Discrimination, competitiveness, and support in US graduate student mental health

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Received 1 July 2020
Revised 27 October 2020
28 December 2020
Accepted 4 January 2021

Abstract

Purpose – Rising rates of anxiety and depression and the varied costs of these conditions indicate a clear need to create learning environments in which graduate and professional students can more readily thrive. However, the absence of multi-institutional, multi-disciplinary evidence about mental health in graduate education has obscured a clear picture of which populations, contexts and social dynamics merit focused attention and resources. The purpose of this study is therefore to analyze prevalence and risk factors associated with anxiety and depression among a large sample of graduate students, with special attention to how graduate education environments and interactions may be associated with mental health.

Design/methodology/approach – This paper offers the first multi-institutional, multi-disciplinary analysis of depression and anxiety among US graduate and professional students. Using a sample of 20,888 students randomly sampled within 69 universities, the author compares depression and anxiety prevalence among fields of study with hierarchical cluster modeling. Then, using a conceptual framework that links social support, role strain and self-determination theories, the author estimates fixed effects multivariate logistic regressions to measure how depression and anxiety are associated with experiencing racial discrimination, support from friends and family, perceived competitiveness in one's classes, and comfort speaking with one's professors about mental health.

Findings – Graduate students who endure frequent racial discrimination have odds of screening positive for depression and anxiety that are 2.3 and 3.0 times higher, respectively, than those who never experience discrimination. Support from family and friends moderates these relationships and perceived competitiveness exacerbates them. LGBTQ students and students who self-report that finances are a struggle or tight also have higher odds of depression and anxiety. Students in the humanities, arts and architecture have significantly higher prevalence of depression and anxiety than the sample as a whole.

Originality/value – The paper offers broadest base of evidence to date about patterns that are usually experienced at the individual level or analyzed institution-by-institution and field-by-field. Specifically, the author identified social dynamics, fields of study and populations where attention to wellbeing may be especially warranted. The conceptual framework and multivariate results clarify how organizational and individual factors in graduate students' mental health may be intertwined through competitive, discriminatory, or supportive interactions with peers, faculty, family and friends. Findings clarify a need for awareness of the contexts and interactions that graduate students experience as well as individual factors that are associated with student wellbeing.

Keywords Mental health, Discrimination, Disciplines, Support, Graduate education

Paper type Research paper

The author gratefully acknowledges the National Academy of Education and Spencer Foundation for a 2015-2017 post-doctoral fellowship that made this research possible, as well as partnership with the Healthy Minds Network. This paper is dedicated to students and scholars everywhere who are working to make academe a more just and humane institution.

Studies in Graduate and Postdoctoral Education

2398-4686
DOI 10.1108/SGPE-07-2020-0042

The life of a graduate student involves a host of micro-level interactions with faculty and peers in advising, research and other close-knit learning environments (Posselt, 2018; Gardner and Holley, 2011; Gildersleeve *et al.*, 2011). Research in psychology and organizational behavior demonstrates how the quality of these seemingly small interactions shapes youth and adult wellbeing (Dimotakis *et al.*, 2011; Frederickson, 2000), with patterns of discriminatory, competitive and supportive interactions bearing strong relationships with subjective wellbeing and mental health outcomes (Posselt and Lipson, 2016; Araújo and Borrell, 2006; Finch *et al.*, 2000; Mays and Cochran, 2001). There is rising concern about racial discrimination's effects on mental health, both within societies (Elias and Paradies, 2016; Wallace *et al.*, 2016), and in higher education (Hudson *et al.*, 2016; Pichardo *et al.*, 2020) as well as a specific need for knowledge about graduate student mental health (Muller, 2014; Tsipursky, 2015). Therefore, the purpose of this paper is to offer the first large-scale analysis of prevalence and risk factors for depression and anxiety, with special attention to the roles of interpersonal factors and how they interact.

Purpose

Burgeoning attention to the links between schooling and mental health (Halpern-Manners *et al.*, 2016; Roeser *et al.*, 1998; Wang and Sheikh-Khalil, 2014) has, for the most part, not been directed to graduate and professional education, defined here as both disciplinary graduate students and those in post-baccalaureate professional training programs (e.g. JD, MD). Yet fully one-third of US college graduates now pursue post-baccalaureate education (Posselt and Grodsky, 2017), and the prevalence of depression and anxiety among undergraduates is on the rise. A study in *Nature Biotechnology* found that graduate students are more than six times as likely to experience depression and anxiety as compared to the general population (Evans *et al.*, 2018). This reality is noticeable to administrators: nearly two-thirds of deans agreed in a survey by the Council of Graduate Schools that today's graduate students appear to struggle more with mental health than they did five years ago, (Okahana, 2018). Leaders responsible for budgeting and setting priorities in higher education need evidence of emerging changes to ensure that appropriate programming and supports are available to students who need them.

The US Centers for Disease Control describe nine dimensions of well-being: physical, economic, social, developmental, emotional, psychological, life satisfaction, domain-specific satisfaction and engaging activities and work (Centers for Disease Control, 2020). Graduate schools may not be able to meet all of these on their own, but it is clear that inadequate supports for well-being in the academy come with significant costs. Though borne most directly by students themselves, student anxiety and depression also affect the health of scholarly communities, institutions' financial interests and the labor market (Eisenberg *et al.*, 2009). Untreated mental health problems contribute to graduate student dropout (Eisenberg *et al.*, 2009; Turner and Berry, 2000; Wilson *et al.*, 1997), which is costly for students, universities that invest tuition and stipend support, and their professors' time and effort (Smith *et al.*, 2006). Mental illness may also place demands or risks upon family members or the wider communities in which students are situated (Marsh and Johnson, 1997). In academia, an enterprise focused on the life of the mind, mental health carries special salience and direct bearing on one's ability to fully engage in the work.

To summarize, rising rates of anxiety and depression in higher education, the costs of these disorders and the absence of large-scale multidisciplinary evidence motivate a closer look at prevalence and factors associated with anxiety and depression among graduate students. This paper addresses the following questions:

Q1. What are the prevalence of and risk factors for anxiety and depression in graduate and professional students, across fields of study and social backgrounds?

Q2. How do interpersonal factors – racial discrimination, support and competitiveness – associate with probabilities of positive screenings for depression and anxiety?

Q3. To what extent do perceived support and perceived competitiveness moderate relationships of discrimination with depression and anxiety?

Literature review

Graduate students have already persisted through many academic challenges, and are therefore more likely than the population at large to exhibit behaviors that contribute to positive mental health, such as resilience, goal-setting and self-regulation (Hoppmann and Gerstorf, 2016). Further, graduate students engage in problem solving and higher order thinking that requires brain activity found in neuroimaging studies to buffer individuals at risk for anxiety from worsening symptoms (Scult *et al.*, 2017). Perspectives like these are part of a growing positive psychology literature that explains and measures not only young adults' mental illness and psychological distress (Kessler *et al.*, 2002; Spitzer *et al.*, 1999) but also their thriving and flourishing [1] (Diener *et al.*, 2010; Feeney and Collins, 2015).

However, graduate students also have specific vulnerabilities with respect to well-being [2]. Onset of several mental illnesses often takes place when people are their early to mid 20's (Patton, 2012). Therefore, there is likely to be a higher prevalence of mental illness among graduate students because individuals in their 20*s* are more highly represented among graduate students. Further, research suggests several aspects of graduate learning environments that can compromise wellbeing and which may be modified: structures, negative interactions and disciplinary cultures. I review evidence for each of these.

Common structures of US graduate education

Basic structures of graduate education may compromise the foundation of students' financial, professional, social and emotional well-being. In the USA, students in most professional and masters-level programs must pay their own tuition and fees, and many take out loans to cover basic needs. These revenues help universities subsidize PhD programs, which often cover students' tuition, health care, and a modest stipend in return for part-time research or teaching assistantships. However, stipends for these positions are typically so low that PhD students may also struggle financially (Patton, 2012). A recent national study found that students from lower socioeconomic status, racially minoritized students, and women are much more likely to take out loans for graduate education than their more privileged counterparts (Pyne and Grodsky, 2020).

Graduate students also face distinct work-life pressures (Levecque *et al.*, 2017; Martinez *et al.*, 2013; Rummell, 2015) and the nature of their work can be isolating (Lovitts, 2002) – two trends associated with depression and anxiety (Cacioppo and Cacioppo, 2014). Steep learning curves for research, teaching and practice in graduate and professional programs are well-known, and may be emotionally daunting when combined with peer-to-peer comparisons, a competitive environment or insufficient mentoring. Feelings of inadequacy that threaten well-being are all too common (Muller, 2014). Meanwhile, cultural beliefs surrounding the qualities of a "good" graduate student [i.e. productivity, collegiality, concentration and intense focus and determination per Kyllonen *et al.* (2005)] intersect in problematic ways with such symptoms of mental illness as distraction, tiredness and periodic disengagement (Price, 2011). And because few universities have adequate mental health leave policies, students are often challenged to

"just keep going" or to leave if they begin to struggle; both choices can compound existing mental health issues (Hyun *et al.*, 2006; DePaola, 2019).

Negative interactions in graduate learning environments

The quality of faculty-student interactions is the strongest predictor of graduate degree completion (Lovitts, 2002). Yet faculty supervisory styles when working with graduate students often leave students with minimal job control and significant job demands, both of which are linked to mental health problems (Levecque *et al.*, 2017). The literature suggests two particularly toxic types of interactions: competition and discrimination.

Overt or subtle competitions for funding, status, faculty attention, and opportunities is part of a "professionalization process" (Margolis and Romero, 1998, p. 8) that can affect graduate student well-being. A survey of 3121 graduate students in four fields at a single university found that competitiveness among students, social support and financial confidence each bore significant relationships with mental health needs (Hyun *et al.*, 2006). Perceived competitiveness in undergraduate classes is associated with significantly higher probability of screening positive for anxiety and depression (Posselt and Lipson, 2016), and a recent survey found that competitiveness was the number one reason that graduate students cited for not pursuing a career as a professor (Russo, 2011).

Institutionalized and everyday forms of racism mean that students from minoritized backgrounds face barriers in the transition to graduate study (Bhopal *et al.*, 2020) and additional mental health threats once enrolled (Jochman *et al.*, 2019). Gildersleeve *et al.* (2011) summarized in a simple question – "Am I going crazy?!" – the refrain that Black and Latinx doctoral students expressed as they sought to make sense of racial microaggressions encountered in predominantly white graduate programs. Indeed, when surveying a national sample of US African American and Latino graduate students, the Council of Graduate Schools found 62% reported frequent or occasional worries about their mental or physical health (Sowell *et al.*, 2015, p. 38). Arday (2018) found that among 32 racially minoritized university students in the UK, students who use campus mental health services experience overt discrimination and lack access to counselors who can provide culturally attuned counseling and support. In short, both in day-to-day academic life and in the provision of mental health care, racial discrimination may be commonplace.

Disciplinary and professional cultures

Only one published study, of graduate students in four disciplines at the University of Arizona, has compared mental health risks across fields (Hyun *et al.*, 2006). Through logistic regression, students in the humanities were identified with significantly higher probability of reporting an emotional or stress problem affecting their well-being or academic performance in the past year. However, distinctive cultures within disciplines and professions have distinct socialization processes, so graduate education fields may come with varying depression and anxiety prevalence. Lawyers, for example, have rates of depression 3.6 times higher than the general population (Eaton *et al.*, 1990). As early as the first-year of law school, students develop higher rates of stress and alcohol abuse than medical students (Heins *et al.*, 1984), and rates of anxiety and depression only increase as they progress and enter the profession (Benjamin *et al.*, 1986). An intense focus on individual achievement and competition for grades (exemplified in curve-based grading), may contribute to this trend, especially paired with Socratic pedagogies and privileging linear thinking over creativity (Hess, 2002). Scholars have observed that these practices may breed defensiveness, pessimism and extrinsic motivation which compromise well-being (Eaton *et al.*, 1990). Other disciplines and professions have cultures with mental health risk profiles of their own.

Summary
Despite its growth in recent years, the existing literature on graduate student mental health suffers from measurement and substantive limitations. With respect to measurement, most research lacks generalizability and construct validity. First, no peer-reviewed research has sampled graduate students from multiple institutions and multiple fields of study, nor modeled social factors associated with mental illnesses using covariates to reduce the risk of omitted variable bias. A second measurement problem has been the tendency to infer student mental health from survey data about subjective feelings, which do not account for behavioral and normative dimensions of depression and anxiety (Perring, 2010). Substantively, only a small number of quantitative studies have captured personal and disciplinary characteristics' relationships to mental health, although research using qualitative methods has highlighted social dynamics like impostor syndrome, everyday racism and disciplinary cultures. The current study begins to address these gaps in the literature by analyzing three different types of interactions: discrimination, competition and support. Establishing the grounds for hypothesized relationships, on a mechanism level, is the focus of the theoretical framework.

A theoretical framework for (un)supportive interactions and mental health

The goal of understanding how graduate education environments and interactions may be associated with anxiety and depression is consistent with a social determinants view of mental health. This perspective emphasizes not only individual factors (e.g. genes, personality, age, social identities) that are associated with well-being but also factors within the environment such as the provision of basic needs, availability of support and quality of relationships (Braveman and Gottlieb, 2014). Theories of social factors' role in graduate student mental health can help scholars and practitioners make sense of prior research and set the stage for new analysis. For decades, the dominant paradigm for social factors in psychopathology followed the "stress process hypothesis," which explained depression and anxiety in terms of exposure to stressors (i.e. life events, chronic stressors) and protective factors like coping and social support. A shift in understanding, however, has acknowledged that support not only serves as a buffer, but also that "conflict, inhibited communication, and lack of stability in close relationships reduce the sense of support" (Coyne and Downey, 1991, p. 413). Theories in this tradition – including role strain, social support and self-determination – identify how supportive, competitive or discriminatory interactions might associate with both measures of depression and anxiety (Spitzer *et al.*, 1999) and subjective measures of distress (Kessler *et al.*, 2002).

Role strain

That systemic, role-related inequalities elevate stress more than isolated, short-term incidents (Kahn, *et al.*, 1964) is a well-established pattern that may help explain why people who identify with a socially marginalized group, on average, have higher probabilities of anxious or depressive symptoms. Originally introduced to understand "felt difficulty in fulfilling role obligations" (Moore, 1960), psychologists and sociologists have used role strain theory to understand role conflict (Davis, 2013; Lopez *et al.*, 2014), social participation and mental health (Shiba *et al.*, 2017) and leadership in diverse communities (Edwards, 2014). This work is sensitive to people's multiple social identities and the meanings that identities take on within their social contexts. Role strain is especially apt to occur when people are worried about meeting expectations that come with multiple roles (Goode, 1960).

Consistent with role strain theory, characteristics of disciplines, professions and relationships within them may constitute environmental risk factors that moderate or exacerbate individual-level vulnerabilities to depression and anxiety (Bowman, 2013). The academy was created by and for a mostly white, male population and its values implicitly privilege those groups (Bhopal *et al.*, 2020; Ahmed, 2012). This privileging may more inherited than intentional, but graduate students of color often experience stress from the mismatch between values with which they have been raised and prevailing values in their departments, disciplines and academia more broadly (Gildersleeve *et al.*, 2011; Antony and Taylor, 2000). Overlaid on everyday experiences with discrimination, graduate students of color experience academia's culture of academic competitiveness as racialized, which can threaten their sense of belonging, raise doubts about their sufficiency, and ultimately, prompt impostorism that is negatively associated with well-being and persistence (Posselt, 2018; McClain *et al.*, 2016). However, impostorism and role strain can be mitigated through third parties, such as mentors, who clarify role expectations and provide support in negotiating them (Edwards, 2014; Antony and Taylor, 2000).

Social support

Among the interactions potentially fostering wellbeing and flourishing amid environmental threats, none has been studied more often than support. Support has had a variety of conceptualizations since the inception of this literature in the 1970s (Cobb, 1976; Cassel, 1974), and within graduate education, students express needs for financial, academic, sociocultural and psychosocial supports (Posselt, 2018). Scholars have documented structural aspects of relationships and institutional affiliations (Bhopal *et al.*, 2020) and the experience of feeling supported in key mentoring relationships (Posselt, 2018; Kessler *et al.*, 1985; Litalien and Guay, 2015). The latter appears to provide a strong buffer against stress (Kessler *et al.*, 1985), which leads to questions about differences in the sources and quality of support available to graduate students by race, gender and class (Arday, 2018).

Self-determination theory

Manipulating support in specific social contexts has long been part of the empirical strategy for testing self-determination theory, which explains "how socio-contextual factors support people's thriving through the satisfaction of their basic needs for competence, relatedness, and autonomy" (Ryan and Deci, 2017, p. 3). Applying this theory has clarified how conditions within learning environments may thwart student well-being or can support their thriving and "optimal learning" (Guay *et al.*, 2008). A few such studies have focused specifically on graduate and professional education settings or students. For example, compared to on-campus students, graduate-level business students enrolled in online programs reported higher levels of anxiety, helplessness and anger (Butz *et al.*, 2015), which may be due to online education's loss of relatedness among students. And among PhD students, Litalien and Guay (2015) conclude that perceived support from one's advisor and other faculty is "the cornerstone" of degree completion, indirectly shaping degree completion outcomes via autonomous and controlled regulation.

Hypothesized relationships

The perspectives discussed in this section should not be thought of as a causal framework, but more modestly, as explanations for hypothesized associations and interactions. Conditions in learning environments may prompt symptoms of anxiety, depression and flourishing; however, those same symptoms may also affect selection into particular fields of study or may lead students to perceive learning environments and interactions as

competitive or unsupportive. The potential for bidirectional relationships with use of cross-sectional data implores descriptive, not causal, analysis.

The preceding research and theory compelled the measurement of mental health correlates at three levels of analysis: disciplines/professions, individual students and the nature of interactions and relationships. At the *disciplinary/professional field level*, I hypothesized heterogeneity in the prevalence of mental illness. I also hypothesized that students in varying disciplines and professions would have varying odds of depression or anxiety, all else being equal. Research implies, for example, that anxiety and depression risks may be higher among students in fields where creativity is a focus of assessment, for students may struggle to gauge their competency or the quality of their work relative to an advisor's or field's standards.

At the individual level, self-determination theory suggests that students who identify with groups whose competency and/or belonging have been called into question in the academy – such as women, Black, Latino and LGBTQ students – may have higher odds of screening positive for these conditions, all else equal. Here, I reiterate that it is not a person's identity that is the mechanism explaining a relationship with depressive or anxious symptoms, but rather the quality of interactions and experiences that are more likely to occur within systems marked by discriminatory or marginalizing power relations.

This brings us to the *level of interactions and relationships*. Graduate students who endure frequent slights, microaggressions and other forms of racial discrimination may question their belonging (a corollary to relatedness) and competency (Gildersleeve *et al.*, 2011), and therefore were hypothesized to have a higher probability of symptoms consistent with anxiety or depression. Perceptions of competitiveness in classes were similarly expected to positively relate to the odds of screening positive for anxiety and depression, because competitiveness may stimulate doubts about belonging. Competitiveness signals some students are more competent than others with the subject matter and/or task at hand. The quality of interactions and relationships with one's faculty, peers, and family are formative to graduate students' self-concept, perceived support and belonging (Posselt, 2018; Lovitts, 2002; Curtin *et al.*, 2013).

Finally, support and competitiveness are not orthogonal to discrimination. Social support and role strain theory, combined with research on sources of support that matter most to graduate students, suggest that:

- strong social support may buffer students from role-related threats to well-being; and
- heightened competitiveness may exacerbate role-related threats.

Therefore, I hypothesized strongly supportive relationships with friends, family and/or faculty would be associated with lower probabilities of anxiety and depression. I also expected that the increase in probability of depression observed with frequent racial discrimination would be:

- lower when students also experience strong support from their friends; and
- higher when a student perceives their classes as very competitive.

Design/methodology/approach

Data

Data come from the 2007–2013 administrations of the Healthy Minds Study (HMS), an annual Web-based survey of mental health and related issues as well as service utilization

among students in over a hundred postsecondary universities across the country. The survey was written by Healthy Minds Network co-directors Dr. Daniel Eisenberg and Dr. Sarah Ketchen-Lipson using an interdisciplinary public health framework designed to measure population-level, biopsychological conceptualizations of mental health. Survey modules vary year to year but consistently include academic, relational and individual characteristics and behaviors, as well as validated measures of anxiety and depression, the focus of research in this paper. It takes approximately 12–16 min to complete, depending on whether the respondent has used mental health services. A strength of the instrument is its use of widely validated, reliable screening tools for mental health conditions that can be used regardless of a respondent's diagnostic or treatment history (additional detail about key measures is provided below).

With respect to ethical considerations, this study was approved by the Institutional Review Board at the University of Michigan. Respondents consent to their de-identified responses being used by institutional researchers and approved scholars in the Healthy Minds Network. The survey instructions outline the topics that will be covered, and respondents are clearly instructed that they have the option of skipping any question or set of questions they wish.

Sample

Any postsecondary institution can participate in the HMS. For participating institutions, the sampling frame includes all degree-seeking students (undergraduate, graduate and professional students). In institutions that enroll at least 4,000 students, 4,000 were randomly sampled, whereas all students were recruited from smaller institutions. Data were collected over one month each year. Students were asked via email to participate in the survey via e-mail, and were sent up to three reminders if they did not respond.

For the current paper, I examined data for graduate and professional students who completed the survey in these years (N = 20,888 across 69 universities). In this sample, 61.4% are female, 81.8% are 22–35 years old. Racially, 69.0% identify as white, 17.3% as Asian, 6.2% as Latino, 5.3% as Black, 1.9% as Arab American and 0.9% as American Indian. Among them, 62.2% were in masters-level programs, 26.7% in PhD programs and 5.7 and 6.7% in MD and JD programs, respectively. This share of masters students is lower than the 81.1% reported by the Department of Education in the national population of graduate and professional degrees awarded in 2012–2013; however, the gender distribution closely resembles the national population (National Center for Educational Statistics (NCES), 2014), and the racial/ethnic composition resembles the doctoral-degree earning population nationally (National Center for Educational Statistics (NCES), 2014). Supplementary materials are available for information about subject recruitment and the construction and application of sample weights.

Dependent variables: depression and anxiety

Symptoms of depression in the past two weeks are measured using the Patient Health Questionnaire-9 (PHQ-9), a validated screening instrument based on core symptoms of a major depressive episode over the past two weeks (Spitzer *et al.*, 1999). A binary measure (positive/negative screen) was created using the instrument's standard algorithm. Metaanalyses have indicated PHQ-9 sensitivity levels ranging from 77 to 80% and specificity of 92 to 94% in diagnosing major depression (Gilbody *et al.*, 2007; Wittkampf *et al.*, 2007). Internal consistency for this measure is high, in both previous studies with university students and in the current study (Cronbach's alpha = 0.84-87; Lipson *et al.*, 2016).

Similarly, the PHQ was used to measure anxiety (defined as symptoms of panic disorder and generalized anxiety disorder) over the past four weeks, and the standard algorithm was used to create a binary measure categorizing students as screening positive/negative for anxiety [3]. Both measures have been validated in diverse populations (Spitzer *et al.*, 1999). They found the sensitivity and specificity of the PHQ-9 for generalized anxiety disorder to be 63 and 97%, respectively, and subsequent studies have corroborated the validity of the measure (Löwe *et al.*, 2004). HMS changed the anxiety screen in 2013. Therefore, analyses of anxiety are limited to the 2007 to –2012 sample (N = 16,501 in 57 universities). Analyses for depression include students from 2007 to 2013 (N = 20,888 in 69 universities).

Independent variables

Table 1 displays all independent variables, covariates and their operationalizations. Analyses emphasized interpersonal factors and disciplinary variation; however, covariates include a variety of individual characteristics to reduce risk of unobserved variable bias.

Individual characteristics	Interpersonal factors	Disciplinary characteristics
Gender (1 = Female; 0 = Male)	Discrimination in the last year (1 = Often; 2 = Sometimes, 3 = Rarely; 4 = Never)	Degree program (Binary vars for JD, MD, PhD, Other; Masters excluded as reference)
Father Education (Binary vars for 'Less than College', 'Bachelors'; 'Graduate Edu' excluded as reference category)	Relationship status (1= Single, Divorced, Widowed; 0= Currently married or partnered)	High creativity field (1 = Humanities, Art, Architecture, Music; 0= Other fields)
Mother Education (Binary vars for 'Less than College', 'Bachelors'; 'Graduate Edu' excluded as reference category)	Classes very competitive (1/0)	Fields of study Art, Architecture, Business, Dentistry, Education, Engineering, Humanities, Information, Kinesiology, Law, Medicine, Music, Natural Resources, Natural Science, Nursing, Pharmacy, Public Health, Public Policy, Social Work (Social sciences excluded as reference)
Finances (Binary vars for 'Are a struggle', 'Are tight'; 'Are not a problem' excluded as reference category)	Degree of support from family (1–5, Likert)	
Sexual orientation (1 = Heterosexual; 0= LGBTQ)	Degree of support from friends (1–5, Likert)	
International (1/0)	Would speak to advisor if mental health affected acad performance (1/0)	
Age (Continuous)	Would speak to another professor if mental health affected acad performance (1/0)	
Exercise (1 = Less than 2 hrs/week, 0 = More)		
Reside on campus (1/0)		

Table 1.
Variables and operationalizations

Disciplinary and degree characteristics

Each student is identified with characteristics of their degree program and discipline, to measure:

- prevalence of depression and anxiety across fields; and
- correlates of mental illness in a multivariate context.

Specifically, the following characteristics are measured: degree program (MA, PhD, JD, MD), academic or professional field of study, and whether the field is known for assessments of creativity. Regarding the latter, humanities, arts, music and architecture are coded as Creative. Table 1 provides a full list of disciplines and professions included.

Individual characteristics

The models also include covariates for gender, age, race/ethnicity, citizenship, sexual orientation and parental education, which have been measured in previous research to associate with screening for depression and anxiety. I also measure subjective financial strain, using the items "Finances are a struggle," "Finances are tight," and "Finances are not a problem." Finally, given the important role of individual health behaviors, I measure students' self-reported:

- time per week spent in exercise; and
- whether they reside on campus.

Interpersonal factors

Following Seng *et al.* (2012) and Blanco *et al.* (2008), family, friend and faculty support are measured as interpersonal factors that may be associated with mental health outcomes and may moderate other relationships. Frequency of discrimination is measured with the following HMS survey item: "In the past year, how many times have you been treated unfairly because of your race, ethnicity, or cultural background?" Based on frequency and bivariate analyses with the dependent variable, we coded discrimination as 1= Often; 2 = Sometimes; and 3 = Never. Peer support is measured by the survey item: "My friends really try to help me." The model also includes two variables that indicate whether a student would talk to their advisor or another faculty member "If you had a mental health problem that was affecting your academic performance." Bivariate analyses and previous research indicated made clear that mental health risks of competition are evident at high levels of competition (Posselt and Lipson, 2016); therefore, competitiveness is coded dichotomously.

Data analysis

Descriptive

Descriptive analyses focused on distributional characteristics of the variables of interest, bivariate relationships between the independent and dependent variables, and the prevalence of depression and anxiety across fields of study. For the former, ANOVA and chi^2 analyses were used given the structure of the variables. To measure and compare heterogeneity in the prevalence of mental illness among disciplines/fields, I conducted a hierarchical cluster analysis, which groups fields of study as having a prevalence rate for depression that is significantly greater than, significantly less than, or not significantly different from the prevalence of depression in the sample as a whole. The process is repeated for anxiety, and the two sets of groupings are displayed as a linked system.

Multivariate

For multivariate analyses, binary dependent variables – positive screenings for depression and anxiety – motivated the estimation of separate logistic regressions. To assess how the quality of interactions and relationships, disciplines/professional fields and degree programs and individual characteristics would relate to the risk of a positive screenings for anxiety or depression on the PHQ, I entered these as separate blocks of variables, resulting in a total of six models. Table 2 reports odds ratios for the full models of anxiety and depression.

Additionally, to examine how support from family and friends may moderate the relationships of discrimination and competitiveness with depression and anxiety, interaction effects were estimated. Changes in the probability of depression and anxiety are tracked for different frequencies of discrimination (often, sometimes and never) at the lowest and highest levels of support from family and friends, respectively. For competitiveness, the probabilities of depression and anxiety screenings are compared for those who report very competitive and less competitive classes, and at the lowest and highest levels of support from family and friends, respectively. Findings are reported as average marginal effects, which represent the difference in the probability of the outcome when a specified variable changes (i.e. from 0 to 1 for binary variables) and other variables are held at the sample mean.

Fixed effects

Individual observations are nested in survey cohorts and post-secondary institutions. This clustering may introduce between-cohort and between-institution differences on variance in the outcomes. To reduce bias in estimates of key factors and mental health across survey years and universities, models included campus-level and survey year fixed effects.

Findings

Findings are reported in this section under the same categories of hypotheses and types of variables that were described above. First, variation by field in the prevalence and risks of depression and anxiety are presented. Then, several individual-level characteristics' associations are summarized, recognizing that their relationships with well-being signal the quality of graduate students' relationships, support and belonging. Finally, students' experiences with discrimination, and their perceptions of competitiveness and support in graduate learning environments are examined, individually and through interaction analyses.

Disciplines and professions: prevalence and risks of depression and anxiety

Figure 1 displays a hierarchical cluster analysis, which groups and compares disciplines/professional fields according to their prevalence of depression and anxiety, relative to prevalence in the sample overall. Three fields stand out for higher rates of both depression and anxiety: humanities, art and architecture. However, there are no fields that have both lower prevalence of anxiety and depression than the sample as a whole. Those fields with lower anxiety rates have higher or average prevalence of depression, and fields with lower prevalence of depression have average prevalence of anxiety. Three professional fields – engineering, medicine and business – have lower than average rates of anxiety. Students in engineering, however, screen positive for depression at significantly higher rates than the overall sample.

Unlike the hierarchical cluster analysis, which captures prevalence, the multivariate models estimate the odds, or risk, that students in a particular field of study will have a

Variable	Anxiety			Depression		
	Odds ratio		Lin. SE Err.	Odds ratio		Lin. SE
Discrim-often	3.041	***	0.657	2.308	***	0.431
Discrim-some	1.896	***	0.332	1.568	***	0.190
Discrim-rare	1.105		0.117	1.214	*	0.103
Compet-very	1.674	***	0.171	1.339	***	0.110
Support-family	0.784	***	0.027	0.793	***	0.022
Support-friends	0.937	†	0.038	0.890	***	0.029
Talk to advisor	0.665	***	0.059	0.608	***	0.046
Talk to other faculty	0.788	†	0.113	0.791	*	0.094
Single	1.049		0.093	1.608	***	0.107
Female	1.631	***	0.168	0.964		0.065
LGBTQ	1.825	***	0.214	1.455	***	0.149
International	0.548	***	0.086	1.049		0.102
Father- LT College	0.962		0.109	0.836	*	0.077
Father- BA/BS	0.998		0.104	0.860	†	0.072
Mother- LT College	0.937		0.111	0.923		0.091
Mother-BA/BS	0.911		0.101	0.874		0.080
Black	0.459	***	0.099	1.165		0.249
Latino	0.807		0.151	1.028		0.127
Amer Indian	1.718	†	0.496	1.254		0.325
Arab Amer	1.324		0.389	1.418	*	0.249
Asian Amer	0.762	†	0.113	1.078		0.110
Asian/Pac Island	1.021		0.649	0.381		0.250
Age	0.934	*	0.028	0.949	*	0.023
Exercise- LT2hrs/wk	1.430	***	0.119	1.636	***	0.106
Finances-struggle	3.186	***	0.392	2.272	***	0.223
Finances-tight	1.323	*	0.150	1.229	*	0.101
Reside on campus	0.752		0.126	0.970		0.111
Degree- JD	0.489	*	0.171	1.218		0.328
Degree-MD	0.442	**	0.117	0.549	**	0.112
Degree-PhD	1.118		0.137	1.179	†	0.106
Creative field	1.097		0.380	2.031	†	0.768
Humanities	1.018		0.329	0.857		0.322
Nat Sci	1.408	*	0.231	1.251	*	0.143
Art	1.434		0.450	0.647		0.237
Architecture	1.381		0.477	0.783		0.312
Business	1.102		0.202	1.124		0.150
Dentistry	0.973		0.496	1.302		0.613
Education	1.007		0.136	0.927		0.112
Engineering	0.958		0.179	1.256	†	0.149
Information	1.060		0.339	1.672	*	0.438
Kinesiology	0.827		0.363	0.828		0.296
Law	2.117	*	0.686	0.848		0.222
Medicine	1.215		0.258	1.349	†	0.239
Music	0.789		0.357	1.015		0.438
Natural Resources	0.986		0.278	0.984		0.233
Nursing	0.939		0.268	0.871		0.203
Pharmacy	0.821		0.318	0.532	†	0.201
Pub health	0.955		0.189	0.884		0.149
Pub policy	1.093		0.342	1.036		0.260
Soc work	1.054		0.189	0.923		0.187

Table 2.
Multivariate logistic regressions, with survey year and campus fixed effects

Notes: Models include campus and survey year fixed effects; Reference categories are Father graduate degree, Mother graduate degree, White, Finances not a problem, Degree-MA/MS, Social sciences; $^{\dagger}=p<0.1$; $^{*}=p<0.05$; $^{**}=p<0.01$; $^{***}=p<0.001$; Sample for anxiety models covers 2007–2012 cohorts; Sample for depression models covers 2007–2013 cohorts

positive anxiety or depression screen in specific fields of study. Comparisons are made to a referent field, in this case social sciences. In four fields, students have significantly higher risk of depression than do students in the social sciences: natural sciences, engineering, pharmacy and information. Students in natural sciences and law have significantly higher risks of anxiety, all else in the model held equal. Students in creatively oriented fields (humanities, art, architecture and music) are more than twice as likely to screen positive for depression. Patterns of self-selection into such fields should be considered as an explanation for this, alongside the possibility that the opacity of quality standards within these disciplinary cultures put students at greater risk for depression.

Individual characteristics

Across fields of study, women have 63% higher risk than men of screening for anxiety, but their odds of depression do not vary from men's, all else in the model held equal. On average, students who regard their current finances as "a struggle" have 2.3 times the risk of depression and 3.2 times the risk of anxiety over students who see finances as "not a problem." Students who describe finances as "tight" also have elevated risks of depression and anxiety. Survey respondents who self-identified as lesbian, gay, bisexual, transgender, queer or questioning (LGBTQ) have 83% higher odds of screening positive for anxiety than students who identify as heterosexual and 46% higher odds of depression. Put in terms of prevalence, 19.2 and 14.8% of LGBTQ graduate students screen positive for depression and anxiety, respectively, compared to 12.5 and 7.7% of straight students. Among racial/ethnic groups in the sample, identifying as Arab American is associated with the most elevated risk of a positive screen for depression, compared to students who identify as white. This finding is notable because the relatively small number of Arab American students in this sample ($n = 385$) depresses the likelihood of finding a significant relationship.

Interactions and relationships in graduate learning environments

Racial discrimination

In the multivariate models (Table 2), one of the most potent risk factors for depression among graduate and professional students was frequently experiencing racial discrimination. Students who report experiencing discrimination "often" over the past year have a 2.3 times higher odds of depression compared to those who report never experiencing it, all else in the model held equal. Discrimination is an even stronger risk factor for anxiety than depression. Compared to those who never experience racial discrimination, graduate students who often endure discrimination have 3.0 times higher risk of reporting clinical

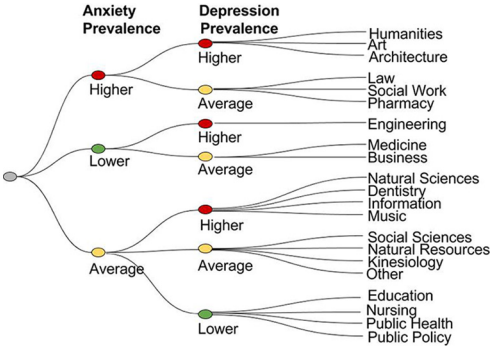

Figure 1.
Hierarchical cluster analysis of anxiety and depression prevalence, by field

symptoms of anxiety, and the risk is 1.9 times higher for those who experience it sometimes. Black students are most likely to report frequent discrimination, but with all else equal they have 54% lower odds than white students of screening positive for anxiety. Prior research suggests that a strong ethnic identity buffers discrimination's negative effects on mental health (e.g. Mossakowski, 2003). Figure 2 displays the prevalence of depression and anxiety by race/ethnicity.

Competitiveness and support

Students who perceive high levels of competitiveness are also more likely to report symptoms of mental illness. Compared to students who see their classes as less competitive, those who describe their classes as "very competitive" have 67% higher odds of screening for anxiety and 34% higher odds of screening for depression. Higher levels of support from both friends and family are associated with lower risk for both anxiety and depression. Graduate and professional students who feel that they could speak to their advisor about mental health issues have 34% lower odds of screening for anxiety and 39% lower odds of screening for depression, all else in the model held equal.

The final set of analyses tests whether support from family and friends, and perceived competitiveness in one's classes, may moderate the relationships of discrimination with depression and anxiety. To do so, I compute average marginal effects for the five levels of support, at different frequencies of discrimination (Table 3). For students who report the

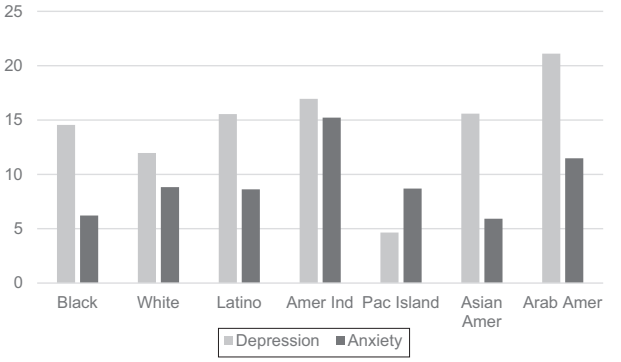

Figure 2.
Prevalence rates of depression and anxiety, by race/ethnicity

Table 3.
Average marginal effects (dy/dx) for discrimination, by support and competitiveness

Outcome	Frequency of discrimination	dy/dx Low friend support	High friend support	Low family support	High family support	Very competitive classes
Anxiety	Often	10.3***	8.25***	15.12***	8.01***	11.22***
Anxiety	Sometimes	5.62***	4.49***	8.26***	4.37***	6.11***
Anxiety	Rarely	0.8	0.6	1.1	0.6	0.6
Depression	Often	12.31***	9.06***	14.79***	8.93***	10.67***
Depression	Sometimes	6.68***	4.91***	8.02***	4.84***	5.76***
Depression	Rarely	2.96*	2.06*	3.36*	2.03*	2.42*

Notes: *=$p < 0.05$; **=$p < 0.01$; ***=$p < 0.001$; dy/dx values represent the percentage point difference in probability of the outcome for a student reporting the lowest and the highest levels of friend and family support, as well as in very competitive classrooms compared to less competitive classrooms

lowest level of support from friends, frequent racial discrimination is associated with 10.3 and 12.3 percentage point increases in the probabilities of screening positive for anxiety and depression, respectively. For students reporting the highest levels of support from friends, on the other hand, increases in the probabilities of anxiety and depression with frequent racial discrimination are smaller: 8.3 and 9.1 percentage points, respectively. Students reporting the lowest levels of family support have 15.1 and 14.8 percentage point increases in the probability of anxiety and depression when they experience frequent racial discrimination; however, at the highest levels of family support, the mental health risks of frequent racial discrimination are significantly reduced. These findings provide consistent support for the proposition that support from family and friends may buffer students experiencing racial discrimination from mental health risks.

Finally, I calculate average marginal effects to compare how perceptions of competitiveness in one's classes may amplify mental health risks associated with discrimination. Indeed, among students who perceive their classes as very competitive, frequent racial discrimination is associated with probabilities of anxiety and depression that are 11.2 and 10.7 percentage points higher than they are for students who read their classes as less competitive.

Originality/discussion

This paper offers the first multi-institutional, multi-disciplinary analysis of graduate and professional students' mental health in the USA. It improves on the generalizability of past research and, through established measures of depression and anxiety validated for diverse populations, offers robust grounds for discussion of anxiety and depression. It compares the prevalence of these conditions in various fields of study, and measures individual, relational and disciplinary risk factors for these mental health conditions. Strong relationships of racial discrimination and financial strain with depression and anxiety are among the most notable findings, suggesting two critical areas for policy, universities and graduate education leaders to intervene. Even among students who have strong support from family and friends, graduate and professional students in this sample who experience frequent discrimination have higher probabilities of anxiety and depression, all else in the model held equal. The research and practical implications of these findings are described in detail below.

Negative associations between support from friends with depression and anxiety, and a positive relationship of competitiveness in one's courses with depression and anxiety provide support for the notion that the quality of one's interactions and relationships with peers matters to graduate student mental health. However, as with all analyses in this study, which used cross-sectional data, these findings should be interpreted as detailed descriptive analyses – not causal. Students with symptoms of depression or anxiety may also be more inclined to view classes as competitive or peer relationships as less supportive. It is also important to note that only the highest levels of competitiveness related to depression and anxiety, suggesting some competition is positive or neutral, but that too much may compromise well-being.

Three of the four fields that were coded for a focus on creativity – humanities, art and architecture – were identified in the hierarchical cluster analysis for a significantly higher prevalence of both anxiety and depression. Hyun *et al.* (2006) also found that graduate students in the humanities have elevated mental health risks. It may be that in competitive environments and in other settings where creativity is being directly evaluated (i.e. where standards of excellence are therefore more likely to be opaque or individualized), social comparison is more common (Dijkstra *et al.*, 2008), either because students perceive a zero-sum-game about success (which pits students against each other) or because quality

standards are ambiguous. In the USA, the labor market is also uncertain for graduates in the humanities and the arts, which may amplify anxiety. This is consistent with Siegrist's (1996) finding that high-effort, low-reward experiences carry adverse health effects.

At the individual student level, higher odds of depression and anxiety were found among LGBTQ students. Women have higher odds of screening positive for anxiety, but not for depression. An unexpectedly strong finding was that graduate and professional students who felt that their finances were a struggle had 2.2 times the odds of depression and 3.2 times the risk of anxiety compared to those who felt finances were not a problem. Those who felt finances were tight also had elevated risk. Although the quality of social interactions was the focus of this study, these greatly increased risks suggest an urgent need to attend to financial support alongside emotional and social support for graduate students. Parental education was associated with depression but not with anxiety, suggesting that financial strain should not be conflated with social origins. Unfortunately, this data set did not contain information about respondents' educational debt or current financial aid, which would help with interpretating financial strain as a risk factor. Future research should investigate these dynamics, especially amid growing concern that investments in graduate education are not consistently yielding anticipated labor market benefits.

Research limitations and implications

Several limitations of this work bear mentioning and help motivate research implications. Although school-level data is available, space precluded a full analysis of between-school variation. Also, to ensure adequate sample sizes for populations that are often underrepresented in graduate education, I included as many HMS survey years as possible; however, this limited me to survey items that were included in all years of the survey's administration, potentially omitting important factors (e.g. sleep, perceived department support for mental health). In sensitivity tests that stratified the sample to include only the cohort(s) for which these variables were available, they were not significantly associated with depression or anxiety, *ceteris parabis*. Academic performance may also be associated with graduate student mental health, but the only variable on the HMS instrument that could be used as an indicator – grade point average – was missing for the majority of survey respondents. In both bivariate ANOVA tests and multivariate models estimated only with those cases for which GPA was available, GPA did not have a significant relationship with depression or anxiety [4].

Going forward, to advance knowledge about the role of mental health among graduate students, we need to continue building generalizable data and reliable, valid measures. Adding additional items about and/or measures of student mental health to national, longitudinal surveys, for example, would allow for tracking and explaining student health through educational trajectories. Additional quantitative research is also needed about:

- the mechanisms of financial strain in student well-being;
- social psychological assets for underrepresented student thriving (e.g. self-efficacy, racial identity); and
- observable measures of competitiveness and support.

A strength of this study is its use of the PHQ to measure depression and anxiety; however, I do rely upon subjective self-reports of competitiveness, support and financial strain. Studies could assess whether specific changes like eliminating grades or improving faculty mentoring skills are associated with student wellbeing. The impact of participation in institutional well-being initiatives (e.g. mindfulness training, peer support programs,

utilization of mobile apps or other online resources sponsored by a university) could also be measured, perhaps even through a randomized control trial.

Qualitative research could uncover alternative explanations for the relationships studied here. I measured specific types of interactions (e.g. discrimination, competitiveness) that may threaten students' developing sense of belonging, competence and autonomy – and how support from key sources provides a buffer for the negative consequences of such interactions. Ong and Burrow (2018) found reactivity to discrimination explains its relationship with mental health outcomes. However, scholars should more directly study cultural and racialized dynamics within disciplines, professions and graduate programs which shape student and faculty well-being. Such inquiry could uncover racialized practices that shape disproportionate attrition from graduate programs and academia, for what appear to be "normal" occurrences of attrition may be intertwined with racism and mental health in ways that we have yet to fully acknowledge (Price, 2011). We need to document the specific cultural disconnects between values and practices that encourage advancement within a field/profession vs those that are known to support human flourishing. Scholars have developed such a literature about law and law school, but the current analysis suggests that research may also be particularly necessary into cultures within the humanities, arts and architecture, where prevalence of anxiety and depression symptoms is high. By contrast, students have lower rates of anxiety in engineering, business, and medicine where the job market for graduates is secure. This combination begs potential research questions: How do students and scholars make sense of their trajectories when standards for the work seem ambiguous – or when the job market is uncertain at best?

Practical implications

How we structure graduate education has real consequences. Just as many universities and departments are considering how to make their environments more conducive to gender and racial diversity at the graduate levels, findings here indicate that we must consider how everyday behaviors and patterns of interaction can carry costs for well-being that could be creatively mitigated. Here, I draw attention to three broad strategies.

Addressing discrimination

The racial/ethnic groups with the highest prevalence of depression were Arab Americans, American Indians and Asian Americans – populations whose experiences with racism on campus have received relatively little attention. In addition to improving our understanding of racism targeting these groups, strong and clear relationships between frequently experiencing racial discrimination and depression/anxiety suggest several implications. Policy should hold faculty accountable to one another, their institutions and their students for eliminating discriminatory behaviors of all kinds. Academic institutions need to document patterns of mistreatment and discrimination that students of color experience. To lower the bar for reporting such behavior, institutions without an ombudsperson in place should consider appointing a person to this role. Further, although graduate programs may not be able to assert control over discrimination that students experience outside the program and/or university, they should take action to ensure protection from bias and discrimination in labs, classrooms, field sites, and faculty offices. Practical steps to this end include selection and training of faculty and graduate students for what Twine (2004) and Harper (2016) call racial literacy (as cited in Flaherty, 2016). The ability to teach and mentor effectively with a diverse student population ought to be expected and rewarded in the scope of what it means to be an effective professor. In this training, opportunities for learning about racism must not stop at implicit bias; academia as an institution needs to build critical

racial consciousness that recognizes the varied manifestations of racism, how they affect student well-being, and how individuals' own teaching, mentoring and research practices may be implicated in this.

Make graduate student well-being an issue of shared responsibility

Bringing realities of racism and graduate student mental health into the open can only serve to enrich initiatives to improve graduate education, including the training of professors to support students from diverse backgrounds. Krieger (2002) found that professors are often in denial about the state of student mental health, mistakenly assuming that most psychological problems precede enrollment and viewing student well-being as outside the scope of their responsibilities. They worried, too, that a more open discussion could call into question entrenched qualities of academic culture (Krieger, 2002). Indeed, symptoms of mental illness intersect problematically with such cherished values in the academy as productivity, independence, rationality and collegiality (Price, 2011, p. 5), which have bearing on developing graduate students' legitimacy.

In the current study, more than 70% of respondents indicated that they would not speak with their advisor or other faculty if mental health issues interfered with their academic performance. The data cannot distinguish whether the *topic* is viewed as unsafe to discuss and/or whether students do not see their *faculty* as safe to disclose how mental health is affecting their work. And, as with other relationships in the model the causal arrow's direction(s) are impossible to entirely tease out; it is possible that respondents' symptoms of anxiety or depression affect their willingness to hypothetically discuss mental health. Regardless, knowing that mental health predicts degree completion among graduate students (Eisenberg *et al.*, 2009), faculty need to be part of a graduate student's community of support, and advisors should be involved in the conversation when mental health threatens student progress. Professional development for mentors on fostering well-being can both raise attention to the ways their supervision affects students and build mentors' capacity to initiate conversations if concerns about mental health arise.

Ensure adequate supports for student well-being

Well-being is multi-dimensional (Centers for Disease Control, 2020), which compels a need to think holistically about the supports that will contribute to graduate student well-being. This study's findings illustrate in particular the need for graduate schools and programs to revisit the quality of financial, mentoring and social supports they provide for students. Graduate student frustration with engrained racism and low pay for their labor has sparked protests and even strikes in US universities. These protests should be interpreted as indicative of the urgent need for institutions and federal agencies to look seriously at the sustainability of their current systems of supporting students as whole people.

As mentioned above, other necessary structural supports involve developing faculty skill in teaching and mentoring, especially across race and gender (Posselt, 2018). Professors need to develop their ability to organize their courses and labs for student health, and to recognize when it may be necessary for them to make referrals for mental health. Presently, there is neither incentive nor accountability for faculty with respect to the quality of supervision they provide: "Unless students drop out," Loissel (2019) wrote, "there are no penalties for labs where trainees are miserable." Recent studies in the UK context have found many supervisors feel poorly equipped to provide even basic support (Shaw, 2014) and may, themselves, be struggling in institutional environments that are not designed with wellbeing in mind (Guthrie, *et al.*, 2018).

In addition to critically examining institutional supports, universities can offer resources that build student capacity and habits to support their own well-being. At the University of California-Berkeley, the Graduate Assembly (2014) argued, "To improve well-being, the university community must go beyond simply raising awareness and help enable beneficial behaviors." Building everyday habits that support mental health – including adequate sleep, nutrition, and, as this study found to be a significant covariate, regular exercise – starts during the transition to graduate school as students adjust to a new lifestyle and develop their professional identity. Field *et al.* (2013) noted in their study of law students the potential of "professional identity to harness intrinsic motivations" (p. 6), and recommended that first-year law curriculum create opportunities to "reflect on the connections between intrinsic rewards, their well-being, and their potential future careers" (p. 7). Brannock *et al.* (2000) and Smith *et al.* (2006) have proposed stress management classes for doctoral students. There is also a growing evidentiary base that reframing the experience of stress itself may enable coping. Crum (2013) found that whether one views stress as detrimental or performance-enhancing was strongly associated with physical manifestations of stress; short video interventions can promote a performance-enhancing mindset. In addition to creating less stressful environments, institutions should consider how they prime students to make sense of, and cope with, the stress that graduate education will inevitably entail.

Conclusion

The paper offers the broadest base of evidence to date – covering 69 universities, 20 fields of study, six years of data and more than 20,000 students – about patterns that are usually experienced at the individual level or analyzed institution-by-institution and field-by-field. In three fields of study – humanities, art and architecture – depression and anxiety are significantly more prevalent than in the broader graduate student population, and attention to well-being may be especially warranted. The theoretical framework and multivariate results, though not causal, clarify how organizational and individual factors in graduate students' mental health may be intertwined through competitive, discriminatory or supportive interactions with peers, faculty, family and friends. As we strengthen the mental health infrastructure in graduate education, findings clarify a need for awareness of both the contexts and interactions through which graduate students advance knowledge (e.g. disciplinary cultures, mentoring relationships, graduate student community) as well as the funding, policies and practices that determine whether students can meet their basic needs.

Notes

1. Flourishing is defined by Ryan and Deci (2017) as "becoming motivated, vital, resourceful, and fully functioning adults. Flourishing individuals feel both empowered and confident in their learning and problem solving and feel a sense of belonging to their schools and the larger community" (p. 354).
2. For example, Eisenberg *et al.* (2009) named persistence and performance as two margins of a broader mental health-academic outcomes relationship. However, they also acknowledged "that it is difficult to imagine variation in mental health problems that is clearly exogenous with respect to academic outcomes" (p. 2).
3. Cut-off scores to create the binary measure followed Manea *et al.*'s (2012) analysis of optimum cut-off scores using the PHQ.
4. Recent academic successes and struggles, not the longer-term performance captured by GPA, may be more likely to manifest in the short-term measures of depression and anxiety in the PHQ.

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