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# U.S. Graduate Students' Prevalence of Post-Traumatic Stress Symptoms during the COVID-19 Pandemic

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**ABSTRACT**

Work assessing the psychological impacts of COVID-19 on university student populations has most often focused on undergraduates. To assess the impacts on graduate students and inform university-led solutions to foster support, this study examines the extent to which students pursuing a doctorate, master's, or other professional degree exhibited post-traumatic stress symptoms (PTSS) during the height of the COVID-19 pandemic. We surveyed graduate students at 12 U.S. universities and analyzed 4,036 survey responses. Thirty-one percent of respondents described experiencing PTSS. Women students and those from historically marginalized racial groups reported greater PTSS than male students and White students. PTSS were correlated with food and housing insecurity, concerns about career plans, and extended degree timelines. PTSS were lower for students who felt supported by advisors and institutional policy changes. Combined with CDC trauma guidelines, our results provide an understanding of graduate students' vulnerability to trauma-related disorders and suggest actions universities can take to provide support.

**Keywords:** COVID-19, Post-Traumatic Stress, Graduate Students, Mental Health, Pandemic, Higher Education

The COVID-19 pandemic has radically disrupted society, including the functioning of higher education (Marinoni et al., 2020). This pandemic, like previous calamities, is likely to have lasting psychological consequences (Adams & Boscarino, 2006; Beaglehole et al., 2018; Sahu, 2020). Graduate students experienced disruption in their classrooms, research sites, and research collaborations (Stewart et al., 2021; Ogilvie et al., 2020), and, in some cases, graduate students took on additional caretaking responsibilities (Kee, 2021; Levine et al., 2021). The stress of these events has exacerbated the already troubling mental health crisis in graduate education (Evans et al., 2018). Before the pandemic, over half of graduate students reported high stress levels, up to 40% of graduate students suffered from anxiety and depression (Evans et al., 2018; Woolston, 2017), and over one third of doctoral students sought help for anxiety and depression (Woolston, 2019). Recent studies of students indicate that levels of anxiety or depression have increased by approximately 10% during the pandemic (Chirikov et al., 2020). These impacts are likely more significant for graduate students with marginalized identities, such as students of color, low-income students, women, and LGBTQ+ students, who are often already struggling with existing inequalities (Figueroa & Hurtado, 2013; Gildersleeve et al., 2011; Ong et al., 2011; Burt et al., 2019; Perez et al., 2020; Posselt, 2020). The cumulative impact of the pandemic, preexisting mental health concerns (including past traumas), and persistent social inequities may lead to post-traumatic stress symptoms (PTSS).

Trauma is associated with a dysregulation in the autonomic nervous system that can result in unhealthy mental and physical responses, including increased irritability, emotional reactivity, intrusive thoughts, avoidance behaviors, and negative changes to mood (Kendall-Tackett, 2009; Wortmann et al., 2016). Although a growing body of research emphasizes the importance of trauma-informed care (Centers for Disease Control and Prevention, CDC, 2020), this approach has seen limited implementation in higher education (Davidson, 2017; Doughty, 2020; Hallett et al., 2018). Conversations have recently begun at the graduate level to advance frameworks for trauma-informed graduate education (Council of Graduate Schools & The Jed Foundation, 2021). Due in part to the lack of widespread understanding of trauma-informed education, many academic advisors and departments were unprepared to support students experiencing PTSS when the pandemic began. Over time, these students may find it difficult to complete their education (Hoch et al., 2015). Moreover, fewer graduate completions have long-term negative impacts on the scientific knowledge base and society's capacity to solve some of its most pressing challenges.

The rationale for this study was to learn the extent to which graduate students exhibited PTSS during the COVID-19 pandemic. Additionally, we examined which groups of students experienced these symptoms at higher levels, under what circumstances students reported worse symptoms, and which factors might help protect students. We focused on postsecondary institutional factors, such as policy

communication and inclusivity and interpersonal support from advisors and others. With an understanding of how PTSS affect graduate students, university leaders can take steps to protect students, as well as provide more effective support related to the longer-term condition of post-traumatic stress disorder (PTSD), wherein students continue to experience symptoms due to their experiences of COVID-19. Given our interest in examining how reports of PTSS varied by graduate students' identities and situations, experiences of institutional support, and educational and career plans, two research questions guided our study of graduate students' experiences during the COVID-19 pandemic:

1. What was the prevalence of PTSS reported among graduate students, and how did these reports differ by students' gender and race/ethnicity?

2. What experiential factors were most strongly associated with reporting PTSS?

## LITERATURE REVIEW

Several studies have established significant levels of mental health problems amongst graduate students. Hyun et al. (2006) found that 46% of graduate students reported feeling overwhelmed and that 40% reported feeling exhausted either "frequently" or "all the time." Eisenberg et al. (2013) found that 14% of graduate students had a positive screen for depression, a result corroborated by another study in which 23% of graduate students reported current moderate or severe anxiety symptoms and 13% reported current moderate or severe depression symptoms (Allen et al., 2020). The level of 13% for depression was confirmed by Jones-White et al. (2020), while Wyatt and Oswalt (2013) found that 17% of graduate students reported being diagnosed with depression in the prior year. Notably, Garcia-Williams et al. (2014) found that 7% of graduate students reported thoughts of suicide and 2% reported self-harm in the prior two weeks.

A meta-analysis of studies (Mackie & Bates, 2018) examining the factors that may be contributing to these high levels of mental health problems in graduate students found connected issues, including "problems in the supervisory relationship, lack of transparency of university processes, workload, role conflict, financial insecurity and uncertain career prospects" (p. 565). These preexisting issues may have made graduate students especially vulnerable to PTSS and other trauma-related disorders resulting from the additional stress of the COVID-19 pandemic. Studies of other vulnerable populations, such as those working in healthcare (d'Ettorre et al., 2021), as grocery workers (Janson et al., 2021), and in education (Lynch, 2021), show significant increases in PTSS, anxiety, depression, and related mental health challenges during the pandemic. Graduate students have reported experiencing emotional and psychological challenges in the past two years, including feelings of anxiety, fear, and disappointment, as well as struggles related to virtual learning and teaching (Kee, 2021). In one study, over one third of graduate and professional students screened positive for major depressive disorder and generalized anxiety disorder, with rates more pronounced among low-income and racially and ethnically marginalized students (Chirikov, 2020). In addition, some graduate students reported

experiencing additional strain while attempting to balance multiple roles, such as student, faculty member, administrator, and caretaker, as the pandemic was underway (Bal, 2020). We add to this previous scholarship an analysis of the prevalence of PTSS among graduate students with an emphasis on gender and racial/ethnic differences. Although prior research demonstrates mental health problems among graduate students, this study adds an understanding of graduate students' vulnerability to trauma-related disorders.

## METHODS

Graduate students from 12 U.S. public research universities participated in our study. The universities were recruited using the listservs of the Council of Graduate Schools and the Center for Integration of Research, Teaching, and Learning (CIRTL), as well as graduate school deans who are personal contacts of the study team. Participating universities varied in terms of research activity, student population, and geographic location. They included one historically Black university and two Hispanic-serving institutions. These institutions are located in states in the Northeast, Southeast, Midwest, Southwest, and Mountain West with relatively divergent policy responses to the pandemic.

Participating institutions emailed our Qualtrics questionnaire to their graduate student cohorts during June and July 2020. Items in the survey asked about students' experiences of the pandemic, their mental health (in terms of PTSS, depression, anxiety, and general well-being), their perspectives on a range of policies and practices that their universities put in place during the pandemic, and their educational and career intentions. All procedures were approved by the Institutional Research Board.

Recruitment strategies yielded 4,036 initial survey responses (3,182 completed surveys and 854 partially completed surveys) from a total of 60,247 graduate students attending the 12 institutions. The response rate was 6.7% overall and 5.3% for completed surveys. Data collection occurred following George Floyd's murder and ongoing Black Lives Matter activism, as well as during the period in July 2020 when U.S. Immigration and Customs Enforcement announced a new rule related to international student enrollment status. As a result, students' stressful experiences could be related to any number of events happening concurrently with the pandemic. Our analytic sample for the OLS regression utilized a smaller number of respondents (2,529) following multiple imputation and listwise deletion of cases with missing demographic data.

### Measures

#### *PTSS, Anxiety, and Depression*

PTSS were assessed using the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013), a self-report questionnaire used to screen for PTSD-related symptoms. The PCL-5 includes a list of 20 symptoms that a person might have in response to a very stressful experience or ongoing stress, such as having disturbing dreams, losing

interest in previously enjoyable activities, feeling cut off from other people, struggling to fall asleep, and acting uncharacteristically irritable or aggressive. Respondents were asked to rate how often they were bothered by each symptom in the past month. The rating scale includes five response options ranging from 0 (not at all) to 4 (extremely). The PCL-5 contains items that correspond to the DSM-5 criteria for PTSD (American Psychiatric Association, 2013). Following Jordan et al. (2019), however, we selected a version of the PCL-5 that does not assess for a Criterion A trauma (i.e., a qualifying traumatic event during the respondent's lifetime), which is required for a diagnosis of PTSD as outlined by the DSM-5. Nonetheless, the 20 items in the PCL-5 format we used correspond to DSM-5 criteria for PTSD: Criterion B, symptoms of intrusion (5 questions); Criterion C, trauma-related stimuli (2 questions); Criterion D, negative thoughts and feelings (7 questions); and Criterion E, arousal symptoms (6 questions). This PCL-5 format asks respondents to think about the most stressful event experienced in the past month (Weathers et al., 2013), given the probability of having multiple ongoing stressors to choose from (e.g., the pandemic, George Floyd's murder and related activism, and challenges related to graduate school during this time and in general). A total PTSS score was obtained by summing all 20 items; possible scores range from 0 to 80 ($\alpha$=0.95). As is standard for the PCL-5 when screening for PTSD (Blevins et al., 2015), a prevalence indicator was created for respondents with a score of 33 or higher, which served as a cutoff for what we operationally define as high PTSS. Limitations of these strategies are noted in the Discussion section. In addition to this PTSS measure, the survey also included the GAD-7 questions for anxiety (Spitzer et al., 2006) and the PHQ-8 questions for depression (Kroenke et al., 2009).

### *Demographics*

Of the survey respondents, 68% were women and 3% were trans or nonbinary. Participants could select from specific racial and ethnic categories, including an option to self-identify. Of our respondents, 24% were classified as U.S. domestic students who identified as Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx. Asian Americans made up 9% of respondents. We also grouped respondents who self-identified as "international students" (14%) and respondents who did not select yes to this item were assumed domestic. Other information collected included respondent age (M=29.3, SD=7.2); respondents who were married or living with a partner (44%); respondents with a low household income (46%, defined as less than $30,000); respondents who were parents or caretakers (17%); respondents who were first-generation college students (24%, defined as not having a parent with a bachelor's degree or higher); respondents classified as STEM students (45%); and respondents earning a Ph.D. (50%), master's (45%), or other professional degree (5%).

**Table 1: Variable Means for Items Included in Full Regression Model**

| Demographics | *M* |
|---|---|
| Woman[1] | 0.68 |
| Transgender[1] | 0.03 |
| Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx[2] | 0.23 |
| Asian American[2] | 0.09 |
| International student | 0.14 |
| Age | 29.38 |
| Married | 0.44 |
| Low income (below $30,000) | 0.45 |
| Parent | 0.18 |
| First generation | 0.24 |
| STEM | 0.44 |
| Ph.D.[2] | 0.46 |
| Other degree[2] | 0.05 |
| **Personal disruptions due to COVID-19** | ***M*** |
| COVID-19 risk to self | 0.12 |
| Around others at risk for COVID-19 | 0.20 |
| Lost someone due to COVID-19 | 0.03 |
| Food insecurity | 0.30 |
| Housing insecurity | 0.30 |
| Did not move house | 0.80 |
| **Educational disruptions due to COVID-19** | ***M*** |
| Extended timeline to degree | 0.42 |
| Changed career plans | 0.16 |
| Pessimism toward career options | 1.73 |
| **Perceptions of institutional policy and support** | ***M*** |
| Graduate policy communication[5] | 2.30 |
| Graduate policy supportiveness[5] | 2.08 |
| Graduate policy inclusivity[5] | 2.20 |
| Advisor health support[6] | 2.92 |
| Graduate policy communication[7] | 2.21 |

*Note.*
[1]Reference category: Men, [2]Reference category: White, [3]Reference category: Master's Degree, [4]Likert-type, five-point scale: Very optimistic (0) to Very pessimistic (4), [5]Composite factor average: Strongly disagree (0) to Strongly agree (4), [6]Likert-type, five-point scale: Very unsupported (0) to Very supported (4), [7]Composite factor average: Very unsupported (0) to Very supported (4)

### *Personal Disruptions Due to COVID-19*

Respondents answered questions about personal disruptions due to COVID-19, including: whether they would be in a high-risk category for negative outcomes if they were to contract COVID-19, live with or regularly interact with someone who is in a high-risk category for negative outcomes, or had lost someone close due to COVID-19 (yes, no); whether they worried that food would run out before they could afford to buy more, and if they worried about having secure housing options (never true, sometimes true, often true); and whether they had changed residence since their institution implemented COVID-19-related policies (yes, no). Table 1 contains psychometric data for these measures.

### *Educational Disruptions Due to COVID-19*

Respondents were asked about personal disruptions due to COVID-19, including: whether they had adjusted their timeline for degree completion since the pandemic began (yes, no); whether their career plan had changed (yes, no); and, in general, how they felt about the conditions for pursuing their current career goal after degree completion (very optimistic, optimistic, neither optimistic nor pessimistic, pessimistic, and very pessimistic). Table 1 contains psychometric data for these measures.

### *Perceptions of Institutional Policy and Advisor Support*

Three composite measures were constructed from separate survey questions on students' perceptions of graduate-level policy: one measure on graduate policy communication, a second on the extent to which students felt supported by the graduate policy, and a third on graduate policy inclusiveness. Each measure was composed of three survey questions, and we performed exploratory and confirmatory factor analyses to ensure the items loaded together in consistent conceptual groups (DeVellis, 2016). Table 1 contains psychometric data for these measures. The wording for questions on personal disruptions, educational disruptions, perceptions of institutional policy, and advisor support was not validated.

## Analysis

We built OLS regression models for PTSS using Mplus, Version 8.4 (Muthén & Muthén, 2017). The data met all assumptions required for the use of OLS. In the first stage, we entered variables in blocks according to our conceptual groups: demographics, personal and educational disruptions due to COVID-19, and perceptions of institutional policy and advisor support. Missing data were handled using multiple imputation, missing continuous and dichotomous variables were imputed, and missing demographic data were listwise deleted (Allison, 2005). Following imputation, our analytic sample for the overall model contained 2,529 graduate students. The overall model had an adjusted $R^2$ of 27% (Table 4).

After running the initial model, we selected items that were either statistically or practically significant ($p<0.01$) to include in a parsimonious model. The results from

this model may be more useful to campus administrators as they focus their actions. The exception was one variable, Asian American, which was retained because it was included in our racial/ethnic identity dichotomous variables. We did not find any significant interactions between demographic variables and other variables of interest.

**Table 4:** ***Initial Full, Blocked Regression Model; Post-traumatic Stress Symptoms (PTSS) Score Outcome***

| | Model est. | *SE* | *p* | β | Rate of missing |
|---|---|---|---|---|---|
| Intercept | 21.848 | 2.095 | 0.000 | 1.277 | 0.009 |
| **Demographics** | **Model est.** | ***SE*** | ***p*** | **β** | **Rate of missing** |
| Woman | 5.195 | 0.663 | 0.000 | 0.142 | 0.006 |
| Transgender | 8.968 | 1.873 | 0.000 | 0.085 | 0.002 |
| Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx | 1.449 | 0.748 | 0.053 | 0.036 | 0.003 |
| Asian American | 0.387 | 1.226 | 0.752 | 0.007 | 0.003 |
| International student | 1.408 | 1.082 | 0.193 | 0.028 | 0.005 |
| Age | -0.042 | 0.047 | 0.375 | -0.018 | 0.007 |
| Married | -0.130 | 0.673 | 0.846 | -0.004 | 0.003 |
| Low income (below $30,000) | -0.755 | 0.681 | 0.268 | -0.022 | 0.003 |
| Parent | -1.093 | 0.886 | 0.217 | -0.024 | 0.001 |
| First generation | -0.262 | 0.690 | 0.705 | -0.007 | 0.001 |
| STEM | 0.246 | 0.628 | 0.696 | 0.007 | 0.004 |
| Ph.D. | -0.773 | 0.668 | 0.247 | -0.023 | 0.006 |
| Other degree | -1.755 | 1.359 | 0.197 | -0.023 | 0.003 |
| **Personal disruptions due to COVID-19** | **Model est.** | ***SE*** | ***p*** | **β** | **Rate of missing** |
| COVID-19 risk to self | 3.556 | 0.921 | 0.000 | 0.068 | 0.005 |
| Around others at risk for COVID-19 | 1.360 | 0.763 | 0.075 | 0.032 | 0.003 |
| Lost someone due to COVID-19 | 7.554 | 1.627 | 0.000 | 0.080 | 0.002 |
| Food insecurity | 4.979 | 0.617 | 0.000 | 0.170 | 0.014 |
| Housing insecurity | 3.507 | 0.629 | 0.000 | 0.119 | 0.030 |
| Did not move house | 0.034 | 0.756 | 0.964 | 0.001 | 0.006 |
| **Educational disruptions due to COVID-19** | **Model est.** | ***SE*** | ***p*** | **β** | **Rate of missing** |
| Extended timeline to degree | 3.227 | 0.672 | 0.000 | 0.093 | 0.077 |
| Changed career plans | 2.443 | 0.858 | 0.004 | 0.052 | 0.004 |

| | | | | | |
|---|---|---|---|---|---|
| Pessimism toward career options | 2.093 | 0.295 | 0.000 | 0.142 | 0.002 |
| Perceptions of institutional policy & support | Model est. | *SE* | *p* | β | Rate of missing |
| Graduate policy communication | 0.066 | 0.461 | 0.886 | 0.004 | 0.002 |
| Graduate policy supportiveness | -2.085 | 0.498 | 0.000 | -0.115 | 0.007 |
| Graduate policy inclusivity | -0.728 | 0.502 | 0.147 | -0.042 | 0.008 |
| Advisor health support | -0.590 | 0.276 | 0.033 | -0.040 | 0.042 |

## RESULTS

Table 1 summarizes the mean values for items included in the full regression model. Sixty-eight percent of the sample identified as women; 23% identified as Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx; and 12% had a health condition that put them at additional risk for negative outcomes if they contracted COVID-19. The average age was 29 years. For educational disruptions due to COVID-19, 42% expected an extended timeline for their degree, and 16% had changed their career plans. Students' perceptions of institutional policy and support varied, with advisors perceived as more supportive than graduate policy.

### Prevalence of PTSS

Table 2 shows the post-hoc comparison of racial/ethnic and gender groups meeting the cutoff for high PTSS (i.e., a PCL-5 score of 33 or higher). Overall, 31% of respondents indicated experiences consistent with high PTSS. We examined the extent to which prevalence differed by gender and race/ethnicity since prior studies have shown that students with marginalized identities are often already struggling with existing inequalities (Figueroa & Hurtado, 2013; Gildersleeve et al., 2011; Ong et al., 2011; Burt et al., 2019; Perez et al., 2020; Posselt, 2020). High levels of PTSS were more prevalent among women (34%) and trans or nonbinary (54%) students as compared to men (26%). In terms of differences by race/ethnicity, high PTSS levels were most prevalent among Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx (37%) students and Asian American (37%) students, with 29% of White students reporting high PTSS.

**Table 2: Post-hoc Comparison of Gender and Racial/Ethnic Groups Meeting the High Post-traumatic Stress Symptoms (PTSS) Screen Threshold**

| Gender | %[1] | *p* |
|---|---|---|
| Men (reference) | 26 | |
| Women | 34 | 0.000 |

| | | |
|---|---|---|
| Transgender | 54 | 0.000 |
| Race/ethnicity | %[1] | *p* |
| White (reference) | 29 | |
| Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx | 37 | 0.001 |
| Asian American | 37 | 0.014 |

*Note.* [1] 31% of the sample met the threshold for high PTSS screen

Table 3 shows the percent meeting the cutoff for high PTSS by race and gender combinations. For men, the fraction of White students with high PTSS is lowest than for all other ethnicities. Among all race and gender combinations, high PTSS levels were least prevalent among White men. Trans students had higher PTSS than other genders with the same ethnicity, although the sample size is small. White women had lower PTSS than women of all other ethnicities, except for Black/African American women. Perhaps this result is related to the Black-White paradox in mental health (Kessler et al., 1994; Louie et al., 2021). Multiracial and Asian American women reported higher PTSS than multiracial and Asian American men and the highest rates of PTSS of any ethnic groups for women.

**Table 3: Percent Meeting Cutoff for High PTSS by Race and Gender Combinations**

| | Man | Woman | Trans |
|---|---|---|---|
| Alaska Native/Native American | 37% | 35% | 100% |
| Asian American | 30% | 42% | 58% |
| Black/African American | 38% | 29% | 50% |
| Hispanic/Latinx | 29% | 37% | 100% |
| South Asian | 38% | 42% | 100% |
| White | 21% | 31% | 50% |
| 2 categories or more | 26% | 41% | 60% |

**Factors Associated with PTSS in Graduate Students**

The parsimonious OLS regression model (Table 5) had an adjusted $R^2$ of 27%. The parsimonious model variables are displayed in Figure 1 as standardized coefficients (β) in order of magnitude according to their relationship with PTSS scores. Food and housing insecurity were among the strongest predictors of increased PTSS (β=0.165 and β=0.131, respectively). Among educational disruptions due to the pandemic, graduate students who felt more pessimistic about their chosen career

paths experienced greater PTSS (β=0.142). Women and trans or nonbinary graduate students reported greater PTSS than men, and Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx graduate students reported greater PTSS than White students.

**Table 5: Parsimonious, Blocked Regression Model; Post-traumatic Stress Symptoms (PTSS) Score Outcomes**

| | Model est. | *SE* | *p* | β | Rate of missing |
|---|---|---|---|---|---|
| Intercept | 19.119 | 1.272 | 0.000 | 1.104 | 0.014 |
| Demographics | Model est. | *SE* | *p* | β | Rate of missing |
| Woman | 5.090 | 0.616 | 0.000 | 0.137 | 0.005 |
| Transgender | 10.581 | 1.798 | 0.000 | 0.097 | 0.003 |
| Alaska Native/Native American, Black/African American, and/or Hispanic/Latinx | 2.148 | 0.668 | 0.001 | 0.054 | 0.008 |
| Asian American | 0.938 | 0.958 | 0.328 | 0.017 | 0.007 |
| Personal disruptions due to COVID-19 | Model est. | *SE* | *p* | β | Rate of missing |
| COVID-19 risk to self | 2.914 | 0.874 | 0.001 | 0.054 | 0.003 |
| Around others at risk for COVID-19 | 1.624 | 0.717 | 0.024 | 0.037 | 0.003 |
| Lost someone due to COVID-19 | 6.088 | 1.513 | 0.000 | 0.064 | 0.004 |
| Food insecurity | 4.745 | 0.568 | 0.000 | 0.165 | 0.038 |
| Housing insecurity | 3.766 | 0.570 | 0.000 | 0.131 | 0.021 |
| Educational disruptions due to COVID-19 | Model est. | *SE* | *p* | β | Rate of missing |
| Extended timeline to degree | 3.052 | 0.641 | 0.000 | 0.087 | 0.156 |
| Changed career plans | 2.703 | 0.790 | 0.001 | 0.058 | 0.004 |
| Pessimism toward career options | 2.126 | 0.271 | 0.000 | 0.142 | 0.014 |
| Perceptions of institutional policy & support | Model est. | *SE* | *p* | β | Rate of missing |
| Graduate policy supportiveness | -2.439 | 0.330 | 0.000 | -0.132 | 0.009 |
| Advisor health support | -0.815 | 0.249 | 0.001 | -0.054 | 0.026 |

Graduate students who perceived high levels of support from campus personnel and policies reported fewer PTSS. Students who perceived graduate-level policy changes as a result of the pandemic to be supportive of their physical, emotional, and economic well-being also reported fewer PTSS (β=-0.132). Further, graduate students who felt proximal support of their mental and physical well-being from their faculty advisors also experienced fewer PTSS (β=-0.054).

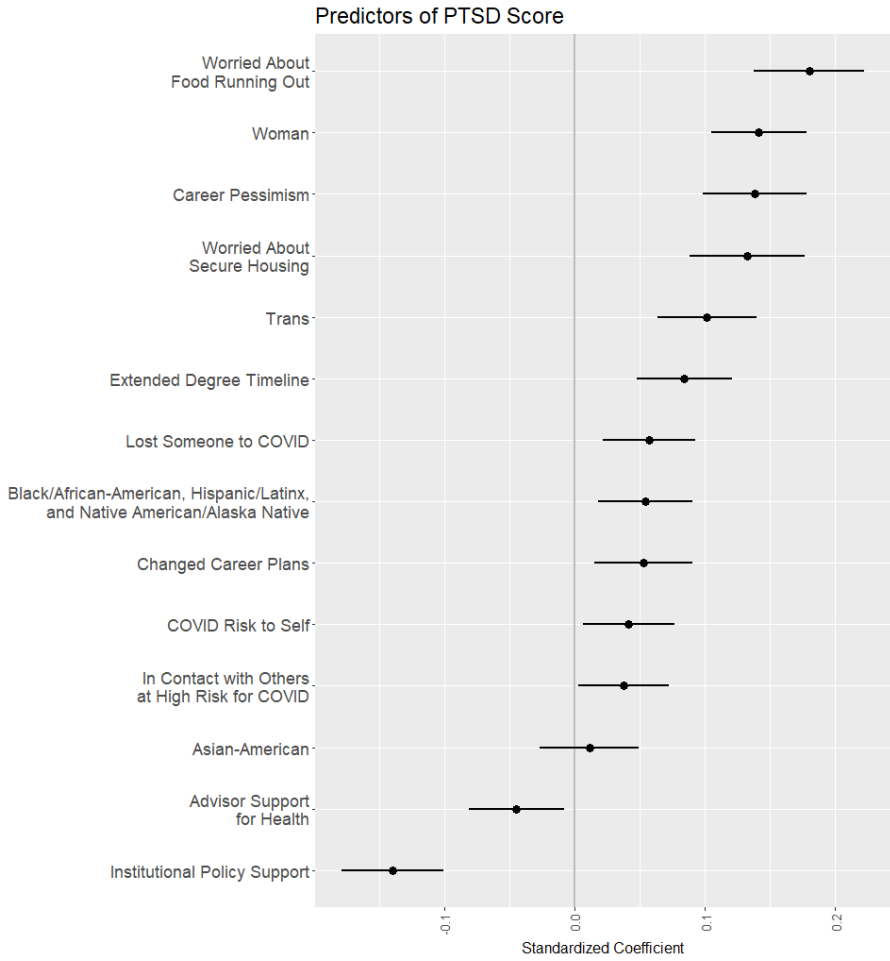


**Figure 1.** Standardized Estimates of Parsimonious Model Variables

## DISCUSSION

This study increases our understanding of the impact of the COVID-19 pandemic on graduate students. The pandemic has radically disrupted our society, including the scientific enterprise. Attention has been paid, for example, to the unequal effects of COVID-19 on women scientists (Myers et al., 2020), the impact of the pandemic on higher education (Martinez & Nguyen, 2020), and the need to prioritize mental health research to understand and attend to the social, psychological, and neuroscientific effects of the crisis (Holmes et al., 2020).

Building on this work, we assessed the extent to which graduate students in the midst of this pandemic exhibited PTSS. Additionally, we examined which groups of students experienced PTSS at higher levels, under what circumstances students reported worse symptoms, and which factors might help protect students. Three core findings emerged from our analysis. First, approximately one third of the graduate students in our sample met the cutoff threshold for high PTSS. As with prior research (Goldstein et al., 2016; Reisner et al., 2016; Roberts et al., 2011; Tolin & Foa, 2006), women and trans or nonbinary respondents were more likely to report symptoms, as were members of historically marginalized racial groups. Second, our regression models explained a large percentage of the variance of PTSS (27%). COVID-19-related disruptions at both the personal and educational levels, along with demographics and perceptions of institutional policy and support, had a sizable and significant association with PTSS. Third, risk and protective factors emerged. Food and housing insecurity, pessimism toward career options, and being a woman were predictors of PTSS. Perceiving graduate-level pandemic policy changes to be supportive of physical, emotional, and economic well-being was associated with fewer PTSS, as was the support of mental and physical well-being from graduate advisors.

It is important to recognize some of the study's limitations. First, this is an observational study that does not test causal effects or temporal order. The data are self-reported and cross-sectional. Using the PCL-5 as a self-reported screening instrument for PTSS (rather than using clinical or diagnostic interviews for assessing PTSD, for example) allowed us to quickly and inexpensively capture a snapshot of graduate student mental health during a critical time. Our results based on the PCL-5, however, should be interpreted with caution because a provisional diagnosis of PTSD cannot be made without the endorsement of a Criterion A trauma, which we did not assess (see also Jordan et al., 2019), though it is worth noting that others have argued that living through the pandemic is in itself a trauma (Ribeiro, 2020; Taylor, 2020). Instead, we use the terms stressor (rather than trauma) and PTSS (instead of PTSD) to indicate cases with scores above 33 on the PCL-5 to help clarify that there is no PTSD diagnosis due to the lack of probing for a Criterion A trauma. There is an extensive debate around the use of Criterion A (Franklin et al., 2019; Pai et al., 2017; Weathers & Keane, 2007). Without a Criterion A trauma, Gold et al. (2005) argued that scores may be inflated. Conversely, Franklin et al. (2019) reported higher scores with its use. In addition, the PCL-5 asks respondents to think about the most stressful event experienced in the past month (Weathers et al., 2013). This means that although we assessed for PTSS during the pandemic, symptoms may not necessarily be due to the pandemic. It is possible that some respondents already had PTSS before the pandemic.

Second, the response rate was 6.7%, and it is likely that the results do not represent all graduate students. That said, we successfully sampled 12 different universities, including one historically Black university and two Hispanic-serving institutions, located in states with relatively divergent policy responses to the pandemic. Third, the study did not include a comparison group. Future research might consider comparing graduate students to a developmentally or age-similar cohort. This would allow researchers to better isolate the disruptive and potentially traumatic

effects of the graduate school experience from other adversities or crises. Although graduate students often report poor mental health (Evans et al., 2018; Levecque et al., 2017), prior research also shows that being younger in age, a potential confound, is positively correlated with PTSD symptoms (Goldstein et al., 2016). Likewise, research shows that young adults in particular are at high risk for COVID-19-related distress (McGinty et al., 2020).

## Implications

PTSD has long been associated with a host of negative outcomes (McFarlane, 2010; Pacella et al., 2013; Qureshi et al., 2011; Yehuda et al., 2015). The core conclusion drawn from this research is that, as we emerge from the COVID-19 pandemic and its extended aftermath, graduate students who report PTSS will likely experience long-term consequences. What could a trauma-informed graduate education look like? Using our results, together with the guiding principles for trauma support suggested by the CDC (2020), some implications for universities are to: 1) strengthen safety and trust, 2) build community and peer support, and 3) empower graduate students.

Institutions can strengthen safety and trust through targeted and accessible economic support, such as food and childcare assistance along with direct funding, especially since housing and food insecurity were strongly correlated with PTSS (Table 1). These interventions must attend to the differential impacts on women and trans or nonbinary students, as well as those from historically marginalized racial groups. Additionally, institutions should include graduate students explicitly in university communications, given that their unclear status as students or employees contributes to uncertainty. Universities can amplify the work of faculty and staff who are exemplars of student support. Faculty and mentors should also receive professional development to learn that potentially traumatized students may have difficulty regulating their responses to stress. The second category of trauma-informed graduate education is to create opportunities for peer support and other forms of sustained social connection and community, such as peer mentoring (Lorenzetti et al., 2019) and discussion groups within research teams (Turner, 2006; Crede & Borrego, 2012), among teaching assistants (Linenberger et al., 2014), and within and across departments (Odom et al., 2016). The final category is to empower graduate students by, for example, prioritizing what is needed to complete their degree (Burian et al., 2010; Ewing et al., 2012), allowing students the flexibility necessary to demonstrate learning outcomes, hosting career workshops with virtual alumni panels (Ashline, 2017), and supporting and compensating graduate students who engage in professional organizations (Gardner & Barnes, 2007) or act as change agents working to improve their departments or on institutional projects related to food, housing, and anti-racism (Lantz et al., 2016). Although more research is needed to document the potential benefits of trauma-informed practice (Broomfield et al., 2020), we believe these approaches based on our research and the CDC's (2020) guiding principles can be used to improve the psychological safety and educational success of graduate students during and after the COVID-19 pandemic.

## CONCLUSION

We found that 31% of graduate student respondents described symptoms consistent with post-traumatic stress, defined as experiencing strong reactions on an ongoing basis to events they would usually take in stride. Women students and those from historically marginalized racial groups reported more pronounced PTSS than men and White students. Combined with the CDC's trauma guidelines, our results provide a basis for university leaders' actions to support graduate students. This support includes readily accessible food and housing assistance, institution-wide policies that facilitate effective advising, and enhanced student agency via career planning.

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