( $F(4233)=.229, p=.632$ ). There was also not a significant omnibus effect of minoritized students and non-Latino White students on anxiety scores in a model covarying out age, level of study, field of study, or year in school ( $F(3909)=0.007, p=0.94$ ). After Bonferroni correction, no differences between racially minoritized



groups (e.g., Black, Latino, Asian, Multiracial) or non-Latino White counterparts were observed (all  $p$ 's > .01).

**Suicidal Ideation and Race.** A model without covariates examining race differences and suicidal ideation was non-significant ( $F(5592)=.229$ ,  $p=.71$ ). This remained in a model with covariates, wherein no effect of minoritized students vs non-Latino White students on suicidal ideation was observed ( $F(5159)=0.026$ ,  $p=0.87$ ). Further, no differences in suicidal ideation between racially minoritized groups (e.g., Black, Latino, Asian, Multiracial) or non-Latino White counterparts were observed (all  $p$ 's > .40).

**Mental Health Burden and Race.** There was not a significant omnibus effect of minoritized students vs non-Latino White students on mental health burden in a model without covariates ( $F(4159)=0.22$ ,  $p=0.89$ ). This remained true even in a model covarying out for age, level of study, year in school, and field of study ( $F(3844)=1.38$ ,  $p=0.94$ .) After running post-hoc analyses to identify any possible differences across racially minoritized groups and mental health burden, no significant differences were observed (all  $p$ 's > .04).

**Discrimination and Race.** There was a significant omnibus effect of minoritized students vs. non-Latino White students on discrimination such that minoritized students were more likely to experience discrimination across all levels ( $F(1759)=14.7$ ,  $p<.001$ ) in a model without covariates. This remained true in a model covarying out age, level of study, field of study, and year in school ( $F(1574)=13.9$ ,  $p<.001$ ; Table 3). We ran simple contrasts to identify possible differences across racially minoritized groups (reference group: Black students) and levels of discrimination, non-Latino White groups were less likely to experience discrimination once in a while, sometimes, a lot, and most of the time when compared to Black students (all  $p$ 's < .002).

Table 3. *GLMM: Levels of Discrimination and Race*<sup>a</sup>.

| Fixed Effects          | Coefficient | SE   | 95% CI |       | Exp<br>(coefficient) | p     |
|------------------------|-------------|------|--------|-------|----------------------|-------|
|                        |             |      | LL     | UL    |                      |       |
| Once in a While        | -.647       | .138 | -.917  | -.376 | 1.58                 | <.001 |
| Sometimes              | -1.1        | .181 | -1.47  | -.760 | .328                 | <.001 |
| A Lot                  | -1.5        | .296 | -2.08  | -.919 | .223                 | <.001 |
| Most of the Time       | -1.66       | .479 | -2.60  | -.720 | .190                 | <.001 |
| Almost all of the Time | -1.48       | .605 | -2.67  | -.29  | .227                 | .014  |

*Note. Summary of Generalized Linear Mixed Effects Model for the Log Odds and Odds Ratios of Level of Discrimination on Race. SE= standard error.; CI= confidence interval; LL= lower level; UL= upper level; <sup>a</sup> 0 = minoritized Graduate Students, 1 = non-Latino White.*

**Academic performance and Race.** There was a significant omnibus effect of minoritized students vs. non-Latino White students on academic performance such that individuals in the minoritized group were .68 times more likely to be in the A- and below group compared to non-Latino White counterparts ( $F(5320)=33.3, p<.001$ ). We ran simple contrasts to identify possible differences between racially minoritized groups (reference group: Black students) and academic performance: after correcting for sequential Bonferroni ( $P<.05$ ), a significant difference was observed between Black and non-Latino White students, such that Black students were .87 times more likely to be in the A- and below groups compared to non-Latino White students ( $\beta = -.136, SE = .030, CI: [-.21, -.061], p < .001$ ).

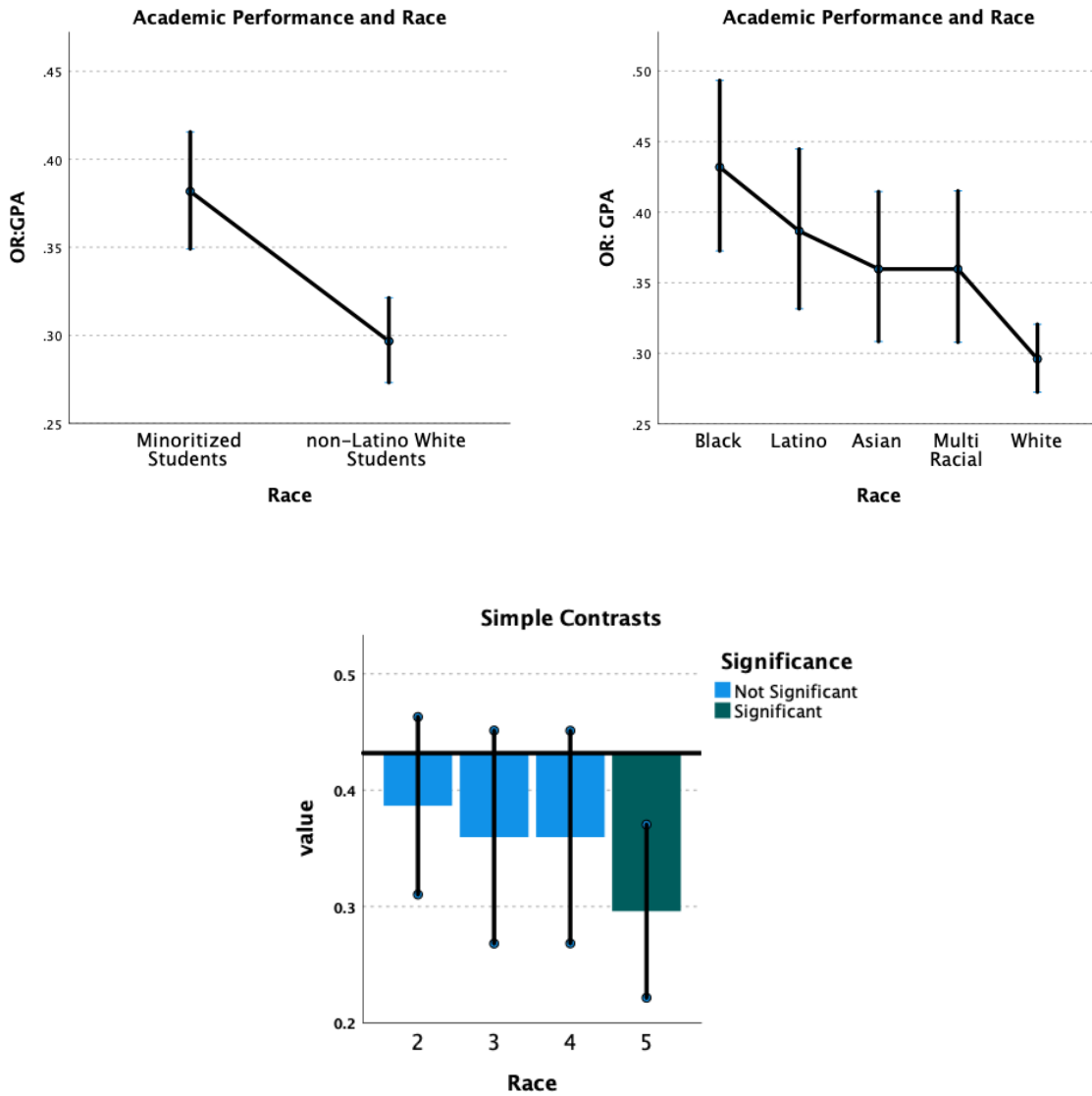


Figure 3. Odds Ratios of minoritized status and likelihood of being in the A- and below group. Simple contrasts were examined to identify possible group differences in academic performance based on race. Contrast 2: Latino vs. Black; Contrast 3: Asian vs. Black; Contrast 4: Multiracial vs Black; Contrast 5: non-Latino White vs. Black

## Exploratory Sex Differences

**Depression and Sex.** There was not a significant omnibus effect of sex on depression scores ( $F(3949)=.327$ ,  $p=.578$ ). In a model looking only at depression scores and sex without covariates, there was not a significant relationship between these ( $F(4277)=1.43$ ,  $p=.23$ ).

**Anxiety and Sex.** There was a significant omnibus effect of sex on anxiety, such that women endorsed higher levels of anxiety when compared to men ( $F(3909)=41.9$ ,  $p<.001$ ). This relationship remained significant in a model without covariates ( $F(4233)=59.8$ ,  $p<.001$ ). When looking at the relationship of sex and race on anxiety, there was not a significant interaction ( $F(3909)=.003$ ,  $p=.997$ ).

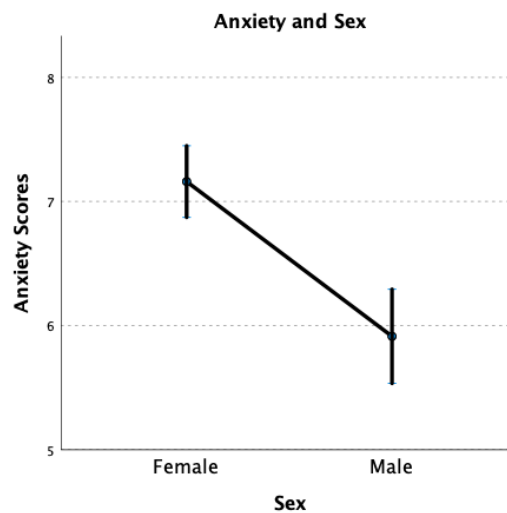


Figure 4. Women endorsed higher levels of anxiety compared to men.

**Suicidal Ideation and Sex.** There was a significant omnibus effect such that men were more likely to endorse suicidal ideation compared to men ( $F(5159)=12.04$ ,  $p<.001$ ). This effect must be considered, however, in the context of a significant race by sex interaction, such that non-Latino White men were most likely to endorse suicidal ideation compared to all other groups ( $F(5159)= 5.89$ ,  $p=.015$ ). This pattern of interaction with sex was seen such that non-Latino White

men were likely to endorse suicidal ideation compared to Black, Latino, and multiracial groups men and women, and non-Latino White women (see Table 4).

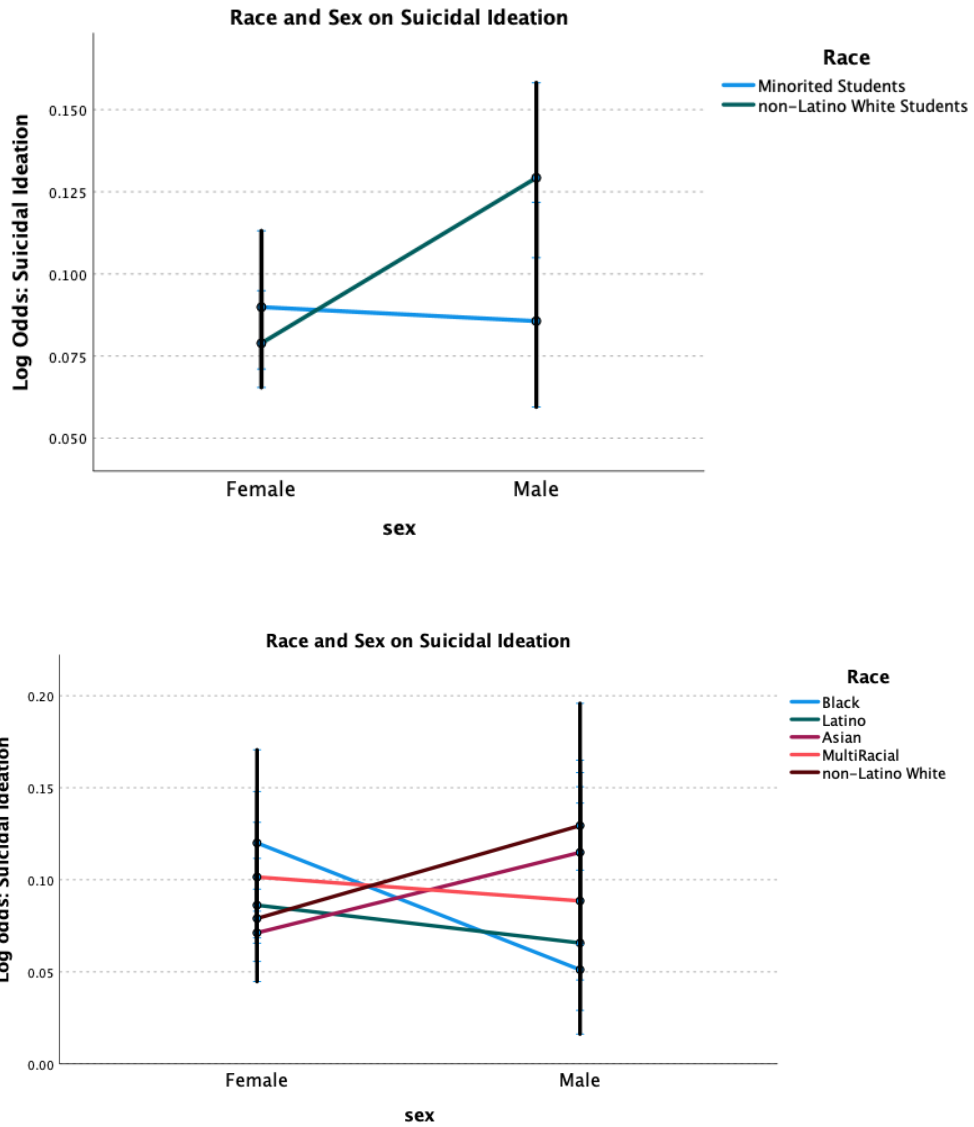


Figure 5. Estimate log odds from models examining likelihood of seriously thinking about attempting suicide for minoritized groups vs. non-Latino White group and sex.

Table 4. *Suicidal ideation in intersectional groups*

|                                      | All Racially<br>Minoritized |              | Black      |              | Latino     |             | Asian      |             | Multiracial  |             | Non-Latino<br>White |              |
|--------------------------------------|-----------------------------|--------------|------------|--------------|------------|-------------|------------|-------------|--------------|-------------|---------------------|--------------|
|                                      | M                           | F            | M          | F            | M          | F           | M          | F           | M            | F           | M                   | F            |
| N (%) endorsing<br>suicidal ideation | 36<br>(7.4)                 | 105<br>(8.1) | 3<br>(3.9) | 34<br>(10.5) | 6<br>(5.4) | 22<br>(7.2) | 13<br>(10) | 19<br>(6.3) | 13<br>(10.1) | 30<br>(9.8) | 127<br>(11)         | 212<br>(7.4) |

*Note.* M=male, F=female.

**Mental Health Burden and Sex.** There was a significant omnibus effect of sex on mental health burden ( $F(3844)=14.3$ ,  $p<.001$ ; Table 4). When running this model without covariates this relationship remained significant ( $F(4159)=14.6$ ,  $p<.001$ ). Females were 0.347 times more likely to be in the anxiety only group compared to males when holding all other predictor variables constant. When examining a race by sex interaction on mental health burden in a model covarying out age, year in school, level of study, and field of study, no significant interactions were observed ( $F(3841)=.48$ ,  $p=.697$ ).

Table 5. *GLMM: Mental Health Burden and Sex*<sup>a</sup>.

| Fixed Effects               | Coefficient | SE   | 95% CI |       | Exp<br>(coefficient) | p     |
|-----------------------------|-------------|------|--------|-------|----------------------|-------|
|                             |             |      | LL     | UL    |                      |       |
| <b>Mental Health Burden</b> |             |      |        |       |                      |       |
| Depression Only             | .128        | .124 | -.116  | .372  | 1.14                 | .304  |
| Anxiety Only                | -1.06       | .174 | -1.40  | -.718 | .347                 | <.001 |
| Depression and Anxiety      | -.118       | .1   | -.316  | .080  | .889                 | .242  |

*Note. Summary of Generalized Linear Mixed Effects Model for the Log Odds and Odds Ratios of Mental Health Burden and Sex. SE= standard error.; CI= confidence interval; LL= lower level; UL= upper level; <sup>a</sup>0 = Females, 1 = Males.*

**Discrimination and Sex.** There was a significant omnibus effect of sex on discrimination levels ( $F(1639)=11.8$ ,  $p<.001$ ). The same model was run without covariates and sex continued to be significant ( $F(1751)=13.6$ ,  $p<.001$ ). The multinomial logit for females relative to males for a one-unit increase is 1.89 units higher for those who experienced discrimination once in a while (compared to never) when holding all other predictor variables constant ( $t(1634)=2.84$ ,  $p=.004$ ; Figure 7). When examining a race by sex interaction on discrimination in a model covarying out

age, year in school, level of study, and field of study no significant interactions were observed ( $F(1639)=1.68, p=.137$ ).

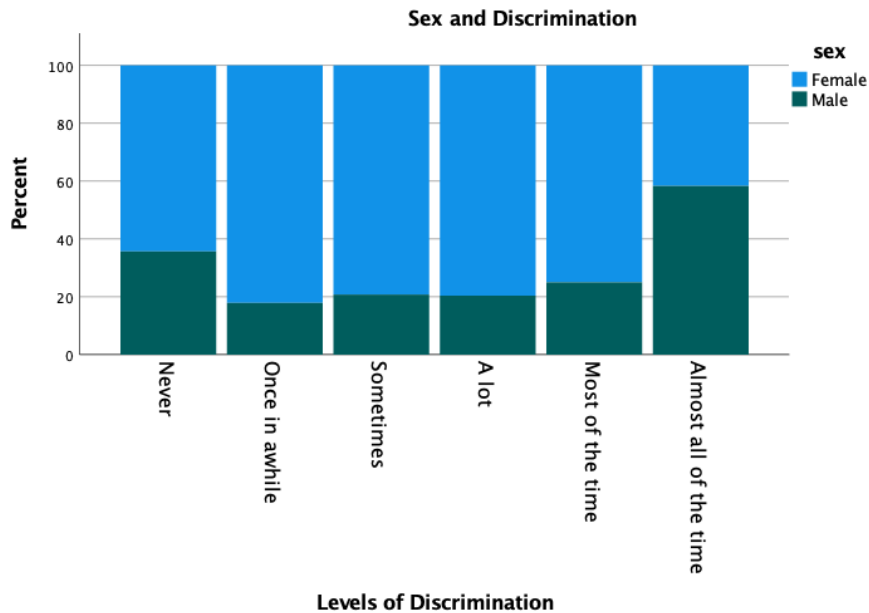


Figure 6. Proportion of women and men by levels of discrimination. Women were significantly over-represented in the Once in A While level compared to Never.

**Academic Performance and Sex.** There was a significant omnibus effect of sex such that men were 1.3 times more likely to be in A- and below group compared to women ( $\beta = .278, SE = .07, CI: [.142, .415], p < .001$ ; Figure 7). When examining a race by sex interaction on academic performance in a model covarying out age, year in school, level of study, and field of study, no significant interactions were observed ( $F(5319)=.03, p=.87$ ).



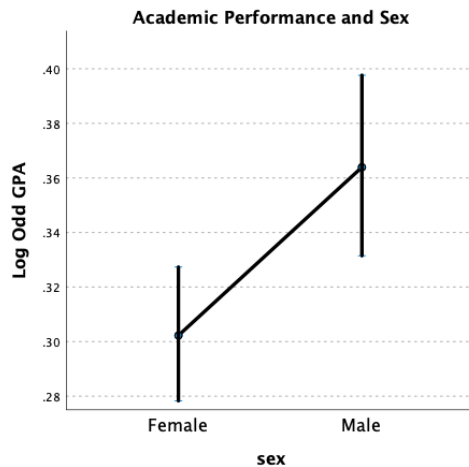


Figure 7. The likelihood of being in the **A- and below** group by sex (estimated log odds from generalized linear mixed model).

**Specific Aim 2.** To examine the relationship between MHC and discrimination, and how that may differ between racially minoritized graduate students and non-Latino White students.

**Depression and Discrimination.** Generalized linear mixed models were utilized to examine the association of discrimination with severity of depression and anxiety, suicidal ideation, and mental health burden. There was a significant effect of discrimination on depression scores for those individuals who reported experiencing discrimination sometimes ( $F(1264)=13.5$ ,  $p<.001$ ), a lot ( $F(1264)=5.7$ ,  $p<.02$ ), and most of the time ( $F(1264)=8.6$ ,  $p=.004$ ; Figure 8). When examining a race by discrimination interaction on depression scores in a model covarying out age, year in school, level of study, and field of study no significant relationships were observed ( $F(1438)=1.3$ ,  $p=.30$ ). When examining a sex by discrimination interaction on depression scores in a model covarying out age, year in school, level of study, and field of study, no significant relationships were observed ( $p's>.10$ ).

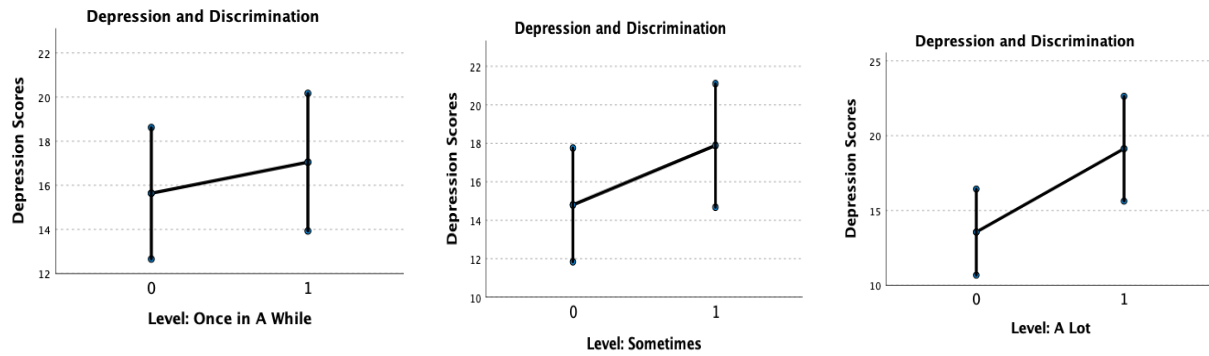


Figure 8. Depression scores and levels of discrimination. Estimated marginal means for 0 = Never and 1 = Once in A While, Sometimes, or A Lot.

**Anxiety and Discrimination.** There was a significant effect at every level of discrimination such that anxiety scores were higher for those reporting discrimination once in a while ( $F(3893)=4.12, p=.041$ ), sometimes ( $F(3893)=17.3, p<.001$ ), a lot ( $F(3893)=16.8, p<.001$ ), most of the time ( $F(3893)=7.5, p=.006$ ), and almost all of the time ( $F(3893)=6.5, p=.011$ ), compared to never (Figure 9).

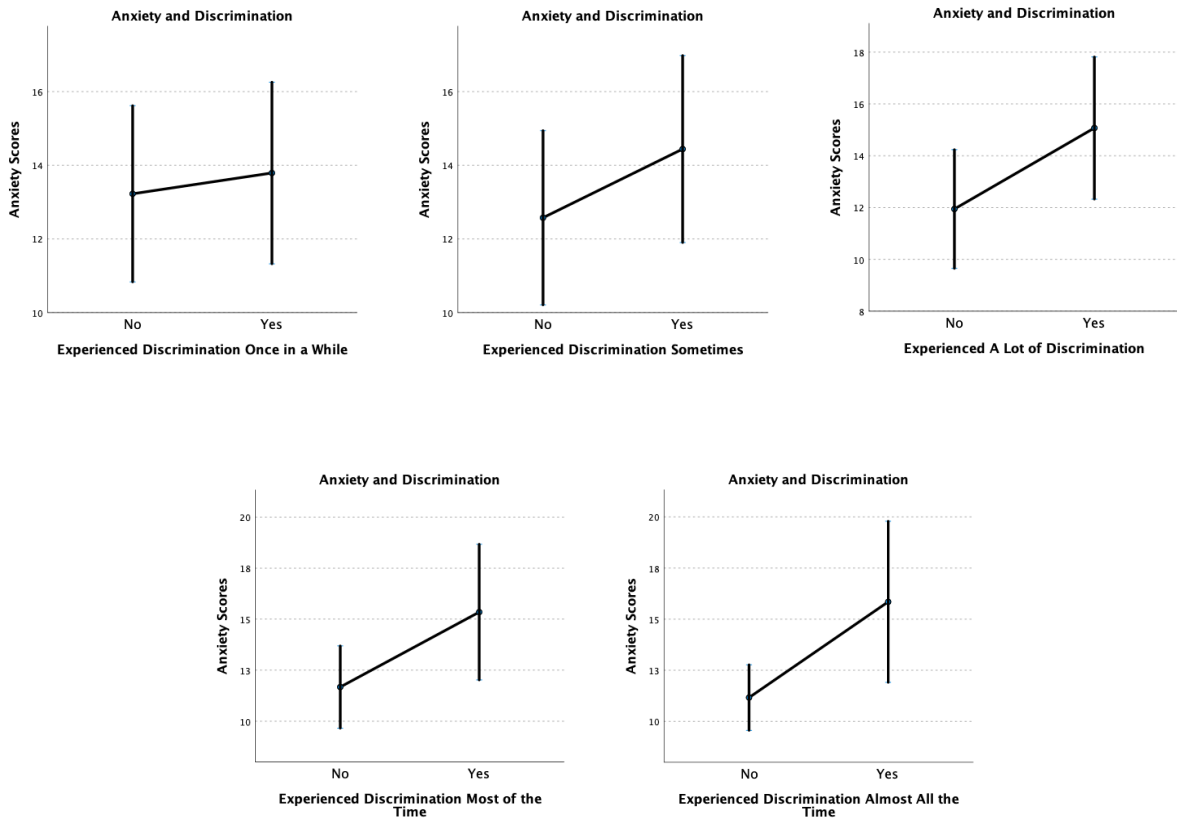


Figure 9. Anxiety scores at different levels of discrimination. Estimated marginal means for 0 = Never and 1 = Once in A While, Sometimes, A Lot, Most of the Time, or Almost All of the Time.

When examining a race by discrimination interaction, significant relationships were observed such that non-Latino White students who identified sometimes experiencing discrimination relative to never experiencing discrimination had more anxiety, whereas students from the minoritized groups showed little difference in anxiety based on this level of discrimination ( $F(3887)=4.6, p=.032$ ; Figure 10); no such moderation was observed for other levels of discrimination.

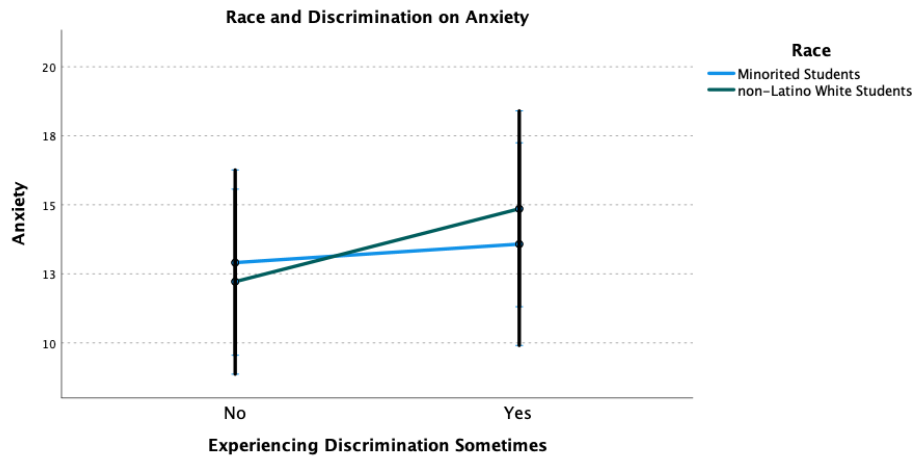


Figure 10. Race differences in relationship of experiencing discrimination never vs sometimes on anxiety scores (estimated marginal means from generalized linear mixed models).

**Suicidal Ideation and Discrimination.** There was a significant effect of discrimination on suicidal ideation for those individuals who reported experiencing discrimination sometimes ( $F(1264)=13.5, p<.001$ ), a lot ( $F(1264)=5.7, p<.02$ ), and most of the time ( $F(1264)=8.6, p=.004$ ; Figure 11). Individuals who reported sometimes experiencing discrimination were 2.2 times more likely to have thought seriously about attempting suicide than those who never experienced discrimination. Individuals who reported experiencing discrimination a lot were 2.5 times more likely to have thought seriously about attempting suicide than those who never experienced discrimination. Individuals who reported experiencing discrimination most of the time were 5.2 times more likely to have thought seriously about attempting suicide than those who never experienced discrimination. When including a race by discrimination interaction, covarying out age, year in school, level of study, field of study, no significant interactions were observed (all  $p$ 's  $>.16$ ). When examining a sex by discrimination interaction on suicidal ideation in a model covarying out age, year in school, level of study, and field of study, no significant interactions were observed ( $p$ 's  $>.10$ ).

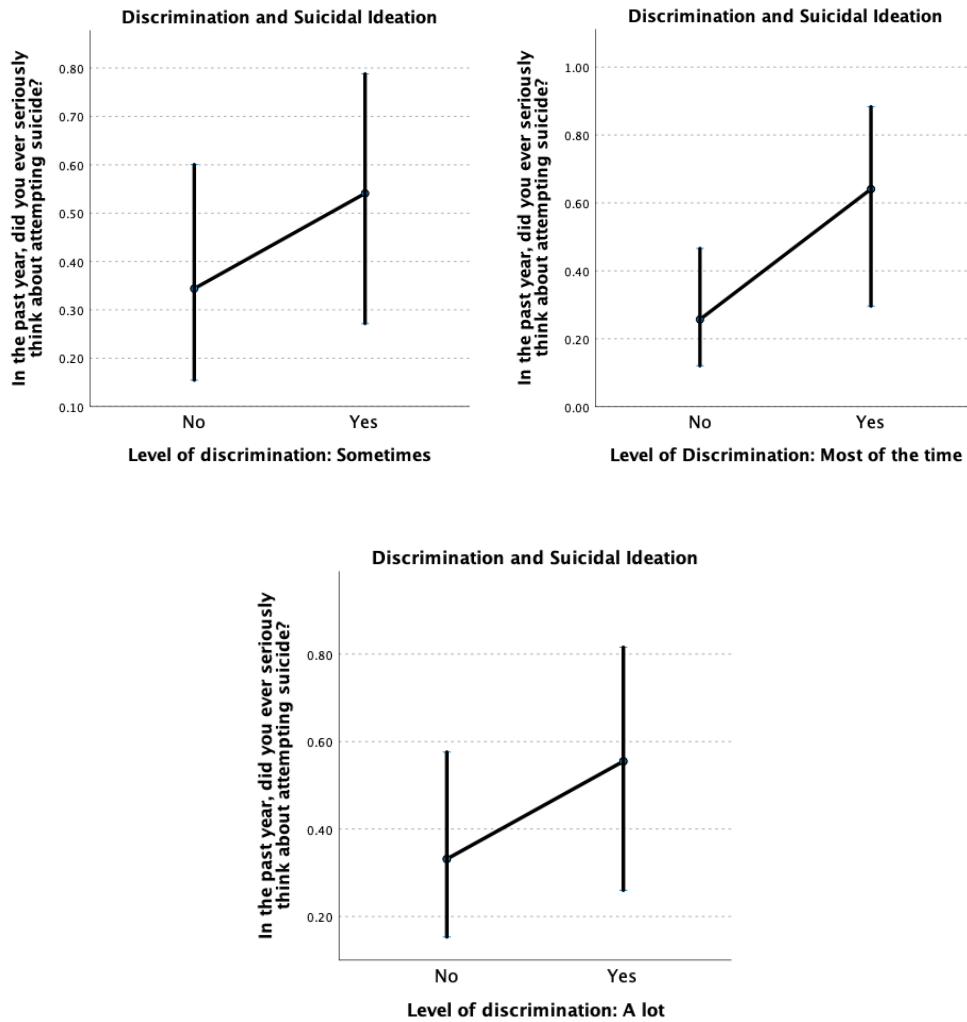


Figure 11. Log odds of suicidal ideation based on level of discrimination.

**Mental Health Burden and Discrimination.** There was a significant effect of discrimination on mental health burden for those students who identified sometimes experiencing discrimination ( $F(3,775)=2.7, p=.04$ ), experiencing discrimination a lot ( $F(3,775)=6.7, p<.001$ ) and experiencing discrimination most of the time ( $F(3,775)=2.7, p=.033$ ). Specifically, subgroups reporting these levels of discrimination had higher proportions of students experiencing both anxiety and depression and lower proportions of students with no diagnoses compared to subgroups of students who had never experienced discrimination (Figure 12). When including a

race by discrimination interaction, covarying out age, year in school, level of study, field of study, no significant interactions were observed on mental health burden (all  $p$ 's  $>.10$ ). When examining a sex by discrimination interaction on mental health burden in a model covarying out age, year in school, level of study, and field of study, no significant interactions were observed ( $p$ 's $>.40$ ).

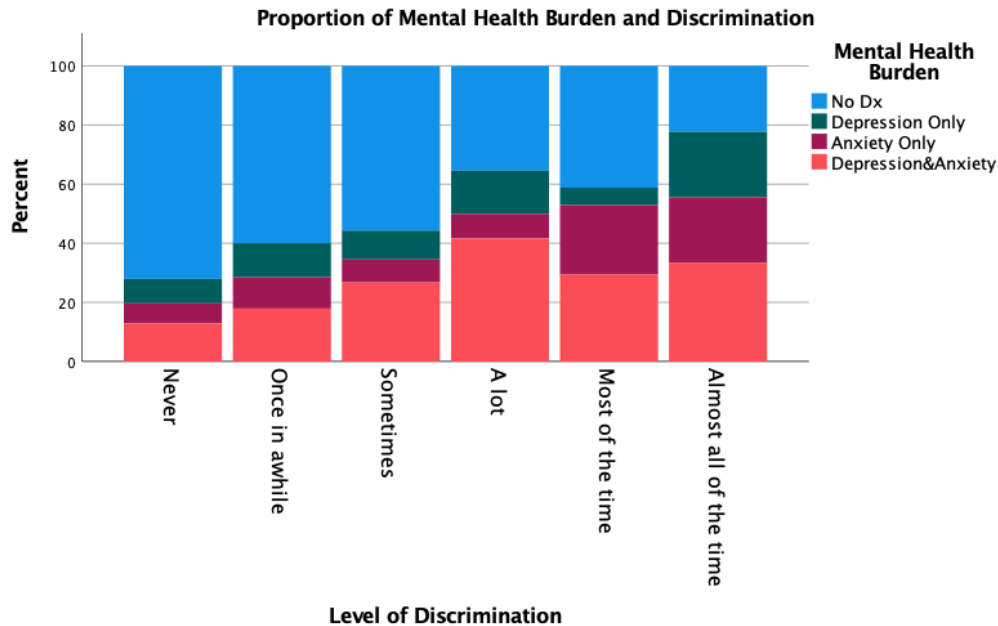


Figure 12. Proportion of students experiencing each level of discrimination within each mental health burden group.

### MHC and Academic Performance

**Depression and Academic Performance.** There was a significant omnibus relationship of depression scores with academic performance ( $F(2688)=31.2, p<.001$ ), such that those with higher depression were more likely to fall in the A- or below GPA group (Figure 13). The same model run without covariates remained significant ( $F(4243)= 44.6, p<.001$ ). No significant interaction of depression and race was observed on academic performance ( $F(4243)=2.64, p=.104$ ). When examining a sex by depression interaction on academic performance in a model

covarying out age, year in school, level of study, and field of study no significant relationships were observed ( $F(2989)=.428, p=.513$ ).

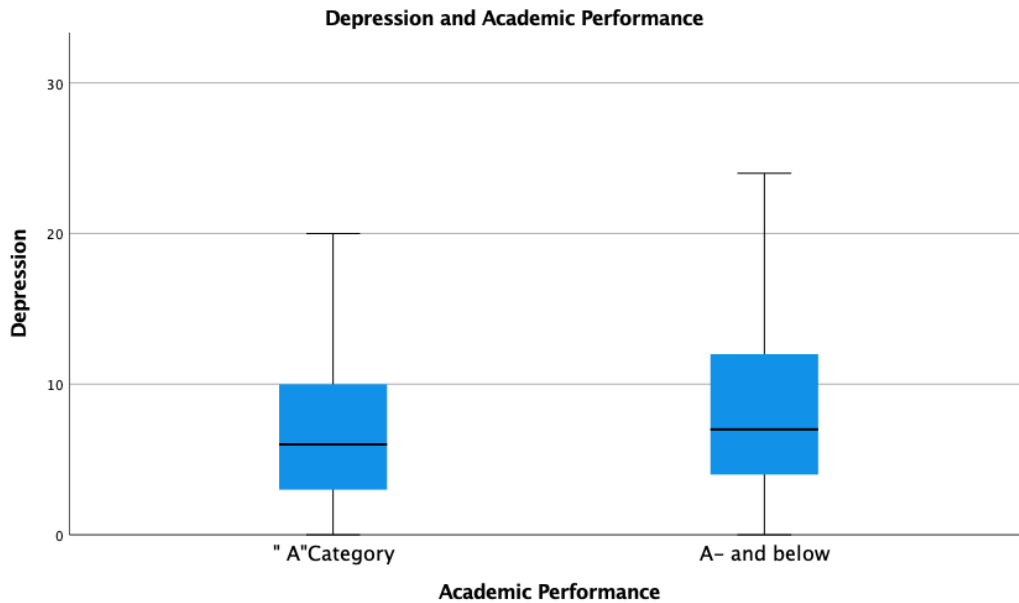


Figure 13. Depression scores and academic performance.

**Anxiety and Academic performance.** In a model examining anxiety and academic performance, covarying out age, year in school, level of study, field of study, there was a significant omnibus effect, such that those students who were experiencing higher levels of anxiety were more likely to be in the A- and below group ( $F(2628)=6.67, p=0.01$ ; Figure 14). In a model looking only at academic performance and anxiety scores without covariates, the relationship became stronger ( $F(4199)=10.36, p=.004$ ). When examining race by anxiety interactions on academic performance no significant effects were observed ( $F(2984)=.498, p=.481$ ). When examining a sex by anxiety interaction on academic performance in a model covarying out age, year in school, level of study, and field of study, no significant relationships were observed ( $F(2914)= 2.91, p=.088$ ).

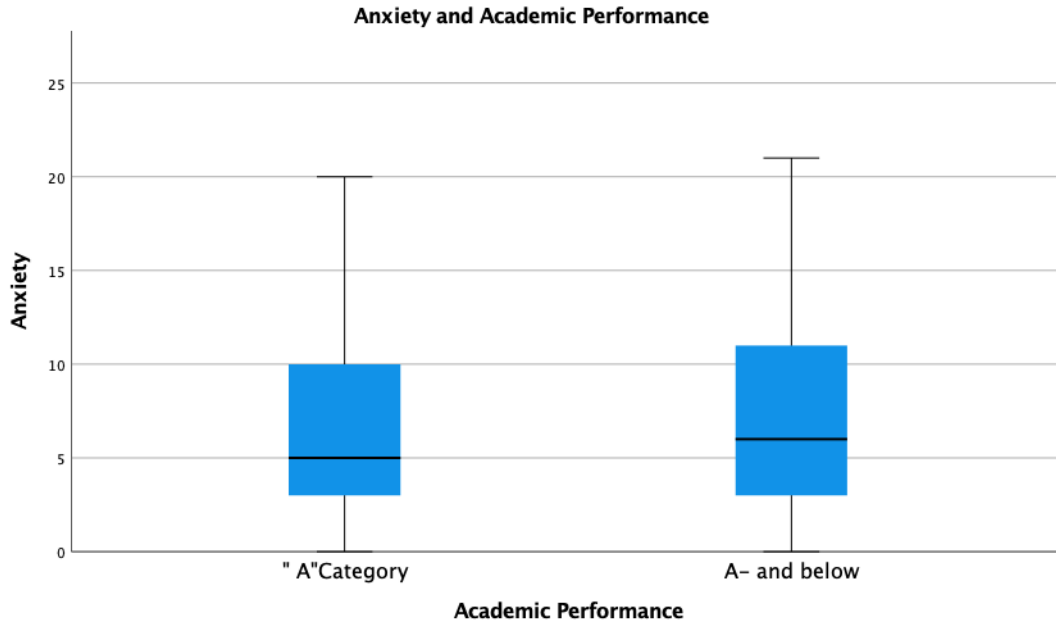


Figure 14. Anxiety scores and academic performance.

**Suicidal Ideation and Academic performance.** In a model examining suicidal ideation and academic performance, covarying out age, year in school, level of study, and field of study, there was a significant omnibus effect, such that individuals who had previously thought about suicide were 1.37 times more likely to be in the A- and below group ( $\beta = .314, SE = .107, CI: [.105, .523], p < .003$ ; Figure 15). When examining race by suicidal ideation interactions on academic performance, no significant effects were observed ( $F(2984)=.498, p=.481$ ). When examining a sex by suicidal ideation interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationships were observed ( $F(1478)=.468, p=.494$ ).



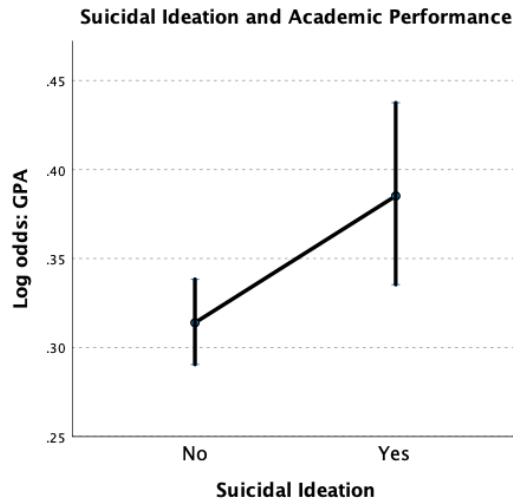


Figure 15. Log odds of A- or below academic performance based on suicidal ideation.

**Mental Health Burden and Academic performance.** There was a significant relationship between being in the depression only ( $F(1490)=11.8, p<.001$ ) and depression and anxiety group ( $(F(1490)=12.7, p<.001)$ ) compared to no diagnosis on academic performance, such that those individuals who endorsed a lifelong depressive or dual diagnosis of anxiety and depression were more likely to be in the A- and below group (Figure 16). In a model examining a race by mental health burden interaction on academic performance, no significant relationships were observed (all  $p's>.30$ ). When examining a sex by mental health burden interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationships were observed ( $p's>.07$ ).

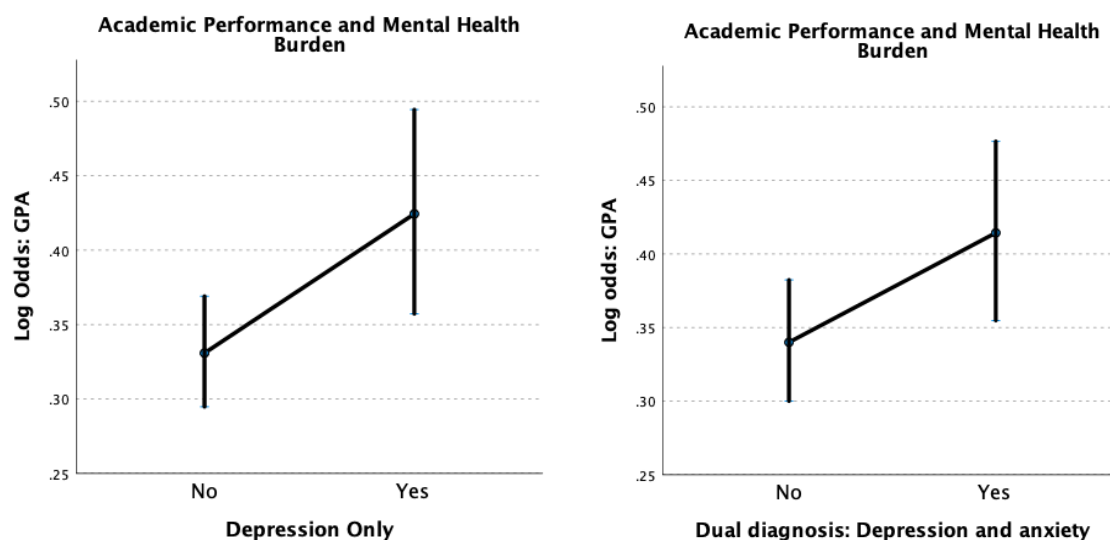


Figure 16. Log odds of academic performance group based on mental health burden.

**Discrimination and Academic Performance.** There was not a significant effect of level of discrimination on academic performance (all  $p$ 's  $>.09$ ). No significant relationships were observed across race/ethnicity groups by level of discrimination (all  $p$ 's  $>.01$ ). When examining a sex by level of discrimination interaction on academic performance in a model covarying out age, year in school, level of study, and field of study, no significant interactions were observed ( $p$ 's  $>.01$ ).

#### Planned Mediation Model

We planned to explore the possible mediation of any observed relationship of discrimination to academic performance by mental health challenges, but as there was no significant association of discrimination and academic performance observed, this analysis could not be conducted.

#### Possible Moderators to Race, Sex, or Intersectional Differences in Mental Health Challenges, Academic Performance, and Discrimination.

**Race, Depression severity, and Mitigating Factors.** We examined the relationship between race and mitigating factors on depression severity. We did not observe any significant interactions between race and resilience (( $F(1526)=.89$ ,  $p=.35$ )), a race by advisor contact interaction ( $F(189)=.628$ ,  $p=.643$ ), or race by social support ( $F(3935)=.155$ ,  $p=.694$ ) on depression severity.

**Race, Anxiety Severity, and Mitigating Factors.** Similarly, we were interested in possible relationships between race and mitigating factors on anxiety severity. We did not observe any significant interactions between race and resilience (( $F(1523)=.22$ ,  $p=.639$ )), a race by advisor contact interaction ( $F(188)=.443$ ,  $p=.777$ ), or race by social support ( $F(3895)=.401$ ,  $p=.526$ ) on anxiety severity.

**Race, Suicidal Ideation, and Mitigating Factors.** Similarly, we were interested in possible relationships between race and mitigating factors on anxiety severity. We did not observe any significant interactions between race and resilience (( $F(1954)=.108$ ,  $p=.743$ )) or race by social support ( $F(5145)=1.2$ ,  $p=.272$ ) on suicidal ideation. A race by advisor contact interaction could not be analyzed given low sample size.

**Race, Mental Health Burden, and Mitigating Factors.** We also examined the relationship between race and mitigating factors on mental health burden. We did not observe any significant interactions between race and resilience (( $F(1473)=.726$ ,  $p=.536$ )), race by advisor contact ( $F(141)=.196$ ,  $p=.998$ ) or race by social support ( $F(3802)=.136$ ,  $p=.938$ ) on mental health burden.

**Race, Academic Performance, and Resilience.** We found that students from minoritized groups were more likely to have grades in the A- or lower category than those from majority groups. We therefore examined the relationship of resilience to academic performance and whether

resilience might buffer racial differences in academic performance. In a model examining race, academic performance, and resilience, covarying out age, year in school, level of study, field of study, there was a significant relationship between resilience and academic performance such that those individuals with more resiliency were more likely in the A group ( $F(1698)=54.7, p<.001$ ). A race by resilience interaction on academic performance was not observed, however ( $F(1698)=.108, p=.743$ ) in a model looking at race, resilience, race by resilience, and covarying out age, year in school, level of study, field of study.

**Race, Academic Performance, and Advisor Contact.** We also examined the relationship of advisor contact to academic performance and whether advisor contact might buffer racial differences in academic performance. In a model examining race, academic performance, and advisor contact, covarying out age, year in school, level of study, and field of study, there was not a significant relationship between amount of advisor contact and academic performance ( $F(165)=.930, p=.470$ ). Further, a race by advisor contact interaction on academic performance was not observed ( $F(166)=.60, p=.667$ ) in a model looking at race, advisor contact, race x advisor contact, and covarying out age, year in school, level of study, field of study.

**Race, Academic Performance, and Social Support.** We also examined the relationship of social support to academic performance and whether social support might buffer racial differences in academic performance. In a model examining race, academic performance, and social support, covarying out age, year in school, level of study, field of study, there was a significant relationship between amount of social support and academic performance ( $F(2383)=7.6, p=.006$ ), such that those individuals with greater social support were 1.13 times more likely to be in the 'A' group. Further, a race by social support interaction on academic performance was marginally not significant ( $F(2383)=3.66, p=.056$ ) in a model looking at race,

advisor contact, and covarying out age, year in school, level of study, field of study. However, after Bonferroni corrections this did not remain significant.

**Race, Discrimination, and Resilience.** We found that minoritized groups experienced higher levels of discrimination. We therefore examined the relationship of resilience to discrimination and whether resilience buffered racial differences in discrimination. In a model examining race, discrimination, and resilience, covarying out age, year in school, level of study, and field of study, there was a significant relationship, such that those individuals that endorsed higher resiliency scores reported lower levels of discrimination ( $F(1698)=54.7, p<.001$ ; Figure 18). However, a race by resilience interaction on discrimination was not observed ( $F(1698)=.108, p=.743$ ) in a model looking at race, resilience, race by resilience, and covarying out age, year in school, level of study, field of study.

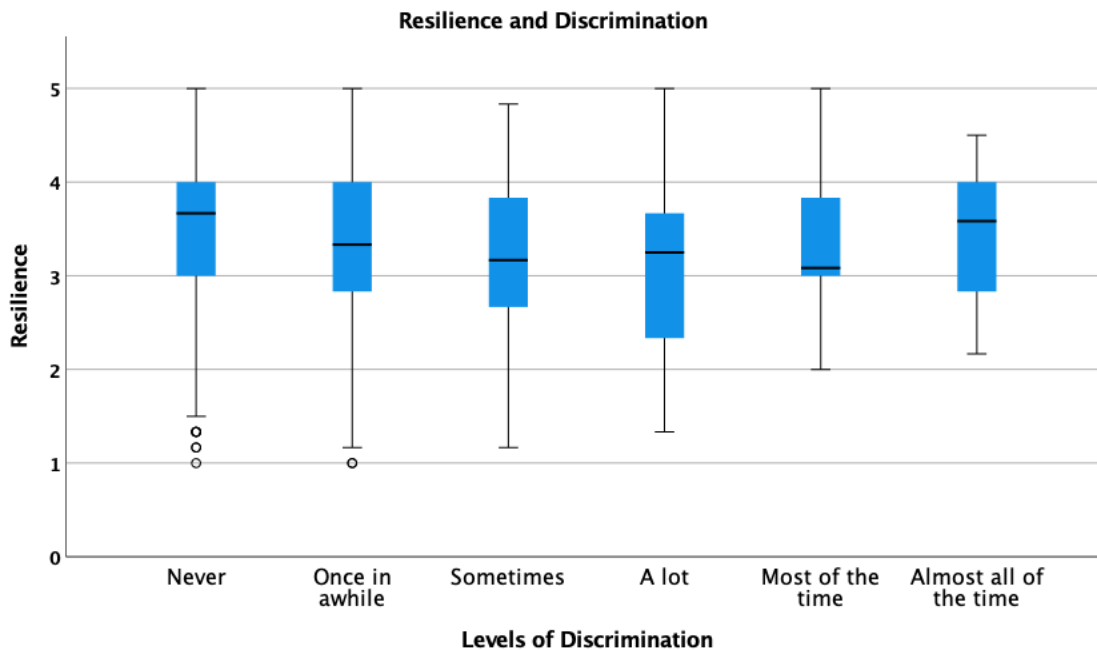


Figure 17. Levels of resilience based on reported levels of discrimination.

**Race, Discrimination, and Advisor Contact.** We also planned to examine the relationship of advisor contact to discrimination and how advisor contact might buffer racial differences in

discrimination. However, these relationships could not be assessed given the low number of individuals who answered both advisor contact and discrimination questions.

**Race, Discrimination, and Social Support.** We also examined the relationship of social support to discrimination and whether social support buffered racial differences in discrimination. In a model examining race, discrimination, and social support, covarying out age, year in school, level of study, and field of study, there was not a significant relationship of social support to discrimination ( $F(1564)=1.6$ ,  $p=.145$ ). Further, a race by social support interaction on discrimination was not observed ( $F(1564)=.597$ ,  $p=.702$ ) in a model looking at race, support, race by support, and covarying out age, year in school, level of study, field of study.

**Sex, Depression Severity, and Resilience.** We examined whether resilience might buffer sex differences in depression severity. A sex by resilience interaction on depression severity was not observed, however ( $F(1943)=.393$ ,  $p=.531$ ) in a model looking at sex, resilience, sex by resilience, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Anxiety Severity, and Resilience.** We found that women reported more severe anxiety symptoms than men. We therefore examined whether resilience might buffer sex differences in anxiety severity. A sex by resilience interaction on anxiety severity was not observed, however ( $F(1522)=.973$ ,  $p=.324$ ) in a model looking at sex, resilience, sex by resilience, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Anxiety Severity, and Advisor Contact.** We also examined whether advisor contact might buffer sex differences in anxiety severity. A sex by advisor interaction on anxiety severity was not observed ( $F(186)=.1.59$ ,  $p=.164$ ) in a model looking at sex, advisor contact, sex by advisor contact, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Anxiety Severity, and Social Support.** We also examined whether social support might buffer sex differences in anxiety severity. A sex by social support interaction on anxiety severity was not observed ( $F(3895)=1.55, p=.213$ ) in a model looking at sex, support, sex by support, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Mental Health Burden, and Resilience.** We found that women reported more anxiety diagnoses than men. We therefore examined whether resilience might buffer sex differences in mental health burden. A sex by resilience interaction on mental health burden was not observed ( $F(1470)=.161, p=.923$ ) in a model looking at sex, resilience, sex by resilience, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Mental Health Burden, and Advisor Contact.** We also examined whether advisor contact might buffer sex differences in mental health burden. A sex by advisor interaction on mental health burden was not observed ( $F(123)=.378, p=.983$ ) in a model looking at sex, advisor contact, sex by advisor contact, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Mental Health Burden, and Social Support.** We also examined whether social support might buffer sex differences in mental health burden. A sex by social support interaction on social support was not observed ( $F(3801)=1.08, p=.356$ ) in a model looking at sex, support, sex by support, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Race, Suicidal Ideation, and Resilience.** We found that men were more likely to report past year suicidal ideation than women and that non-Latino White men were most likely to report past year suicidal ideation than other intersectional groups. We therefore examined whether resilience might buffer sex and intersectional differences in suicidal ideation. A sex by resilience interaction on suicidal ideation was not observed ( $F(1772)=2.05, p=.152$ ) in a model including

sex, resilience, race, sex by resilience, and covarying out age, year in school, level of study, field of study and nesting school. A sex by resilience by race three way interaction on suicidal ideation was not observed ( $F(1770)=.883$ ,  $p=.449$ ) in a model including sex, resilience, race, sex by resilience, sex by race, race by resilience, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Race, Suicidal Ideation, and Advisor Contact.** We also examined whether advisor contact might buffer sex and intersectional differences in suicidal ideation. A sex by advisor contact interaction on suicidal ideation was not observed ( $F(168)=.071$ ,  $p=.996$ ) in a model including sex, advisor contact, race, sex by advisor contact, and covarying out age, year in school, level of study, field of study and nesting school. A sex by advisor contact by race three-way interaction could not be conducted given low sample sizes.

**Sex, Race, Suicidal Ideation, and Social Support.** We also examined whether social support might buffer sex and intersectional differences in suicidal ideation. A sex by social support interaction on suicidal ideation was not observed ( $F(5140)=.94$ ,  $p=.33$ ). In addition, a sex by race by social support three way interaction on suicidal ideation was not observed ( $F(1539)=.234$ ,  $p=.993$ ) in a model including sex, resilience, race, sex by resilience, sex by race, race by resilience, and covarying out age, year in school, level of study, field of study and nesting school.

**Sex, Academic Performance, and Resilience.** We found that men were more likely to report grades in the A- and below range. We therefore examined the relationship of resilience to academic performance and whether resilience might buffer sex differences in academic performance. In a model examining resilience, sex, and academic performance, covarying out age, year in school, level of study, field of study, there was a significant relationship between resilience and academic performance such that those with lower resiliency scores were more likely to be in



the A- and below group ( $F(1684)=8.89, p=.003$  Figure 19). When examining a sex by resilience interaction in a model looking at sex, resilience, sex by resilience, and covarying out age, year in school, level of study, and field of study, a significant relationship was not observed ( $F(1683)=.393, p=.531$ ).

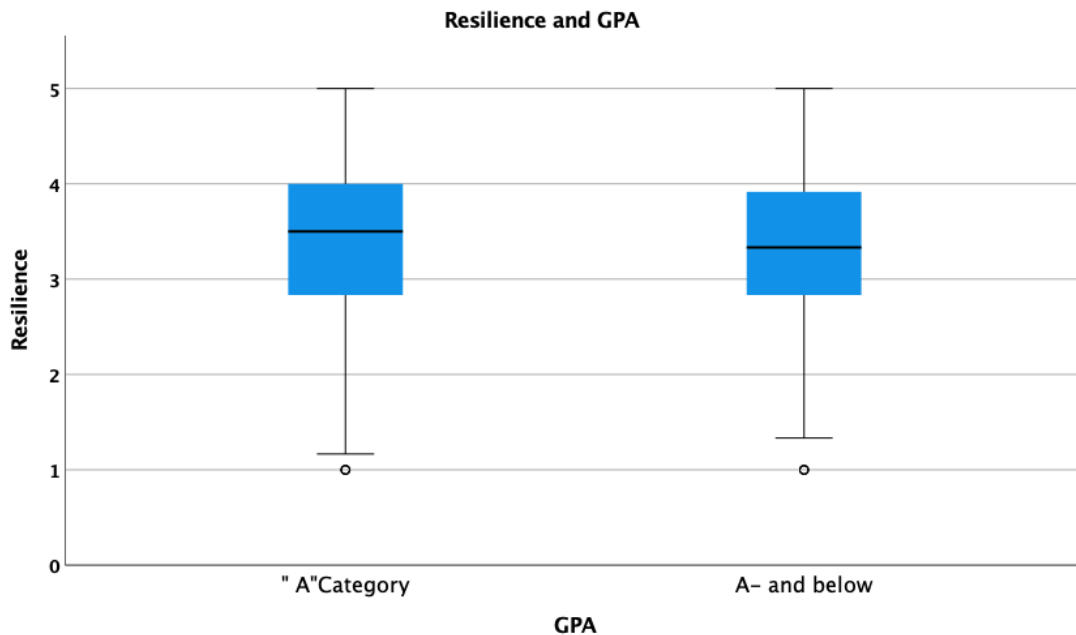


Figure 18. Level of resilience based on academic performance.

**Sex, Academic Performance, and Advisor Contact.** We also examined the relationship of advisor contact to academic performance and whether advisor contact might buffer sex differences in academic performance. In a model examining sex, academic performance, and advisor contact, covarying out age, year in school, level of study, and field of study, there was not a significant relationship between amount of advisor contact and academic performance ( $F(163)=.474, p=.795$ ).

**Sex, Academic Performance, and Social Support.** We also examined the relationship of social support to academic performance and whether social support might buffer sex differences in academic performance. In a model examining social support, sex, and academic performance,

covarying out age, year in school, level of study, field of study, there was there was not a significant relationship between amount of social support on academic performance ( $F(2300)=1.44, p=.156$ ). Further, a sex by social support interaction on academic performance was not significant ( $F(2301)=.166, p=.975$ ) in a model looking at sex, advisor contact, and covarying out age, year in school, level of study, field of study.

**Mental Health Challenges, Academic Performance and Mitigating factors.** We were also interested in examining whether the potential mitigating factors of resilience, advisor contact or social support moderated the relationships of mental health challenges with academic performance. We did not observe any significant relationships between these on academic performance (all  $p$ 's  $>.05$ ). We were also not able to examine advisor contact by anxiety severity, suicidal ideation, or mental health burden due to low sample sizes.

**Mental Health Challenges, Discrimination, and Mitigating Factors.** Similarly, we were interested in examining whether the potential mitigating factors of resilience, advisor contact or social support moderated the relationships of mental health challenges with discrimination. As observed above, we observed a depression severity by resilience interaction on discrimination. However, no other relationships were observed between anxiety severity, suicidal ideation, or mental health burden by resilience, advisor contact, or social support on discrimination (all  $p$ 's  $>.05$ ). We were unable to run the suicidal ideation by advisor contact, or mental health burden by advisor contact interactions due to low sample sizes.

**Mental Health Challenges, Academic Performance, and Resilience.** We found that academic performance was poorer among people experiencing more mental health challenges. We therefore examined whether resilience might buffer these observed associations. When examining a **depression by resilience** interaction on academic performance in a model covarying out age,

year in school, level of study, and field of study no significant relationship was observed ( $F(1494)=1.13$ ,  $p=.286$ ). When examining an **anxiety by resilience** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationship was observed ( $F(1481)=.495$ ,  $p=.482$ ). When examining a **suicidal ideation by resilience** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationship was observed ( $F(1614)=.109$ ,  $p=.742$ ). When examining a **mental health burden by resilience** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationship was observed (all  $p$ 's $>.27$ ).

**Mental Health Challenges, Academic Performance, and Advisor Contact.** We also examined whether advisor contact might buffer the observed associations of mental health challenges with academic performance. When examining a **depression by advisor contact** interaction on academic performance in a model covarying out age, year in school, level of study, field of study no significant relationship was observed ( $F(180)=1.04$ ,  $p=.394$ ). When examining an **anxiety by advisor contact** interaction on academic performance in a model covarying out age, year in school, level of study, field of study no significant relationship was observed ( $F(177)=.889$ ,  $p=.489$ ). When examining a **suicidal ideation by advisor contact** interaction on academic performance in a model covarying out age, year in school, level of study, field of study no significant relationship was observed ( $F(157)=.019$ ,  $p=.989$ ). When examining a **mental health burden by advisor contact** interaction on academic performance in a model covarying out age, year in school, level of study, field of study no significant relationship was observed (all  $p$ 's $>.21$ ).

**Mental Health Challenges, Academic Performance, and Social Support.** We also examined whether social support might buffer the observed associations of mental health

challenges with academic performance. When examining a **depression by social support** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study no significant relationship was observed ( $F(13344)=1.08, p=.299$ ). When examining an **anxiety by social support** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study, no significant relationship was observed ( $F(3283)=.138, p=.710$ ). When examining a **suicidal ideation by social support** interaction on academic performance in a model covarying out age, year in school, level of study, and field of study, no significant relationship was observed ( $F(1988) =.419, p=.518$ ). When examining a **mental health burden by social support** interaction on academic performance in a model covarying out age, year in school, level of study, field of study no significant relationship was observed (all  $p's > .25$ ).

**Mental Health Challenges, Discrimination, and Resilience.** We found greater MHC of all types among those reporting higher levels of discrimination. We therefore examined whether resilience was related to discrimination and whether resilience might buffer the observed relationships between MHC and discrimination. Resilience was related to discrimination, such that those individuals who endorsed discrimination sometimes reported less resilience than those individuals who never experienced discrimination. When examining a **depression by resilience** interaction on discrimination in a model covarying out age, year in school, level of study, field, nesting school as a variable, there was a significant interaction ( $F(1213)=2.34, p=.049$ ; Figure 20), such that those that endorsed discrimination sometimes and had higher resilience endorsed lower levels of depression ( $B=.073, SE=.023, CI[.028,.118], p=.002$ ). Among individuals with high levels of resilience, depression is low regardless of discrimination level. Among those with normal levels of resilience, there is a stair-step gradual increase in depression across discrimination levels.

Among those with low resilience, discrimination levels of “A Lot” or greater have higher depression than most other groups.

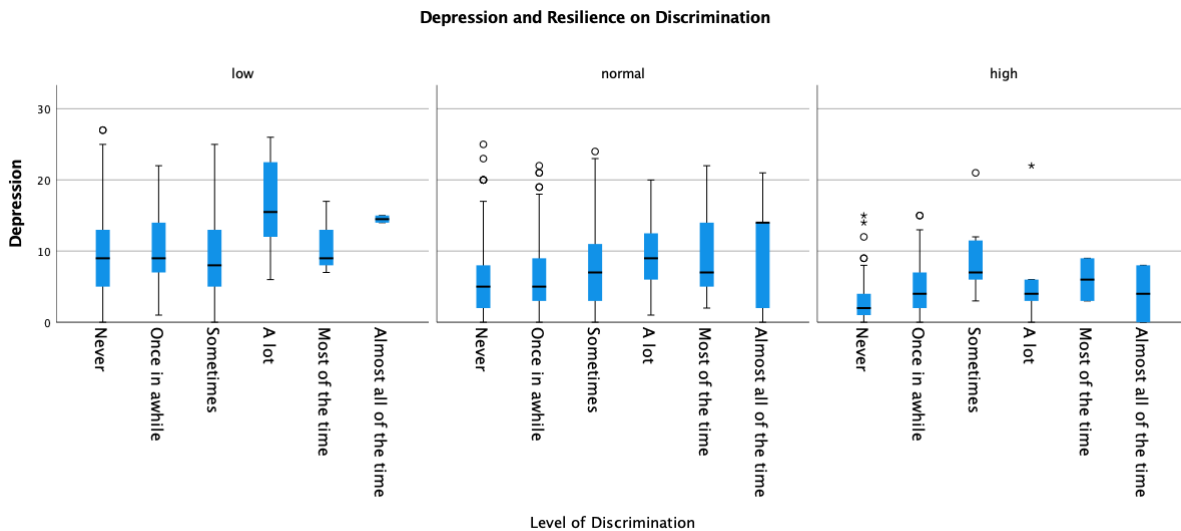


Figure 19. Levels of resilience and depression on level of discrimination.

When examining an **anxiety by resilience** interaction on discrimination in a model covarying out age, year in school, level of study, field of study, and school as a nested variable, no significant relationship was observed ( $F(1218)=1.88, p=.095$ ).

When examining a **suicidal ideation by resilience** interaction on discrimination in a model covarying out age, year in school, level of study, field of study, and school is nested, a significant relationship was observed ( $F(1349) = 3.11, p=.009$ ; Figure 21) such that suicidal ideation was most prevalent among those who were less resilient and endorsed discrimination once in a while ( $B=.664, SE=.305, CI[.07, 1.26], OR=1.94, p=.030$ ), sometimes ( $B=1.17, SE=.342, CI[.50, 1.8], OR= 3.2, p<.001$ ), or a lot ( $B=2.36, SE=1.11, CI[.18, 4.54], OR:10.6, p=.030$ ). Suicidal ideation frequency among those with normal or high levels of resilience was only elevated when discrimination was very pervasive.

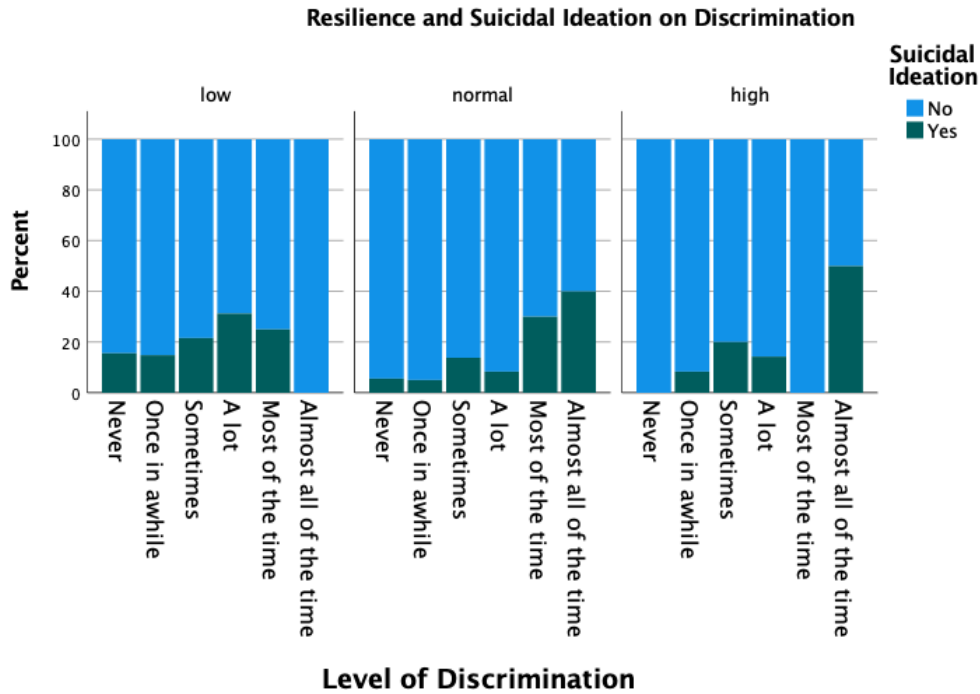


Figure 20. Suicidal ideation by discrimination subgroups for three levels of resilience.

When examining a **mental health burden by resilience** interaction on discrimination in a model covarying out age, year in school, level of study, field of study, and school as a nested variable, no significant relationship was observed ( $F(1178)=1.17, p=.291$ ).

**Mental Health Challenges, Discrimination, and Advisor Contact.** We also examined whether advisor contact was related to discrimination and whether advisor contact might buffer the observed relationships between MHC and discrimination. However, cell sizes were too small for advisor contact, and models for depression, anxiety, mental health burden, and suicidal ideation examining these relationships could not be run.

**Mental Health Challenges, Discrimination, and Social Support.** We also examined whether social support might buffer the observed relationships between MHC and discrimination. In a model examining **social support by depression severity** on discrimination covarying out age, year in school, field of study, level of study, with school as a nested variable, there was no significant relationship ( $F(1359)=.537, p=.748$ ). In a model examining **social support by anxiety**

**severity** on discrimination covarying out age, year in school, field of study, level of study, with school as a nested variable, there was no significant relationship ( $F(1329)=.42, p=.837$ ). In a model examining **social support by suicidal ideation** on discrimination covarying out age, year in school, field of study, level of study, with school as a nested variable, did not show a significant interaction ( $F(1556)=.856, p=.510$ ). In a model examining **social support by mental health burden** on discrimination covarying out age, year in school, field of study, level of study, with school as a nested variable, did not show a significant interaction ( $F(1307)=.906, p=.557$ ).

**Other exploratory analyses.** We had planned to explore whether resilience, support or advisor contact moderated any *differential* relationships of MHC, academic performance, and discrimination between racial/ethnic minoritized groups and non-Latino Whites or between men and women. Because of small cell sizes, these three-way interactions could not be examined. We had also planned to examine whether advisor contact was more beneficial for students who listed advisors as a source of emotional support, but there were no observed relationships with advisor contact and the number of students listing advisors as a source of emotional support was low.

## V. Discussion

This dissertation project was designed to investigate graduate student mental health, discrimination, and academic performance and their inter-relationships, and how these might differ between racially minoritized vs majority groups and between men and women. Further, we aimed to understand whether resilience, advisor contact, and social support were mitigating factors moderating racial and sex differences or the inter-relationships between variables of interest.

In our sample, 25% of students endorsed depression, 29% of students endorsed anxiety, and approximately 8% of students endorsed suicidal ideation. These percentages are similar to a previously published Healthy Minds Study of >350,000 undergraduate and graduate students from their 2013-2021 surveys wherein 23% of students endorsed depression, 18.2% reported anxiety, and 5.3% reported suicidal ideation (Lipson et al., 2022). In the most recent Healthy Minds Study (Healthy Minds Study, 2020) data reported separately for 19,665 graduate and professional students showed that 46.7% of them endorsed self-reported anxiety; 52.7% endorsed depression; and 18.2% endorsed suicidal ideation. The most recent ACHA-NCHA report, which included 9,741 graduate and professional students from 50 U.S. universities, found that 21% of students endorsed being diagnosed with depression, 26% of students endorsed an anxiety diagnosis, and 19% of students were positive on a suicidal ideation screening (American College Health Association, 2020). Finally, a survey of 2,279 graduate students from 26 countries and 234 institutions found that 39% reported moderate to severe levels of depression and 41% self-reported moderate to severe levels of anxiety (Evans et al., 2018). Thus, the rates of anxiety, depression, and suicidal ideation found in the present sample of graduate students pursuing MA and PhD degrees (mostly MAs) were comparable to rates seen in combined samples of undergraduate and graduate students but somewhat less than rates observed in published reports on samples that may



have included more students pursuing terminal doctoral degrees, as well as Medical Doctor and Juris Doctor degrees, which we excluded. In terms of academic performance, our sample was largely in the A category, and rates of reported discrimination were low overall among the subset of 1,751 graduate students who filled out the module containing that question.

In terms of the race/ethnicity makeup of the analyzed sample, minoritized student groups were largely under sampled compared to national rates of graduate student enrollment. Our sample consisted of 6.8% Black, 7.1% Latino, 7.4% Asian, <1% Pacific Islander, <1% American Indian, and 7.5% multiracial groups compared to 5% Black, 9% Latino, 10% Asian, 5% Pacific Islander, 5% American Indian/ Alaska Native, 11% two or more races enrollment rates (U.S. Department of Education, 2019). In terms of the proportions of men and women in the analyzed sample, we had 71.8% women; this is higher than the proportion enrolled in graduate programs (58% women). Additionally, overall survey response rates were below expectations with only 16% responding leaving an 84% non-response rate, such that interpretation and generalizability of results warrants caution. However, a recent literature review focused on survey response in cross-sectional studies by Hendra & Hill (2018) suggests little relationship between response rate and response bias, did not find there to be an optimal percentage for rate of response, and found that research design, the nature of the population being studied, and survey administration were more important biasing factors (Hendra & Hill, 2018).

Our analyses revealed significant racial/ethnic group differences in the expected directions for discrimination and academic performance; minoritized graduate students experienced higher levels of discrimination compared to non-Latino White students and minoritized students were more likely to be in the A- and below group. These results are consistent with a host of previous studies showing group differences across minoritized and majority groups in higher education

(Posselt, J., 2022; Hwang, W.-C., & Goto, S., 2008; Prelow, H. M., Mosher, C. E., & Bowman, M. A., 2006; Weng, S. S., & Gray, L. A., 2017; Brittian et al., 2015; Savas, G., 2014; Brown, R., & Lee, M., 2005). However, no group differences were observed between depression, anxiety, suicidal ideation, and mental health burden (lifelong prevalence) between minoritized and majority groups. These results are inconsistent with previously reported results from the 2012-2015 Healthy Minds Study, where they identified minoritized subgroups differences (i.e., Black, Latino, Asian) in a combined undergraduate and graduate student sample to have *higher* rates of depression, anxiety, suicidal ideation, and previous mental health diagnoses when compared to non-Latino White groups (Lipson et al., 2018). In contrast, a recent study by Chen et al., (2019) examining racial differences in symptoms and diagnoses of 93,034 undergraduate students who completed the American College Health Association—National College Health Assessment (ACHA-NHCA) found that Black, Hispanic and Asian/Pacific Islander students had *lower* rates of both mental health symptoms and previous psychiatric diagnoses compared to non-Latino White groups (Chen et al., 2019). Ours was the first study to examine race/ethnicity differences in mental health challenges solely among graduate students, so differences from the previous literature may be due to differences in the mental health of minoritized graduate students compared to minoritized undergraduates. Consistent with this, a study by Wyatt and Oswald (2012) comparing undergraduate to graduate students, independent of race/ethnicity, found that graduate students on average were reporting lower rates of mental health issues and reporting higher levels of stress (Wyatt & Oswald, 2012). It is possible that students from minoritized groups who pursue graduate level education represent a “survivor” cohort of those who had the fewest MHC as undergrads or developed good skills for coping and therefore levels of MHC at this stage of training are generally lower and more similar to the rates seen among non-Latino Whites.

Another possible explanation for the lack of group differences in mental health challenges based on minoritized group status is that the way in which we conceptualize mental health distress is better aimed for majority Westernized groups. For example, symptom checklists may underestimate mental health challenges among racially minoritized groups, since higher levels of somatization of mental health symptoms in minoritized groups are not often captured in our most common mental health questionnaires (Ferrari et al, 2015), such as those used in the present survey. To better address this gap, the addition of both clinical symptom checklists and questions of somatic expression of psychological distress should be simultaneously assessed. Further, previous studies have shown an underreporting of mental health disorders among minoritized groups (Chen et al., 2019; Liu et al. 2018), yet symptom severity of depression, anxiety and increased suicidal ideation has been reported at higher levels within minoritized students are compared to non-Latino White students and these groups had generally lower rates of service utilization (Lipson et al., 2018, Eisenberg et al., 2007, Hunt et al., 2015). This suggests that minoritized students may be experiencing higher levels of psychological distress, however, are not being properly treated for and are experiencing undetected psychiatric problems placing them at particularly high risk. These results have also been seen in the general US population among minoritized groups where rates of depression, generalized anxiety disorder and social phobia disorders are lower when compared to non-Latino White groups (Breslau et al., 2006), however, those individuals who are diagnosed with a mental health disorder experience higher psychological distress, and have a more persistent and debilitating illness (Breslau et al., 2006; McGuire & Miranda, 2008).

Another possibility is that we are not fully capturing the full range of minoritized graduate students' experiences in our sample if those who answered the survey were experiencing less psychological distress and thus were more willing to complete the study. Alternatively, those

students who were experiencing the highest levels of psychological distress may have already dropped out of their respective graduate program, biasing responses. With attrition rates among doctoral students being approximately 50% (Sowell et al., 2015; Fernandez et al., 2019) further research assessing those students who drop out is imperative in helping better understand the role of mental health challenges in academic achievement among graduate students and to develop possible targets of intervention to enhance rates of successful completion of graduate degrees.

Although research is nascent regarding sex differences in mental health among graduate students, our results are concordant with the current literature in college samples; women often endorse higher levels of anxiety and are more likely to report an anxiety disorder (Barton & Bulmer, 2017; Elkins, E.L., 2021; Evans et al., 2018; Hyun et al., 2006; Peddrelli et al., 2015, Hazell et al., 2020; Malandraki, 2021). Despite these findings being supported, little is known about what is driving these sex differences among graduate students. In a study by Altemus et al. (2014) examining sex differences in anxiety disorders across the lifespan, sex differences in anxiety disorders were noted as early as pre-pubescence. Further, some of the most common anxiety disorders (generalized anxiety disorder, social anxiety disorder) are observed at higher base rates in females compared to males (Altemus et al., 2014), suggesting that a possible predisposition to affective disorders is exacerbated in a setting where females must cope with high academic demands, high stress, familial roles, and often face additional barriers compared to males. For example, females have been found to experience higher levels of impostor phenomenon (Bravata et al., 2020), are more likely to perceive higher stress in college (Saleh et al., 2017), are more likely to experience isolation and loneliness on campuses, (Liu et al., 2020), and endorse greater mental health symptoms than males (McIntyre et al., 2014). These factors, including impostor phenomenon, have been found to be highly comorbid with anxiety disorders among

college students (Bravata et al., 2020) and interventions focused on reducing stress and increasing belongingness may be especially beneficial for female students.

In our sample there was an omnibus effect of sex on suicidal ideation, such that men were more likely to endorse seriously thinking about suicide within the past year. In addition, we found a race by sex difference in suicidal ideation, such that non-Latino White men were more likely to have thought about suicide seriously over the past year compared to the other intersectional groups. Previous studies of sex differences in suicidal ideation among students have been mixed, but consistent with our findings, several studies showed that men were more likely to have thought about suicide than women in college samples (Mackenzie et al., 2011; Garlow et al., 2008; Kisch et al., 2005). In undergraduate samples, those students who endorsed thinking about SI were more likely to carry a weapon, engage in physical fights, ride with a driver that had been drinking, drive after drinking, and not use a seatbelt (Barrios et al., 2010). Depression and substance use have been found to increase the likelihood of SI such that those students who are reporting higher levels of depression or using tobacco, alcohol, or other illicit substances have higher rates of SI (Arria et al., 2009; Brener et al., 1999; Konich & Gutierrez, 2005; Garlow et al., 2008; Farabaugh et al., 2012). Alcohol-related issues may place college men, in particular, at risk for suicide (Lamin & Lester, 2013), but very little is known about the relationship of substance use to suicide in graduate students. It is unclear why non-Latino White men were most likely to report seriously thinking about attempting suicide compared to minoritized men and all women. This group might have had the most substance use, but those data were not available for analysis. Alternatively, non-Latino White men may lack some of the cultural taboos against contemplating suicide that can be present in minoritized groups and women. Finally, it is possible that some of the non-Latino White men who reported high suicidal ideation had other, unexamined, intersectional identities putting them

at higher risk for suicide, such as being from sexual or gender identity-based minoritized groups. Further research is needed that takes an intersectional perspective and examines multiple MHC challenges, including substance use, to help design effective suicide prevention interventions for graduate students.

Interestingly, research suggests that despite endorsing higher levels of trait anxiety or test anxiety, women still perform better or at the same levels academically as males (Nuñez-Peña et al., 2016) and despite women earning better grades, men are more likely to be hired above women (Quadlin, N., 2018). These results are in the same vein as our findings, wherein men were more likely to perform more poorly than women academically, even though women's anxiety levels were higher and anxiety diagnoses more prevalent. Current research indicates that in addition to women performing better academically than men, women also reported higher self-efficiency, have different coping mechanisms than men, and grades are less variable throughout their academic careers (Nuñez-Peña et al., 2016; Quadlin, N., 2018; Pirmohamed et al., 2017; Wenjuan et al., 2020; O'Dea et al., 2018). Interestingly, even though men are performing worse academically, their job prospects and hiring rates are not diminished after graduation (Nuñez-Peña et al., 2016), this could provide additional stressors for women interested in working towards tenured positions or finding employment post-graduation, increasing stress and exacerbating psychological distress regarding career, financial stressors, and employment.

Our findings of relationships between greater discrimination and more mental health challenges were as expected and concordant with the established literature (Carter et al., 2019; Pascoe & Smart Richman, 2009; Williams and Mohammed, 2008; Causadias & Korous, 2019; Earnshaw et al., 2016; Miranda et al., 2013; Kessler, Mickelson & Williams, 1999). We found that individuals who endorsed moderate levels of discrimination also endorsed moderate to severe

levels of depression and anxiety. These relationships were generally similar across racial/ethnic groups, perhaps because our measure of discrimination was not limited to racial/ethnic discrimination. We did, however, observe a stronger link between experiencing discrimination “sometimes” and symptoms of anxiety in the non-Latino White group than in minoritized groups. While research largely shows that minoritized students are experiencing the highest levels of discrimination and in turn higher levels of anxiety (Jocham et al., 2019), it may be that there is a higher threshold for minoritized students to meet, given higher daily occurrences and normalization/expectations of experiencing discrimination in largely non-Latino White dominated spaces, before experiencing psychological distress as a result of discrimination. Meanwhile, non-Latino White students may be experiencing anxiety at lower thresholds of discrimination given the relative absence of these experiences in their day-to-day life. Additionally, given that most of the non-Latino White group consisted of White women, and our discrimination variable did not distinguish between discrimination type, experiences of gender discrimination, particularly in fields that are male-dominant may be driving up anxiety levels in this group (Barthelemy et al., 2016; Witte et al., 2006; Hayes & Bigler, 2013).

Individuals who endorsed moderate levels of discrimination were also more likely to have seriously considered attempting suicide within the past year regardless of race/ethnicity. In a recent study by Polanco-Roman et al. (2019), they used the Race-Based Traumatic Stress theory to examine whether traumatic stress or depression was independently able to help explain the relationship between racial/ethnic discrimination and suicidal ideation. They recruited 1,344 emerging adults (aged 18-29) and found that there were independent relationships between traumatic stress or depressive symptoms to the relationship of racial/ethnic discrimination and suicidal ideation. Further, they suggest that cumulative racial/ethnic discrimination increases

suicidal ideation which in turn increases traumatic stress and depressive symptoms (Polanco-Roman et al., 2019). Interestingly, consistent with our findings, Oh and colleagues found that everyday discrimination increases the odds of reporting suicidal ideation, that race did not moderate the association between these, and that everyday discrimination and suicidal ideation are not stronger for individuals with mood or anxiety disorders (Oh et al., 2019).

As expected, and observed within the literature, we found that those individuals who endorsed higher levels of depression and anxiety symptoms, and individuals formally diagnosed with depression or both depression and anxiety, were more likely to be in the A- and below category (Ahmed & Julius, 2015; Eisenberg, Golberstein, & Hunt, 2009; Hart, 2019; Hysenbegasi, Hass, & Rowland, 2005; Hermann & Betz, 2006). Additionally, those individuals who had strongly considered suicide within the past year had a greater likelihood of performing in the A- and below category. We did not observe any relationships between discrimination and academic performance, and therefore were not able to run any mediation analyses. A previous study examining longitudinal within-person mental health predictors on academic performance in undergraduate and graduate students, found that depression was a significant predictor of lower GPA and higher probability of dropping out (Eisenberg et al., 2009). These findings were particularly strong among individuals who also had a concurrent anxiety disorder (Eisenberg et al., 2009). Previous studies have identified that individuals with co-occurring mood and anxiety disorders are particularly at risk of engaging in substance abuse, unhealthy behaviors, and have worse physical health (Lubman et al., 2007; Hides et al., 2010; Baker et al., 2012; Mezuk et al., 2010). Even though outside the scope of this study, very little work has been done in understanding the role of substance abuse and comorbid affective disorders in graduate students, despite research that has identified a national increase in use of alcohol and illicit substances in higher education and negative



associations with academic performance, discrimination, minoritized status and increased suicidal ideation (Welsh et al., 2019; Qeadan et al., 2022; Swisher & Dennison, 2020; Esang & Ahmed, 2018). This future work could help identify possible deleterious effects of substances on the interplay of mental health, discrimination, suicidal ideation, and academic performance. While we observed that minoritized groups and men were more likely to perform at less than an A-level academically and that men were less likely to report MHC with the exception of suicidality, we did not find that race/ethnicity or sex were factors that modified the strength of relationships between MHC and academic performance. Overall, our sample on average endorsed only mild depression and anxiety and to similar levels among racial groups; if students with more severe symptoms had responded to the survey, we may have seen differential relationships by race and sex between MHC and academic performance. In addition, while the influence of MHC on academic performance may be similar between race and sex groups, other factors such as a sense of belonging, family stress, financial strains, and acculturation factors that have been found to affect minoritized students' academic performance (Ren & Hagedorn, 2012; Mushtaq & Khan, 2012; Vakkai et al., 2020) might have shown a differential association based on race if they had been assessed in this graduate student sample.

We did not observe the predicted relationship of academic performance and discrimination in this sample. While many studies have focused on the relationship between discrimination and mental health in college students, only a few studies have addressed the roles of discrimination and mental health in academic performance (Stevens, Liu & Chen, 2018; Del Toro & Hughes, 2020). These studies have shown that with higher levels of perceived discrimination there was worse academic performance (Stevens, Liu & Chen, 2018; Del Toro & Hughes, 2020). These studies, however, use reliable and valid measures of perceived discrimination, while our variable

was limited to a single question that amalgamated several types of discrimination. This makes it difficult to parse out and discern what forms of discrimination are driving results and does not account for possible cumulative effects of various types of discrimination. In addition, we were limited to a crude measure of academic performance, a dichotomous GPA variable. If we had been able to measure academic performance in a more fine-grained fashion, we may have observed a larger influence of discrimination. Finally, it is possible that, at the graduate level, discrimination has a smaller impact on academic performance because advanced students have developed coping mechanisms that allow them to perform well despite suffering from discrimination and concomitant mental health consequences.

Our study was the first to examine the possible role of mitigating factors such as resilience, advisor contact, and social support on race, sex, and intersectional differences in MHC, academic performance, and discrimination and on inter-relationships among MHC, academic performance and discrimination. In a sample that, on average, reported levels of resilience in the normal, compared to low or high, resilience range (Smith et al., 2013), we found that graduate students who reported higher levels of resilience were more likely to have A grades, less likely to think about suicide and less likely to endorse discrimination. Resilience, advisor contact, and social support did not moderate any of the observed race or sex or intersectional differences in MHC, discrimination, or academic performance, however.

We did find that resilience, but not advisor contact or social support, buffered the observed negative relationships of discrimination on depression and suicidal ideation. Specifically, for depression, students who reported normal levels of resilience showed a gradual increase of depressive symptoms with increasing levels of discrimination; students in the high resiliency group had lower depression than other groups across all levels of discrimination; and, individuals in the

low resiliency group on average reported higher levels of depression across all levels of discrimination, with a sharp uptick at the level of “A Lot”, of about 7 points, putting them at moderate levels of depression. Given that discrimination questions were included in an optional module for universities, the subsample of responses for most of the time (N=20) and almost all of the time (N=12) were very small. Additionally, the categories of discrimination levels may make it difficult for students who are experiencing discrimination at levels of a lot and above to be differentiated. Future research should include different types of discrimination and include discrimination variables across all institutions.

We also observed a moderation of the link between discrimination and suicidal ideation by resilience, such that within the low resilience group students were more likely to endorse suicidal ideation across most levels of discrimination when compared to normal or high levels of resilience, in which only the most prevalent discrimination was associated with elevated suicidal ideation.

These results suggest that resiliency training, in combination with efforts to reduce structural and interpersonal biases that manifest as discriminatory policies or actions, delivered to students in classes, didactics, and in supervision or mentoring settings would highly benefit students’ abilities to cope with discrimination and help buffer depression and suicidal ideation. Several studies have tested or proposed small-scale interventions aimed at enhancing resilience. In one, an 8-month pilot via a peer coaching model with 11 graduate students (Fried et al., 2019) was implemented that focused on mentorship, motivational interviewing, and Co-Active Life Coaching; while qualitative results indicated a positive impact on students perceived resilience, no statistically significant changes were noted pre- and post- intervention (Fried et al., 2019). Another pilot study by Dresen and colleagues (2019) used strengths-based learning to build resilience in a group of graduate students studying abroad and found that 11 respondents perceived improved

resiliency in leadership skills. Malandraki (2022) proposed the use of emotional resilience training in graduate student training to help improve mental health challenges in higher education. The proposed training model uses reflective ability, emotional intelligence, accurate and appropriate empathy, social confidence, and social support as the four competencies needed to foster emotional resilience (Malandraki, 2022). These competencies could be translated to weekly check-ins, encouraging regular wellness activities, weekly wellness journal reflections, peer-counseling sessions, and organizing panels of professionals to address barriers within specific fields (i.e. managing clinical professional duties; Malandraki, 2022). This model is currently being tested in communication sciences graduate students (Malandraki, 2022). It will be important for future studies to examine whether interventions that improve resilience also mitigate harmful effects of discrimination among graduate students.

Academic advising was not found to be directly related to any mental health challenge or academic performance variable. Additionally, given small sample sizes, relationships of race, discrimination and advisor contact could not be examined. Furthermore, advisor contact did not moderate any racial or sex differences observed in MHC or academic performance, nor did it buffer relationships between MHC and discrimination or academic performance. We were also not able to perform follow-up analysis with students who had reported that they spoke to their academic advisors about mental health challenges. In addition to that, the quality of interactions between mentor-mentee were not assessed and even if there was a higher frequency of contact, it would be important to also note whether these were positive or negative experiences. Although not supported by our results, supportive academic advisors have been shown to be instrumental to the success of graduate students, particularly for students from minoritized backgrounds (Bain et al., 2011; Lynch & Lugin, 2018; Museus & Ravello). Future work examining academic advising

styles, mentor-mentee contracts, quality of advising, perceived support, and culturally sensitive advising in graduate students could help inform and increase retention and student success and well-being.

For our social support variable, we found a relationship with academic performance such that more sources of social support increased the likelihood of performing better academically but did not relate directly to discrimination or mental health challenges. Nor did we observe that social support buffered racial or sex differences or moderated any associations between MHC and academic performance or discrimination. Social support has been found to be a moderator of the relationship of stress (as measured using the Demographic/Stress Questionnaire) and distress (as measured by the General Health Questionnaire) among graduate students (Nelson et al., 2001). A lack of peer-support for racially minoritized groups was predictive of poor college adjustment and lower GPA in a group of 100 racially minoritized first generation students (Dennis et al., 2005). Despite the research showing social support as a positive factor in graduate student mental health and academic performance, we did not observe these relationships in our study. One possible explanation is that we asked a single question to capture the amount of social support, but we did not assess for the quality of these interactions. Additionally, on average our sample only reported about 1.7 sources of support, indicating our sample had lower levels of social support in general. We also were not able to examine for the type of source (e.g., family, friend, religious) which could help better understand where graduate students are receiving the most support.

**Limitations, Implications and Future Directions.** As with any study, certain limitations should be considered in interpreting the results. First, we are examining relationships of mental health challenges, discrimination, and academic performance through a cross-sectional study and therefore cannot assess for directionality of relationships. Secondly, there was only a 16% response

rate and responses may be biased to individuals who are experiencing mental health challenges or discrimination and to individuals who are performing well enough academically to still be enrolled in graduate school. Further, some racial/ethnic groups were under-sampled relative to their enrollment in graduate school. It may be that given the geographic location of universities limited racially minoritized students in attendance. It may also be that higher drop out rates within minoritized graduate students led to lower survey responses. This limits our abilities to examine and discuss group differences among racially/ethnically minoritized groups. Survey response rates across the 79 universities were also discrepant with some institutions having anywhere from a single response to over 1,000 responses; although we controlled for school in our mixed models. Additionally, information on geographic location and public versus private institution type was not available and not accounted for in our analyses. Academic performance was examined using a crude dichotomous variable based on GPA, which is not a good predictor of student success or abilities. Furthermore, although we followed up analyses using single minority groups, the use of a dichotomous racially minoritized variable takes away from understanding the depth and variability of racially minoritized groups. Future research should focus on obtaining and studying a variety of individual groups to better understand cultural and racial etiologies. Additionally, our use of a single question for discrimination does not allow us to differentiate between discrimination type or impact of said discrimination on each student's academic performance or well-being. We also did not assess for the quality of interactions between advisor contact and social support to better understand not only frequency but impact of these interactions. Measures focused on minoritized group experiences, such as acculturative stress, acculturation, assimilation, cultural identity, independent vs interdependent thinking, or race-based trauma were not utilized in this

study, and the use of these factors in future work will be important in helping universities best understand minoritized students and help improve student well-being.

**Future directions.** Our findings confirm that mental health challenges may vary depending on sex and the intersection of sex and race, and that academic performance and discrimination differ depending on sex and race. Thus, it is important for higher education leadership to acknowledge individual differences in the graduate school experience and provide supports that are tailored for students from different backgrounds. Our results also emphasize the continued need for addressing mental health challenges faced by graduate students and highlight how these are linked both to experiences of discrimination and to academic performance. Although the links we observed with MHC were not differential by race or sex, we have discussed some reasons why our findings might under-estimate the degree to which minoritized students differ from majority students in the inter-play of MHC with discrimination and academic performance. Importantly, in all students, the association of MHC with discrimination did seem to depend on the student's level of resilience such that more resilient students fared better in the face of discrimination. In addition to a need for further longitudinal research, our results suggest some commonsense actions that universities could take to improve the graduate student experience.

## V. Conclusions

This study was the first, to our knowledge, to examine differences between racially minoritized and majority graduate students, and between male and female graduate students, in mental health challenges, discrimination, and academic performance and their interplay using the 2018-2019 Healthy Minds Study. We found that minoritized groups experienced more discrimination and had less-than-perfect grades but had similar levels of mental health challenges. Our work replicated gender differences with women reporting higher anxiety symptoms and disorders. We found that men were also more likely to think about suicide, in the context of a sex by race interaction where non-Latino White men in particular were most likely to have contemplated suicide in the past year. Like previous literature, we showed relationships between higher depression, anxiety, mental health burden, suicidal ideation and poorer academic performance; and relationships between greater discrimination and more mental health challenges. The observed associations, in general, were very similar among minoritized vs majority groups and among men and women. Resilience, but not advisor contact or social support, seemed to buffer the harmful association of discrimination with depression and suicidal ideation. Thus, while minoritized graduate students do not seem differentially at risk for MHC and show similar inter-relationships between MHC and both academic performance and discrimination, findings do suggest that attending to sex differences and intersectionality, and focusing on building resilience, might yield more effective interventions aimed at improving the graduate student experience. Further prospective, longitudinal studies with purposeful recruitment of minoritized students and culturally-appropriate measures are needed to help guide interventions to improve graduate student mental health for students from all backgrounds.



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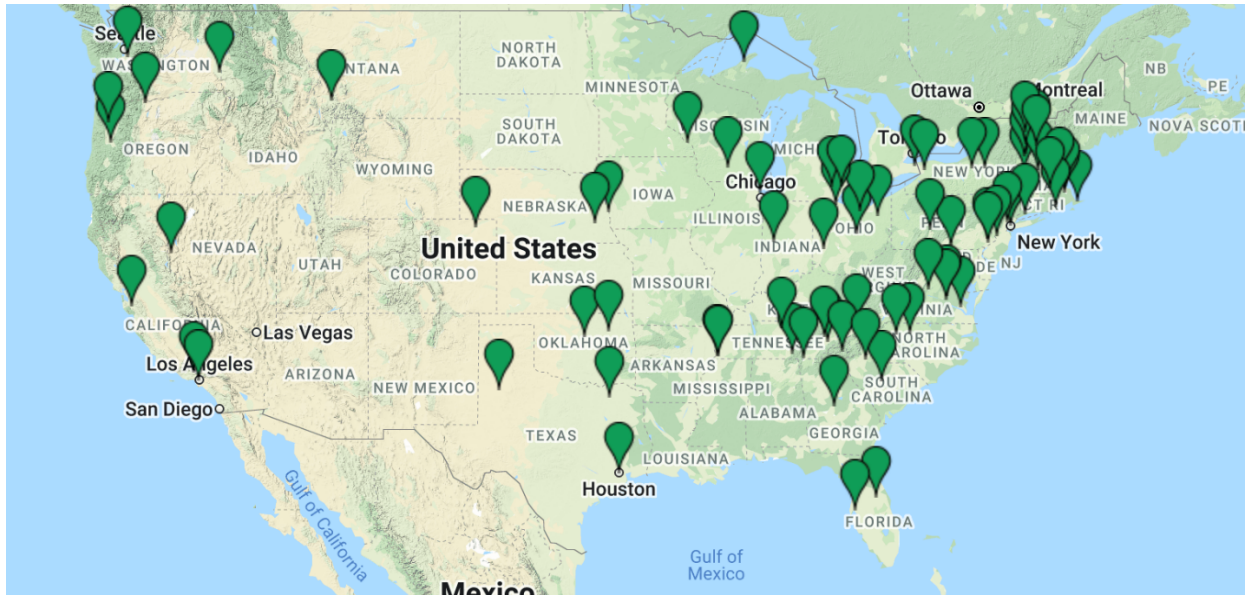
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Supplemental



Supplemental Figure 1. Map of participating schools for the 2018-2019 Healthy Minds Study Survey.