

## Evidence for a mental health crisis in graduate education

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**With mental illness a growing concern within graduate education, data from a new survey should prompt both academia and policy makers to consider intervention strategies.**

There is a growing cry for help from graduate students across the globe who struggle with significant mental health concerns<sup>1</sup>. Despite increased discussion of the topic, there remains a dire need to resolve our understanding of the mental health issues in the trainee population.

Recent research on mental health in the trainee population has focused on within-institution cohorts, such as the 2014 UC Berkeley report<sup>2</sup>, which found that 43–46% of graduate students in the biosciences were depressed, and the 2015 University of Arizona report<sup>3</sup>, which found that a majority of doctoral students reported “more than average” current stress or “tremendous” stress and endorsed school and education-related issues as the most significant contributors to their stress. Although these studies demonstrate the mental health concerns in this population, more research is needed to better define the prevalence of mental health issues and the role of key variables such as gender, mentorship relationships and perceived work–life balance on susceptibility to mental health struggles in the trainee population.

In order to address gaps in the understanding of mental health prevalence in the graduate

trainee population, we deployed a comprehensive survey that included clinically validated scales for anxiety (GAD07) and depression (PHQ09) via social media and direct email. We surveyed a total of 2,279 individuals (90% PhD students and 10% Master’s students). Respondents were from 26 countries and 234 institutions (**Supplementary Tables 1 and 2**) and represented diverse fields of study including, biological/physical science (38%), engineering (2%), humanities/social sciences (56%) and “other” (4%). The data presented here demonstrate that the graduate trainee community has a considerable prevalence of individuals with anxiety and depression. Although this is a convenience sample in which respondents who have had a history of anxiety or depression may have been more apt to respond to the survey, the data should prompt both academia and policy makers to consider intervention strategies.

### Mental health crisis in the graduate student population

Our results show that graduate students are more than six times as likely to experience depression and anxiety as compared to the general population. Forty-one percent of graduate students scored as having moderate to severe anxiety on the GAD07 scale as compared to 6% of the general population, as demonstrated previously<sup>4</sup>. Additionally, 39% of graduate students scored in the moderate to severe depression range in our study, as compared to 6% of the general population measured previously with the same scale<sup>5</sup> (**Fig. 1a**). In order to better understand the factors influencing this significantly higher prevalence of anxiety and depression in this population compared to the general population, we also examined their prevalence across genders and in association

with perceived work–life balance and mentorship quality.

The transgender and/or gender-nonconforming population faces an increased risk of depression and anxiety<sup>6</sup>. Further, women consistently are more likely to suffer from mental health disorders than men<sup>7</sup>. Our results corroborate these findings within the graduate trainee population; both transgender/gender-nonconforming and female graduate students are significantly more likely to experience anxiety and depression than their male graduate student counterparts (**Fig. 1b**). Our study found that the prevalence of anxiety and depression in transgender/gender-nonconforming graduate students was 55% and 57%, respectively, compared with their nongender minority counterparts (43% and 41% in females and 34% and 35% in males, respectively).

Work–life balance is associated with physical and mental well-being, and among academic faculty there are long work hours and varying degrees of work–life balance as a result<sup>8</sup>. However, little is known about work–life balance in the graduate trainee population. Our respondents were asked if they agree with the statement, “I have a good work–life balance.” Of the graduate students who experienced moderate to severe anxiety, 56% did not agree with this statement versus 24% who agreed (**Fig. 1c**). Additionally, of those graduate students with depression, 55% did not agree with the statement versus 21% who agreed. These results show that good work–life balance is significantly correlated with better mental health outcomes.

Lastly, the principal investigator (PI)/advisor relationship with graduate students affects the quality of training in graduate education<sup>9</sup>. Therefore, it is alarming to find

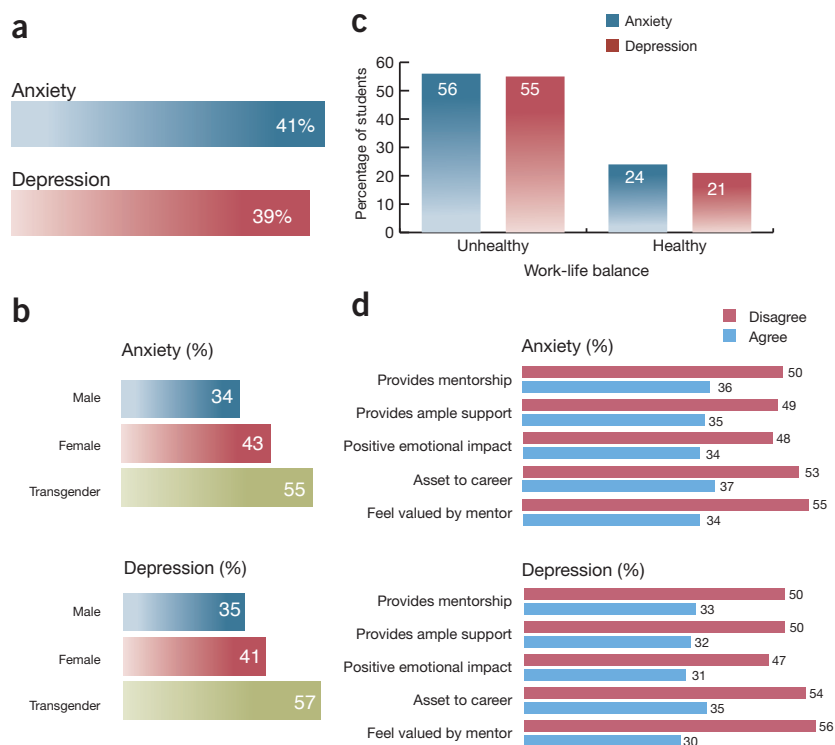
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**Figure 1** The prevalence of anxiety and depression within the population of graduate students studied. (a) Overall prevalence. (b) Prevalence of anxiety and depression by gender. (c) Effect of perceived work-life balance. (d) Effect of relationship with mentor (see **Supplementary Data**).

that of graduate students who experienced anxiety and/or depression, 50% did not agree with the statement that their PI or advisor provides “real” mentorship as compared to 36% and 33% who agreed, respectively (**Fig. 1d**; see **Supplementary Data**). The majority of those who experienced anxiety (49%) and depression (50%) disagreed with the statement that their PI/advisor provides ample support versus 35% and 32% who agreed. When asked if their PI/advisor positively impacts their emotional or mental well-being, 48% with anxiety and 47% with depression did not agree versus 34% and 31% who agreed. Further, the majority of graduate students experiencing anxiety and/or depression did not agree with the statements that their PI/advisor is an asset to their career (53% and 54% versus 37% and 35% who agreed) or that they feel valued by their mentor (55% and 56% versus 34% and 30% who agreed). These data indicate that strong, supportive and positive mentoring relationships between graduate students and their PI/advisors correlate significantly with less anxiety and depression.

**Intervention strategies**

**Enhanced access to mental health support.**

There has been a keen focus on building the biomedical workforce of tomorrow among

graduate institutions and the US National Institutes of Health (NIH). The NIH has provided a model through efforts such as the Broadening Experiences in Scientific Training (BEST) award program and within the NIH campus through establishing the Office of Intramural Training and Education that houses many programs to support the career development of intramural trainees. Although these resources have served as a scaffold for the development of local programs at many graduate institutions, there are still many universities that lack adequate career and professional development programs.

Career development encompasses many skills that are vital to graduate student success but is often not included under this umbrella as mental health<sup>10</sup>. We believe that our data support the need for a more comprehensive development of more adequate career development offices across institutions to ensure that they can serve to educate students about mental health and refer those who need mental health support. Establishing this infrastructure is a foundational step for institutions to ensure that students are prepared to become the biomedical workforce of tomorrow. Further, creating programs and interventions within career development offices that promote mental

health will result in a competitive advantage for institutions and increase retention, thus strengthening the bioscience workforce pipeline.

**Call for cultural change.** There is a grave need to educate faculty about the impact of graduate education on the mental health of graduate students. The NIH Office of Intramural Training and Education recently used a train-the-trainers model at a highly successful event where career development leaders trained the next generation of career development professionals on topics that are vital to their success<sup>11</sup>. Using a similar train-the-trainers model, faculty and administration could be trained by mental health professionals to ensure that those in a position to directly support graduate students are equipped to identify student mental health needs and provide adequate guidance and referrals as needed. This model could also be used by career development professionals to provide faculty with training in the fundamental skills and knowledge needed to mentor today’s PhD students in the vast and ever-changing job market.

Many in academia have spoken out about their own mental illnesses and the stigma they faced within the academic community. Fears of not gaining tenure or judgments being cast by colleagues are just a few of the major concerns faced by those who suffer from mental health disorders in academia<sup>12</sup>. Fundamentally, data such as ours call for a shift in the culture within academia to eliminate the stigma and ensure that students are not reluctant to communicate openly with their faculty advisors.

Work-life balance is hard to attain in a culture where it is frowned upon to leave the laboratory before the sun goes down. The stress of increased pressure to produce data in order to compete for funding has increased exponentially, and science fields are feeling immense pressure<sup>13</sup>. Faculty and administrators must set a tone of self-care as well as an efficient and mindful work ethic in order to move to a healthier work and education environment.

**Call to action.** These data demonstrate a critical need for additional studies that investigate intervention strategies that could address the mental health crisis in the graduate trainee population. It is only with strong and validated interventions that academia will be able to provide help for those who are traveling through the bioscience workforce pipeline.

**Conclusions**

Our studies show a high prevalence of anxiety and depression in a diverse graduate student

sample. The strikingly high rates of anxiety and depression support a call to action to establish and/or expand mental health and career development resources for graduate students through enhanced resources within career development offices, faculty training and a change in the academic culture.

*Note: Any Supplementary Information and Source Data files are available in the online version of the paper.*

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The authors declare no competing financial interests.

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