The Canadian Journal for the Scholarship of Teaching and Learning

Volume 12 | Issue 1 Article 2

Fall 09-20-2021

Concordance (or Discordance) Between Students and Staff/Faculty Perceptions of Student Stress in Science

A. Dana Ménard
University of Windsor, dana.menard@uwindsor.ca
Kendall Soucie
University of Windsor, ksoucie@uwindsor.ca
Sira Jaffri
University of Windsor, jaffris@uwindsor.ca
Chris Houser
University of Windsor, chris.houser@uwindsor.ca
Dora Cavallo-Medved
University of Windsor, dcavallo@uwindsor.ca

https://doi.org/10.5206/cjsotl-rcacea.2021.1.10810

Recommended Citation
Ménard, A.D., Soucie, K., Jaffri, S., Houser, C., & Cavallo-Medved, D. (2021). Concordance (or discordance) between students and staff/faculty perceptions of student stress in Science. *The Canadian Journal for the Scholarship of Teaching and Learning, 12*(1). https://doi.org/10.5206/cjsotl-rcacea.2021.1.10810

Concordance (or Discordance) Between Students and Staff/Faculty Perceptions of Student Stress in Science

Abstract
The purpose of this study was to explore the experience and management of stress in science students and to evaluate concordance with faculty/staff members' appraisal of student stress. A survey was completed by 308 students and by 40 staff and faculty members. Students' stress levels were high but there were no differences based on demographic groups. Students' top stressors included workload, grades, career, time management, and anxiety. Faculty and staff members accurately estimated the level of undergraduate student stress but underestimated graduate student stress. They also demonstrated a good understanding of the role of specific academic stressors, but consistently overestimated the contribution of stress from other sources. Students described using a variety of different coping strategies, including social support, self-care, hobbies, and problem-solving.

L'objectif de cette étude était d'explorer l'expérience et la gestion du stress parmi les étudiants et les étudiantes en sciences et d'évaluer leur concordance avec l'évaluation du stress des étudiants et des étudiantes par les professeurs, les professeures et les membres du personnel. Un sondage a été mené auprès de 308 étudiants et étudiantes ainsi que 40 professeurs, professeures et membres du personnel. Les niveaux de stress ressenti par les étudiants et les étudiantes étaient élevés mais il n'y avait aucune différence basée sur les groupes démographiques. Les principaux facteurs de stress ressenti par les étudiants et les étudiantes étaient la charge de travail, les notes, les carrières, la gestion du temps et l'anxiété. Les professeurs, les professeures et les membres du personnel avaient estimé avec exactitude le niveau de stress ressenti par les étudiants et les étudiantes de premier cycle mais avaient sous-estimé le niveau de stress ressenti par les étudiants et les étudiantes des cycles supérieurs. Ils avaient également montré une bonne compréhension du rôle des divers facteurs de stress spécifiques à l'université, mais avaient systématiquement surestimé la contribution du stress causé par d'autres sources. Les étudiants et les étudiantes ont expliqué qu'ils faisaient appel à toute une variété de stratégies différentes pour gérer le stress, y compris le soutien social, les soins personnels, les passe-temps et la résolution de problèmes.

Keywords
student stress, leaky pipeline, coping strategies, faculty and staff; stress des étudiants et des étudiantes, canalisation qui fuit, stratégies de gestion, professeurs, professeures et membres du personnel

This research paper/Rapport de recherche is available in The Canadian Journal for the Scholarship of Teaching and Learning: https://doi.org/10.5206/cjsotl-rcacea.2021.1.10810

Student stress is a major concern across university campuses in Canada. In 2019, the National College Health Assessment (NCHA) administered by the American College Health Administration (ACHA) was completed by 55,284 students from 58 Canadian universities; 61.1% of participants described their stress levels as greater than average or tremendous. High stress levels in students are associated with lower grades, the development and/or exacerbation of mental health issues, delayed graduation, and increased rates of drop-out (Richardson et al., 2012; Shankar & Park, 2016). Stress may be a particularly salient issue for science students who must negotiate a heavy workload and intense time management commitments in both the field and lab (Smith & Cooke, 2011). However, institutional responses to student mental health have tended to take a "one sizes fits all" approach that does not account for differences between faculties. Although students are embedded within a wider academic community, researchers have often neglected to consider faculty and staff perceptions of student stress in their studies. Thus, the purpose of this study is threefold: (1) to explore the experience and management of academic stress for science students, (2) to evaluate the concordance (or discordance) between students' ratings of stress and faculty and staff members' perceptions of student stress, and (3) to identify the specific coping strategies that science students engage in to manage their stress.

Student Stress

Canadian students who completed the 2019 NCHA survey reported disruption to their academic performance stemming from issues in different life domains, including mental health concerns (e.g., anxiety, depression, sleeping difficulties), stress, family problems, finances, roommate issues and physical health (ACHA, 2019). In Beiter et al.'s (2015) study of 374 undergraduates, the top three concerns identified by participants were academic performance, pressure to succeed, and post-graduation plans. Stress related to anxiety, depression, relationship concerns, family issues, academic performance, career worries, and relationship problems are typical presenting issues for many students seeking psychological services on campus (Cairns et al., 2010; Winerman, 2017).

Within the wider academic population, certain sub-groups may be differentially impacted by stress. Female students may experience higher stress levels than male students within both undergraduate (Eisenberg et al., 2013; Hyun et al., 2006; Misra et al., 2000) and professional school/graduate populations (Eisenberg et al., 2013; Evans et al., 2018; Toews et al., 1993; Toews et al., 1997). This discrepancy may be due to greater exposure to sexual assault and domestic violence (Fond et al., 2018) and/or higher levels of depression and anxiety (Gitay et al., 2019) among women. Some findings suggest that graduate students experience a greater frequency of mental health issues relative to the general student population (Evans et al., 2018; Toews et al., 1993) due to pressure to gather and publish data, teach courses, pass their candidacy exams, organize fieldwork, coordinate collaborations, and mentor other students (Wedemeyer-Strombel, 2018). Researchers have not tended to investigate experiences of stress in post-doctoral fellows, although anecdotal evidence suggests that they may struggle with intense academic demands, isolation, frequent moves, short-term employment contracts, the competitive academic job market and responsibilities arising from multiple life domains (Etchells, 2017; Miller & Feldman, 2015).

Very little empirical research has been conducted on stress and mental health issues specific to students studying science. In their study comparing graduate science students to medical students and residents, Toews et al. (1997) found that science students had significantly higher scores on an overall measure of distress and higher scores on the somatization, phobic anxiety,

paranoid ideation, and psychoticism subscales of the Symptom Checklist-90-Revised. May and Casazza (2012) found that undergraduate students in "hard sciences" reported higher perceived stress than those in "soft sciences." The lack of research specific to science students is problematic due to differences in workload between science students and their counterparts in other faculties (Smith & Cooke, 2011), and possible contributions of stress to the "leaky pipeline" (i.e., higher dropout rates from science studies and careers among marginalized groups) (Hyun et al., 2007; Linnenbrink-Garcia et al., 2018).

Faculty and Staff Members' Perception of Student Stress

There has been a limited number of studies focused on faculty and staff perceptions of student stress. Henggeler and colleagues (1980) found that student respondents were more likely to identify alcohol abuse, drug abuse, weight control, and personal experiences of abuse as serious mental health concerns whereas university staff rated career choice, problems making friends and sleep disturbance as more serious issues than the students did. A more recent study by Misra et al. (2000) found that faculty tended to overestimate students' overall level of stress, as well as the sources of academic stress.

Discordance between student and faculty perceptions of student stress is an important issue, as these relationships may be critical to students' success in the academic realm and the ability of faculty and administrators to develop appropriate mental health strategies. The quality of the relationships between students and faculty/staff is related to student persistence and dropout (Schertzer & Schertzer, 2004). In a study comparing returning and non-returning students, Heverly (1999) found that the most frequent positive comments made by students were focused on faculty and other staff at the college, illustrating the crucial role of the relationships between students and faculty/staff. Focusing specifically on science students, one study found that students were more engaged in introductory "gatekeeping" courses when the instructors recognized their role in helping students succeed (Gasiewski et al., 2012).

Students' Stress Management Strategies

Studies of how students cope and manage their stress have identified a variety of strategies, including practicing a religious faith, engaging in hobbies, talking to friends and family, and maintaining a regular sleep schedule (Pace et al., 2018; Pickles et al., 2012). With certain exceptions (e.g., Jensen et al., 2016), few studies on postsecondary students have used a qualitative framework to assess stress management strategies but have more often approached the question through the lens of pre-existing theoretical categories (e.g., Shermeyer et al., 2018). No research has focused on science students in particular, and whether the strategies they employ might be different given the demands of their workload and limitations of their schedules.

Purpose

Student stress levels and mental health issues are related to academic performance (ACHA, 2019), dissatisfaction with their studies (Lipson & Eisenberg, 2018), persistence issues (Cox et al., 2016) and overall life satisfaction (Coffman & Gilligan, 2002). Complex and systemic issues such as student stress require comprehensive, evidence-based systemic interventions. For those to be

possible, data must be collected from all major stakeholders in order to develop effective programs that support students and inform faculty and staff members.

The purpose of this study was to identify the overall level of stress in a sample of science students, examine group differences in both stress level and contributors to stress, determine concordance/discordance rates between students' perceptions of stress and those of faculty and staff, and illustrate how students manage their stress.

Method

Participants

Completed questionnaires were obtained from 308 students and post-doctoral fellows. Within that group, 80.1% were undergraduate students and 19.8% were graduate students or post-doctoral fellows; 71.5% were female and 28.5% were male (students identifying as gender diverse were too small to analyze separately and for ethical reasons). Most students (64.7%) were between 18-21 years old. The majority of participants were studying biology (33.8%), followed by chemistry/biochemistry (18.5%), computer science (12.3%), earth and environmental science (7.1%), forensic science (4.9%), mathematics and statistics (3.6%), general science (3.2%), physics (2.6%), institution-specific programs (6.8%), and double majors (7.1%). Completed questionnaires were obtained from 40 staff members and faculty, of which 43.6% were female and 56.4% male. Most staff and faculty participants (61.6%) were between 40 and 60 years of age. The majority of faculty/staff participants reported that their primary affiliation was chemistry/biochemistry (35.1%), followed by physics (16.2%), biological sciences (13.5%), earth and environmental sciences (13.5%), computer science (8.1%), mathematics and statistics (8.1%), and economics (5.4%)

Measures

Data for this study was collected as part of a larger needs assessment completed in advance of implementing a new health and wellness initiative in the Faculty of Science. The measures for this study were designed by the authors based on the existing literature on student stress, previously-developed measures of student stress and questionnaires created by other institutions for similar purposes (Queen's University, 2012; University of Waterloo, 2012).

The creation of a set of measures, rather than the use of a pre-existing, validated measure, was done for several reasons. The intention was to use the data from this survey to make tailored, institution-specific changes to programming. Measures of student stress often focus only on intrapsychic impacts of stress (e.g., Feldt, 2008; Locke et al., 2011), and not on the contributors to stress. However, because the data from this survey would be used to directly address and make changes to sources of stress (e.g., heavy academic workload, conflict with staff or professors), the identification of contributors to stress was prioritized. In addition, one of the main goals of this study was to collect data from both students and faculty/staff; currently no published measures exist for this purpose.

Two mirror-image questionnaires were developed – one for undergraduate students, graduate students and post-doctoral fellows, and the other for faculty and staff. Students and post-doctoral fellows first completed a demographic survey, including age, sex, program and year of study. They were asked to rate their current stress level over the past week on a Likert scale ranging from 0 (not much stress) to 100 (extreme stress). The use of single-item stress measures has

demonstrated good convergence validity with validated measures of stress and well being (Littman et al., 2006), and also discriminates between gender and age groups (Elo et al., 2003). Students were asked how much various unique stressors contributed to their overall stress level from 0 (not at all) to 3 (extremely). These stressors were grouped into three main categories: (a) life stressors (e.g., finances, family problems, roommate issues, personal health concerns), (b) academic stressors (e.g., grades, anxiety about career, workload, time management), and (c) mental health stressors (e.g., problems with mood, anxiety, sleep, personal appearance). (Note: subtotals were not calculated for these different domains as it was not expected that experience of one stressor in a category, such as stress from one's own children, would be associated with other stressors in that category, such as personal health concerns). Finally, participants were provided with an open text box and asked to share their stress management strategies.

Faculty and staff were also asked to complete a demographic information form, which included questions about their age, sex, and primary departmental affiliation. They were asked to estimate the average stress level over the past week for both undergraduate students and graduate students/post-doctoral fellows on a Likert scale ranging from 0 (not much stress) to 100 (extreme stress). They were then asked to estimate how much the stressors identified above (i.e., life stressors, academic stressors and mental health stressors) contributed to undergraduates' stress (from not at all to extremely) and graduate/post-doctoral fellows' stress.

Procedure

This study was cleared by the Research Ethics Board of the university. An e-mail was sent to all members of the Faculty of Science requesting their participation and including a link to the online survey. A social media campaign, including posts on Twitter and Facebook was launched a few days later. Posters were displayed in multiple buildings on campus describing the survey and soliciting participation. In-person announcements were made in several of the largest undergraduate science classes and at several science faculty/departmental meetings. Reminder e-mails were sent on a weekly basis.

Results

Preliminary Analyses

Prior to conducting the proposed analyses, preliminary analyses were conducted using SPSS, version 25.0. The data set was first assessed for invalid responses (e.g., response sets, quick completion times, etc.). Data were also screened for missing responses and outliers. There were no univariate or multivariate outliers present in the data, and all variables were approximately normally distributed. Research questions related to group differences in overall stress levels, differences in contributors to student stress levels and faculty members' understanding of student stress were examined through a series of ANOVAs and/or *t*-tests with a Sidak-Bonferroni correlation to adjust for Type I error inflation where appropriate (Keppel & Wickens, 2004). Items with very low base rates or low variance were omitted from the analyses presented below. These included items measuring stress related to students' own children, religious beliefs, sexual victimization, staff-related stress, alcohol use and substance use, which had a response rate close to 0.

Group Differences in Overall Stress Levels

Students' ratings of their overall stress level were high, with a mean of 69.90 (*SD* 20.34, range 8-100). The vast majority of students reported an overall stress level above 50 (81.8%) and a significant proportion reported a level above 75 (40.6%) indicating substantial perceptions of stress. There were no significant differences in stress level between male and female students, $t(126) = 1.57$, $p = .12$, $d = 0.21$, 95% CI [-1.30, 10.25], or between undergraduates and graduate/post-doctoral fellows, $t(304) = .75$, $p = .45$, $d = 0.11$, 95% CI [-3.55, 7.92].

Contributors to Student Stress and Group Differences

The top 10 stressors for the sample overall were workload ($M = 2.11$, $SD = .82$), grades ($M = 2.11$, $SD = .93$), future career ($M = 2.07$, $SD = .90$), time management ($M = 1.81$, $SD = .90$), anxiety issues ($M = 1.76$, $SD = 1.00$), sleeping difficulties ($M = 1.50$, $SD = .99$), mood problems ($M = 1.29$, $SD = .95$), financial problems ($M = 1.21$, $SD = .92$), concerns around physical appearance ($M = 1.14$, $SD = .94$), and personal health issues ($M = 1.12$, $SD = .95$).

Undergraduate students reported significantly higher levels of grade stress, $t(70) = 5.4$, $p<.002$, $d = .86$, 95% CI [.53, 1.15] and higher levels of extra-curricular activities stress $t(268) = 4.33$, $p<.002$, $d = .71$, 95% CI [.32, .86] compared to graduate students, and male students reported significantly higher levels of sexual problems compared to female students, $t(89) = -3.32$, $p<.002$, $d = .52$, 95% CI [-.64, -.16].

Faculty Understanding of Student Stress

There were no significant differences between undergraduate students' overall ratings of their stress and faculty perceptions of undergraduates' overall stress levels, $t(282) = .95$, $p = .343$, $d = 0.18$, 95% CI [-3.43, 9.83]. However, faculty underestimated the stress levels reported by graduate students and post-doctoral fellows, $t(98) = 2.99$, $p<.01$, $d = 0.63$, 95% CI [4.08, 20.11]. Whereas staff and faculty estimated an overall stress level of 55.92 ($SD = 17.19$) for graduate students/post-doctoral fellows, but the average level reported by that group was 68.02 ($SD = 21.14$). Although faculty and staff were generally accurate in their estimation of the levels of specific academic stress reported by both groups, they consistently overestimated the contribution of specific life stressors and mental health issues to actual reported stress levels. This was true for both undergraduate students (Table 1), and graduate students/post-doctoral fellows (Table 2).

Table 1

Mean Stressor Ratings for Undergraduate Students Versus Faculty/Staff Perceptions of Undergraduate Student Stress

Stressor	Undergraduate ratings	Faculty/staff ratings	95% CI for mean differences	*t*	*df*	*p*-value
Finances	1.16	1.70**	-.86, -.21	-3.28	267	.001
Parents or other family members	.95	1.44	-.85, -.12	-2.61	260	.010
Own children	.01	1.33**	-1.77, -.87	-6.16	17	.000
Friends	.71	1.46**	-1.06, -.45	-4.86	257	.000
Romantic partner or spouse	.67	1.81**	-1.49, -.78	-6.34	180	.000
Religious beliefs	.28	1.00**	-1.04, -.41	-4.54	198	.000
Employment	.92	1.74**	-1.14, -.50	-5.09	243	.000
Roommates	.34	1.50**	-1.49, -.83	-6.91	136	.000
Unwanted sexual contact or comments	.24	1.50**	-1.75, -.76	-5.33	18	.000
Personal health issues	1.06	1.57	-.87, -.14	-2.75	246	.006
Anxiety about future career	2.11	1.95	-.12, .44	1.17	54	.248
Academic workload	2.16	2.03	-.13, 40	.99	279	.322
Grades	2.26	2.24	-.25, .31	.20	278	.845
Extra-curricular activities	1.15	1.27	-.48, 24	-.65	244	.516
Problems with professors	.85	1.48**	-.98, -.29	-3.65	258	000
Problems with GAs/TAs	.65	1.12**	-.77, -.18	-3.22	45	.002
Problems with staff	.36	.72	-.71, -.02	-2.14	33	.040
Time management	1.84	2.05	-.52, .09	-1.36	278	.175
Sleeping difficulties	1.50	1.62	-.50, .26	-.63	269	.531
Eating difficulties	1.11	1.56	-.85, -.05	-2.20	252	.027
Alcohol use issues	.17	1.59**	-1.85, -.99	-6.78	23	.000
Substance use issues	.13	1.45**	-1.80, -.85	-5.82	20	.000
Mood problems	1.28	1.57	-.57, -.02	-2.17	44	.035
Anxiety problems	1.75	2.26**	-.78, -.22	-3.62	50	.001
Anger issues	.66	1.52**	-1.25, -.47	-4.36	235	.000
Loneliness/homesickness	1.07	1.62	-.97, -.13	-2.56	236	.011
Concerns around personal appearance	1.16	1.41	-.62, .13	-1.30	261	1.94
Overuse of Internet/computer games	.97	1.80**	-1.24, -.42	-4.02	244	.000
Sexual problems	.35	1.50**	-1.49, -.81	-6.74	190	.000
Traumatic symptoms	.53	1.70**	-1.59, -.76	-5.58	191	.000

** t-test significant at $p<.002$

Table 2

Mean Stressor Ratings for Graduate Students/Post-Doctoral Fellows Versus Faculty/Staff Perceptions of Graduate Student/Post-Doctoral Fellows Ratings

Stressor	Graduate/post-doctoral fellow ratings	Faculty/staff ratings	95% CI for mean differences	*t*	*df*	*P*
Finances	1.39	2.11**	-1.08, -.35	-3.89	88	.000
Parents or other family members	.72	1.45**	-1.14, -.33	-3.62	81	.001
Own children	.06	1.56**	-1.86, -1.14	-8.61	30	.000
Friends	.67	.96	-.64, .06	-1.66	62	.102
Romantic partner or spouse	.61	1.50**	-1.36, -.42	-3.82	65	.000
Religious beliefs	.11	1.21**	-1.58, -.62	-4.74	20	.000
Employment	1.11	2.06**	-1.39, -.52	-4.38	87	.000
Roommates	.71	1.17	-.81, -.11	-2.61	59	.011
Unwanted sexual contact or comments	.54	1.28	-1.23, -.24	-2.99	55	.004
Personal health issues	1.33	1.52	-.65, .26	-.86	74	.395
Anxiety about future career	1.92	2.35	-.78, -.09	-2.49	96	.015
Academic workload	1.90	1.68	-.14, .58	1.24	95	.219
Grades	1.43	1.44	-.45, .42	-.07	90	.942
Extra-curricular activities	.56	.96	-.79, -.03	-2.13	80	.036
Problems with professors	.98	1.64	-1.10, -.21	-2.95	88	.004
Problems with GAs/TAs	.41	.78	-.78, .05	-1.76	62	.083
Problems with staff	.32	.89**	-.91, -.22	-3.27	78	.002
Time management	1.66	2.15	-.80, -.18	-3.11	85	.003
Sleeping difficulties	1.51	1.67	-.60, .28	-.71	81	.478
Eating difficulties	.93	1.48	-1.00, -.10	-2.42	78	.018
Alcohol use issues	.25	1.25**	-1.43, -.57	-4.82	26	.000
Substance use issues	.25	1.28**	-1.54, -.51	-4.09	25	.000
Mood problems	1.32	1.64	-.70, .06	-1.67	85	.098
Anxiety problems	1.78	1.84	-.42, .30	-.33	76	.745
Anger issues	.95	1.40	-.98, .07	-1.73	73	.087
Loneliness/homesickness	1.20	1.77	-1.02, -.12	-2.52	79	.014
Concerns around personal appearance	1.05	1.04	-.41, 44	.06	82	.951
Overuse of Internet/computer games	1.05	1.61	-1.02, -.09	-2.38	77	.020
Sexual problems	.34	1.41**	-1.46, -.68	-5.50	65	.000
Traumatic symptoms	.35	1.56**	-1.66, -.76	-5.35	62	.000

** t-test significant at $p<.002$

Student Coping Strategies and Group Differences in the Usage of these Strategies

Participants' open-ended responses to the question about stress management strategies were submitted to content analysis (Neuendorf, 2017). Two coders separately reviewed the data and generated codes reflecting students' self-reported stress management strategies. Coders met to refine codes and themes before agreeing on a preliminary coding system. Participants' responses were then reviewed by a third party, familiar with qualitative methodologies, but blind to the development of the initial coding system. Based on this input, additional refinements and changes were made to the coding system. Percentage agreement, an assessment of inter-rater reliability, was calculated between the two initial coders on 20% of the data, followed by further discussion and refinements of the rubric. Percentage agreement at this stage of the analysis was 91.3%. All responses pertaining to stress management were coded using this system, with raters aiming to achieve complete consensus through discussion.

Six major themes of stress management strategies were identified: (a) hobbies and leisure, (b) physical self-care, (c) social support, (d) mental health self-care, (e) active problem-solving, and (f) struggling/not coping. The first major category, was hobbies and leisure (reported by 40.9% of the sample) and included playing an instrument, reading, playing sports, watching streaming services, giving themselves treats and painting. The second category was physical self-care (29.5%); respondents identified exercising, practicing good sleep habits, paying attention to diet, and taking prescribed medications to cope with stress. The third category was seeking social support (25.6%) from networks of friends and family, partners, pets, and formal religious communities. The fourth category of stress management was mental health self-care (19.2%), involving activities such as reflecting on their situation (e.g., through journaling, prayer or meditation), attending therapy/counselling, soothing and relaxation rituals (e.g., taking baths, doing breathing exercises), and using campus wellness programs. The fifth category was active-problem solving (12.3%): managing their time, goal-setting, planning and scheduling, minimizing exposure to stressors, and taking purposeful breaks. The last major category was struggling or not coping (7.8%). This category was added because many students reported that they could not deal with their stress, their stress management tactics were not working, they used harmful methods to try to cope (e.g., drugs, alcohol) or they were unable to implement desired stress management strategies.

There were no significant differences between male and female students in the use of these coping strategies, and no differences between undergraduate students and graduate students/post-doctoral fellows. Most students (47.8%) described using one main type of coping strategy, 27.8% identified using two types of coping strategies, 13.9% reported using three types, and 5.3% reported using four or more types. On average, female students were more likely to report using more types of stress management strategies (M = 1.74, SD = 1.00) as compared to male students (M = 1.47, SD = .90), $t(239) = 1.99$, $p<.05$, d= .28, 95% CI [.003, .54]. There was no significant difference in the number of strategies reported by undergraduate students as compared to graduate students/post-doctoral fellows, $t(242) = .62$, $p>.05$, d=.11, 95% CI [-.22, .42]. There was a small but significant negative correlation between the number of different coping strategies reported and overall stress level $r = -.16$, $p<.05$; students reporting more types of coping strategies showed lower overall levels of stress.

Discussion

In summary, overall stress levels were high across students but no differences were observed based on level of study or sex. A few group differences were noted between undergraduate students and graduate students/post-docs (i.e., grade stress, extra/co-curricular stress) and between male and female students (i.e., sexual problems). Faculty and staff were accurate in estimating the overall level of undergraduate student stress but significantly underestimated the stress experienced by graduate students/post-doctoral fellows. Faculty and staff consistently overestimated the contribution of specific stressors for both groups particularly with regard to specific life problems and mental health concerns. Students and fellows reported using a variety of different coping strategies to manage their stress and there were no group differences in the use of these strategies based on sex or level of study.

Student Stress Levels

A substantial proportion of respondents in this study (40%) reported a stress level above 75/100, which is comparable to results from the 2019 NCHA survey, in which over 60% of respondents rated their stress level as above average or tremendous. Students' top concerns in our investigation were academic workload, grades, future career, time management, and anxiety issues, which corroborate previous findings that student stress originates from various life domains including both academic and interpersonal sources (e.g., Beiter et al., 2015; Winerman, 2017). There was an overwhelming focus on academic stressors in this investigation that is inconsistent with past research but may represent a novel lens through which to understand the role of academic stress in science and STEM fields (e.g., Beiter et al., 2015; Pickles et al., 2012).

Contrary to previous research (Evans et al., 2018; Hyun et al., 2006), this study did not find statistically significant differences in the overall stress level reported between male and female students. One explanation could be that the highest contributors to student stress were academic, a factor common to all science students, rather than areas that are known to demonstrate significant sex differences (e.g., depression, anxiety). It may also be that differences observed in previous studies of the overall student population are not applicable or generalizable across all faculties. Some group differences were observed in the contributors to stress for undergraduate students and graduate students/post-doctoral fellows (i.e., higher stress in undergraduates due to grades and extra-curricular activities), which confirms findings by some researchers (e.g., Eisenberg et al., 2013), but not others (e.g., Evans et al., 2018).

Faculty and Staff Understanding of Student Stress

In general, academic faculty and staff seemed to have a good understanding and appreciation of student stress, were aware that students may be impacted by a variety of negative life issues and were concerned about these issues. This could be due to awareness campaigns designed to destigmatize mental health concerns (Yamaguchi et al., 2013) or to address significant social justice issues.

Faculty and staff accurately estimated the overall level of undergraduate student stress but underestimated the overall level of graduate student/post-doctoral fellow stress. Underestimation of graduate student stress levels may have been affected by greater participation in this study of graduate students completing course-based degrees compared to traditional research-based

degrees. Faculty and staff may be more familiar with the issues faced by students who are working in their labs and with whom they have more frequent contact as compared to students in their classrooms. Graduate students may also have a vested interest in downplaying their experiences of stress to avoid appearing "weak" or incompetent in front of their supervisors. In turn, few faculty members have training in effective mentorship (Hund et al., 2018) and may not know how to effectively identify or assess stress levels in their students. Departmental and faculty programming related to mental health often focuses on undergraduate students to the exclusion of graduate students and post-doctoral fellows, a problem noted by respondents to this survey.

Professors' and staff members' perceptions about the specific contributors to student stress were often incorrect; specifically, while they were accurate in their perceptions of the relevance of academic stressors, they tended to overestimate the magnitude of mental health and life stressors to students (e.g., alcohol/substance use, sexual problems). It is unsurprising that professors and staff would be more familiar with the stressors related to students' academic lives than with their personal lives. Few professors or staff members in a Faculty of Science could be expected to have formal training in mental health issues, so perceptions of student stress may be influenced by media representations of students or by over-reliance on the perceptions of colleagues (who may themselves be influenced by media stereotypes). Discomfort related to asking students directly about personal concerns or stigma around mental health issues may also influence perceptions about student stress.

In general, these findings suggest the need to make additional training available to faculty and staff to address gaps in knowledge and communication challenges related to stress and mental health. When faculty and staff respondents were incorrect in estimating student stress, their errors tended to come in the form of overestimation; from the perspective of student safety, overestimation of stress levels related to certain issues (i.e., false positives) is less dangerous than underestimation (i.e., false negatives).

Stress Management Strategies

Student participants in this investigation reported using a variety of methods to manage their stress including hobbies and leisure, active problem-solving, mental and emotional self-care, physical self-care and social support. Most students (close to 60%) reported using more than one type of strategy. As in previous studies, students mentioned using hobbies such as watching television, doing crafts or playing sports (Pickles et al., 2012), seeking social support (Pace et al., 2018), and problem-solving strategies to mitigate stress (Giamos et al., 2017). Differences in the types of coping strategies used were not observed between male and female students; however, female students reported using slightly more types of strategies compared to male students.

Strengths and Limitations

This study examined a comprehensive set of stressors across a variety of domains to ensure that students' experiences of stress were described accurately and comprehensively, both inside and outside the classroom. Questions about contributors to stress were designed to be as inclusive as possible. The use of both quantitative and qualitative methods captured rates of stress, as well as students' coping strategies. This is also one of very few studies to consider faculty and staff members' understanding of student stress, which is necessary to create appropriate and meaningful programs to aid in the reduction of student stress and to ensure that the most appropriate support

is provided to students experiencing high levels of stress . Notably, academic issues (i.e., those in which staff and faculty play an important role) were the most significant contributors to students' stress in this study. While professors may be limited in their capacity to assist with other types of stressors, they are well-positioned to address stress related to academic workload, grades, and future career planning. This investigation also included data from staff members and post-doctoral fellows. The omission of staff members from other studies is short-sighted as they are often front-line responders to mental health issues and would be well-positioned to direct students to the most appropriate services on campus or in the community. The experiences of post-doctoral fellows are also rarely reported on, which is a serious concern given their invaluable contributions to academic research, training, and teaching, especially in science. Finally, few studies have focused on the unique experiences of stress in science students; however, research on their experiences of stress and coping may pave the way to a better understanding of the "leaky pipeline" (Linnenbrink-Garcia et al., 2018), and the differential impact of stress on groups in the sciences. Researchers in this area will need to look at the specific experiences and needs of other potentially-marginalized groups (i.e., sexual minority group members, ethnic minorities, first generation students).

The findings of this study are subject to some limitations. As with all studies involving volunteer participants, the degree to which these findings can be generalized to the wider population of students, staff and faculty is unclear. Participants in this investigation were likely to be those who were most engaged with Faculty of Science activities; it seems probable that these students may be less distressed than the general population (and therefore had the time and energy to complete this survey), and that the faculty and staff who chose to participate were more invested in student well-being. The measures used for this investigation were created by the authors and have not been used or validated in previous investigations, although the key constructs of interest were reliable and valid indicators of student stress. Finally, many of the graduate student participants were from course-based rather than research-based programs. Future studies should attempt to include a variety of different types of graduate students in order to compare and contrast their experiences of stress and coping.

Conclusion

The results of this investigation demonstrate that overall stress levels amongst science students and post-doctoral fellows were high and came primarily from academic sources. Faculty and staff demonstrated an accurate understanding of overall undergraduate student stress levels but largely underestimated graduate student stress. They showed a good understanding of the role of specific academic stressors, but consistently overestimated the contribution of stress from other sources. Students reported a variety of different stress management strategies, and there were few significant group differences in their use. The development of strategic and effective mental health strategies requires research on student stress that considers how stress varies across disciplines of study and university education (e.g., courses, research opportunities and extra- or co-curricular activities), and recognizes that stress is not uniform across faculties. It is also important to continue investigating the role that stress and mental health issues play in exacerbating the leaky pipeline effect seen in science.

References

American College Health Association (2019). American College Health Association-National College Health assessment II: Canadian Reference Group Data Report Spring 2019. American College Health Association.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *Journal of Affective Disorders*, *173*, 90-96. https://doi.org/10.1016/j.jad.2014.10.054

Cairns, S. L., Massfeller, H. F., & Deeth, S. C. (2010). Why do post-secondary students seek counselling? *Canadian Journal of Counselling and Psychotherapy/Revue canadienne de counseling et de psychothérapie*, *44*, 34-50.

Coffman, D. L., & Gilligan, T. D. (2002). Social support, stress, and self-efficacy: Effects on students' satisfaction. *Journal of College Student Retention: Research, Theory & Practice*, *4*(1), 53-66. https://doi.org/10.2190/BV7X-F87X-2MXL-2B3L

Cox, B. E., Reason, R. D., Nix, S., & Gillman, M. (2016). Life happens (outside of college): Non-college life-events and students' likelihood of graduation. *Research in Higher Education*, *57*, 823-844. https://doi.org/10.1007/s11162-016-9409-z

Eisenberg, D., Hunt, J., & Speer, N. (2013). Mental health in American colleges and universities: Variation across student subgroups and across campuses. *The Journal of Nervous and Mental Disease*, *201*(1), 60-67. https://doi.org/10.1097/NMD.0b013e31827ab077

Elo, A. L., Leppänen, A., & Jahkola, A. (2003). Validity of a single-item measure of stress Symptoms. *Scandinavian Journal of Work, Environment & Health*, *29*(6), 444-451. https://doi.org/10.5271/sjweh.752

Etchells, P. (2017). The human cost of the pressures of postdoctoral research. https://www.theguardian.com/science/head-quarters/2017/aug/10/the-human-cost-of-the-pressures-of-postdoctoral-research

Evans, T. M., Bira, L., Gastelum, J. B., Weiss, L. T., & Vanderford, N. L. (2018). Evidence for a mental health crisis in graduate education. *Nature Biotechnology*, *36*, 282-284. https://doi.org/10.1038/nbt.4089

Feldt, R. C. (2008). Development of a brief measure of college stress: The college student stress scale. *Psychological Reports*, *102*, 855-860. https://doi.org/10.2466/pr0.102.3.855-860

Fond, G., Bourbon, A., Auquier, P., Micoulaud-Franchi, J.-A., Lançon, C., & Boyer, L. (2018). Venus and Mars on the benches of the faculty: Influence of gender on mental health and behavior of medical students. Results from the BOURBON national study. *Journal of Affective Disorders, 239,* 146–151. https://doi.org/10.1016/j.jad.2018.07.011

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in Higher Education*, *53*, 229-261. https://doi.org/10.1007/s11162-011-9247-y

Giamos, D., Lee, A. Y. S., Suleiman, A., Stuart, H., & Chen, S. P. (2017). Understanding campus culture and student coping strategies for mental health issues in five Canadian colleges and universities. *Canadian Journal of Higher Education/Revue canadienne d'enseignement supérieur*, *47*(3), 136-151. https://doi.org/10.7202/1043242ar

Gitay, M. N., Fatima, S., Arshad, S., Arshad, B., Ehtesham, A., Baig, M. A., Ilyas, M.F., Rizvi, S.F., Farooqui, Q., Masroor, M. & Haque, Z. (2019). Gender differences and prevalence of mental health problems in students of healthcare units. *Community Mental Health Journal*, *55*, 849-853. https://doi.org/10.1007/s10597-018-0304-2

Henggeler, S. W., Sallis, J. F., & Cooper, P. F. (1980). Comparison of university mental health needs priorities identified by professionals and students. *Journal of Counseling Psychology*, *27*, 217-219. https://doi.org/10.1037/0022-0167.27.2.217

Heverly, M. A. (1999). Predicting retention from students' experiences with college processes. *Journal of College Student Retention: Research, Theory & Practice, 1*(1), 3-11. https://doi.org/10.2190/C1MB-YP0J-UHJ0-MGMB

Hund, A. K., Churchill, A. C., Faist, A. M., Havrilla, C. A., Love Stowell, S. M., McCreery, H. F., ... & Scordato, E. S. (2018). Transforming mentorship in STEM by training scientists to be better leaders. *Ecology and Evolution*, *8*(20), 9962-9974. https://doi.org/10.1002/ece3.4527

Hyun, J., Quinn, B., Madon, T., & Lustig, S. (2007). Mental health need, awareness, and use of counseling services among international graduate students. *Journal of American College Health, 56*, 109-118. https://doi.org/10.3200/JACH.56.2.109-118

Jensen, C., Forlini, C., Partridge, B., & Hall, W. (2016). Australian university students' coping strategies and use of pharmaceutical stimulants as cognitive enhancers. *Frontiers in Psychology*, *7*, 277. https://doi.org/10.3389/fpsyg.2016.00277

Keppel, G., & Wickens, T. D. (2004). Simultaneous comparisons and the control of type I errors. In G. Keppel (Ed.), *Design and analysis: A researcher's handbook* (4th ed.) (pp. 111-130). Pearson Prentice Hall.

Linnenbrink-Garcia, L., Perez, T., Barger, M. M., Wormington, S. V., Godin, E., Snyder, K. E., Robinson, K., Sarkar, A., Richman, L., & Schwartz-Bloom, R. (2018). Repairing the leaky pipeline: A motivationally supportive intervention to enhance persistence in undergraduate science pathways. *Contemporary Educational Psychology*, *53*, 181-195. https://doi.org/10.1016/j.cedpsych.2018.03.001

Lipson, S. K., & Eisenberg, D. (2018). Mental health and academic attitudes and expectations in university populations: results from the healthy minds study. *Journal of Mental Health, 27*, 205-213. https://doi.org/10.1080/09638237.2017.1417567

Littman, A. J., White, E., Satia, J. A., Bowen, D. J., & Kristal, A. R. (2006). Reliability and validity of 2 single-item measures of psychosocial stress. *Epidemiology*, *17*(4), 398-403. https://doi.org/10.1097/01.ede.0000219721.89552.51

Locke, B. D., Buzolitz, J. S., Lei, P.-W., Boswell, J. F., McAleavey, A. A., Sevig, T. D., Dowis, J. D., & Hayes, J. A. (2011). College counseling assessment of psychological symptoms-62 (CCAPS-62). APA PsycTests. https://doi.org/10.1037/t33462-000

May, R. W., & Casazza, S. P. (2012). Academic major as a perceived stress indicator: Extending stress management intervention. *College Student Journal*, *46*(2), 264-274.

Miller, J. M., & Feldman, M. P. (2015). Isolated in the lab: Examining dissatisfaction with postdoctoral appointments. *The Journal of Higher Education*, *86*, 697-724. https://doi.org/10.1353/jhe.2015.0029

Misra, R., McKean, M., West, S., & Russo, T. (2000). Academic stress of college students: Comparison of student and faculty perceptions. *College Student Journal*, *34*, 236-245.

Neuendorf, K. A. (2017). *The content analysis guidebook* (2nd ed.). Sage. https://doi.org/10.4135/9781071802878

Pace, K., Silk, K., Nazione, S., Fournier, L., & Collins-Eaglin, J. (2018). Promoting mental health help-seeking behavior among first-year college students. *Health Communication, 33*, 102-110. https://doi.org/10.1080/10410236.2016.1250065

Pickles, K. J., Rhind, S. M., Miller, R., Jackson, S., Allister, R., Philp, J., Waterhouse, L. & Mellanby, R. J. (2012). Potential barriers to veterinary student access to counselling and other support systems: perceptions of staff and students at a UK veterinary school. *Veterinary Record*, *170*(5), 124-132. https://doi.org/10.1136/vr.100179

Queen's University. (2012). *Report of the principal's commission on mental health.* https://www.queensu.ca/principal/sites/webpublish.queensu.ca.opvcwww/files/files/CMHFinalReport.pdf

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin, 138*, 353-387. https://doi.org/10.1037/a0026838

Schertzer, C. B., & Schertzer, S. M. (2004). Student satisfaction and retention: A conceptual model. *Journal of Marketing for Higher Education*, *14(1)*, 79-91. https://doi.org/10.1300/J050v14n01_05

Shankar, N. L., & Park, C. L. (2016). Effects of stress on students' physical and mental health and academic success. *International Journal of School & Educational Psychology*, *4*(1), 5-9. https://doi.org/10.1080/21683603.2016.1130532

Shermeyer, L., Morrow, M. T., & Mediate, N. (2019). College students' daily coping, mood, and quality of life: Benefits of problem-focused engagement. *Stress Health, 35*, 211-216. https://doi.org/10.1002/smi.2847

Smith, E., & Cooke, S. (2011). 'I was told it was going to be hard work but I wasn't told it was going to be this much work': The experiences and aspirations of undergraduate science students. *International Journal of Science and Mathematics Education*, *9*, 303-326. https://doi.org/10.1007/s10763-010-9228-1

Toews, J. A., Lockyer, J. M., Dobson, D. J., & Brownell, A. K. (1993). Stress among residents, medical students, and graduate science (MSc/PhD) students. *Academic Medicine, 68*, S46-S48. https://doi.org/10.1097/00001888-199310000-00042

Toews, J. A., Lockyer, J. M., Dobson, D. J., Simpson, E., Brownell, A. K. W., Brenneis, F., MacPherson, K.M., & Cohen, G. S. (1997). Analysis of stress levels among medical students, resident, and graduate students at four Canadian schools of medicine. *Academic Medicine, 72*, 997-1002. https://doi.org/10.1097/00001888-199711000-00019

University of Waterloo. (2012). *Report of the University of Waterloo student mental health project.* https://uwaterloo.ca/mental-health-wellness/sites/ca.mental-health-wellness/files/uploads/files/student_mental_health_project_-_final_report.pdf

Wedemeyer-Strombel, K. (2018). Graduate school should be challenging, not traumatic. https://www.chronicle.com/article/Graduate-School-Should-Be/245028

Winerman, L. (2017). By the numbers: Stress on campus. *American Psychological Association*, *48*(8), 88.

Yamaguchi, S., Wu, S. I., Biswas, M., Yate, M., Aoki, Y., Barley, E. A., & Thornicroft, G. (2013). Effects of short-term interventions to reduce mental health–related stigma in university or college students: a systematic review. *The Journal of Nervous and Mental Disease, 201*, 490-503. https://doi.org/10.1097/nmd.0b013e31829480df