



***“The Canadian Federation of Engineering Students believes that engineering students confront negative mental health outcomes at rates exceeding the general population as a consequence of the structure and workload demands of their programs. All stakeholders, including faculty, accreditors, and student leaders, have a responsibility to review and amend their practices to give students a healthy and effective learning environment.”***

### **The Students’ Position**

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- University students are at an elevated risk of negative mental health outcomes relative to the general population, with the risk for engineering students being especially acute.
- The high incidence of these negative mental health outcomes is a result of increased stress, which has a range of damaging psychological and physiological impacts on students.
- Excessive student workload is likely a primary cause of these negative mental health outcomes, and steps should be taken to reduce academic stress related to workload.
- Engineering students deserve to be able to reach their fullest academic potential within their programs, unhindered by their mental or physical health.

### **The Issue**

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As taboos around the discussion of mental illness have begun to diminish in recent years, the true breadth of the issue has been brought to light. In a major nationwide study in 2012, Statistics Canada found that 12.6% of Canadians met the criteria for a mood disorder (including depression and bipolar disorder) during their lifetime, and 8.7% of Canadians met the criteria for a generalized anxiety disorder during their lifetime. (Statistics Canada 2012)

The impact of these issues is magnified when looking at student populations. In 2015, the American College Health Association National College Assessment found that within the last year, 47.7% of university students felt that things were hopeless, 56.9% felt overwhelming anxiety, 34.5% felt so depressed that it was difficult to function, and 8.9% seriously considered suicide. Currently, 11.9 per 100 000 persons per year between the ages of 20-29 commit suicide (ACHA 2015). Many mental-health issues first emerge during the range of ages commonly associated with university students, and the incidence of mental health issues is higher among students than non-students (MacKean 2011).

Among students, the impacts of mental health are known to vary by area of study. The largest body of research on this topic is focused on medical students; this is logical, as medical students have been found to consistently have the highest rates of negative mental health outcomes among students, and are well positioned to be subjects in studies of health (CFMS 2015). Mental health outcomes in other areas of study, including engineering, have been less intensively studied. However, a study at the University of Adelaide found that engineering students had the second-highest rates of mental distress on their campus, and were also the least likely to seek help for a mental illness (6% of engineers sought help, compared to 11% of all students) (Honi Soit 2010). While there is no authoritative study comparing professions or fields of study in Canada, the Centers for Disease Control and Prevention found that among Americans, engineers and architects had the 5<sup>th</sup>

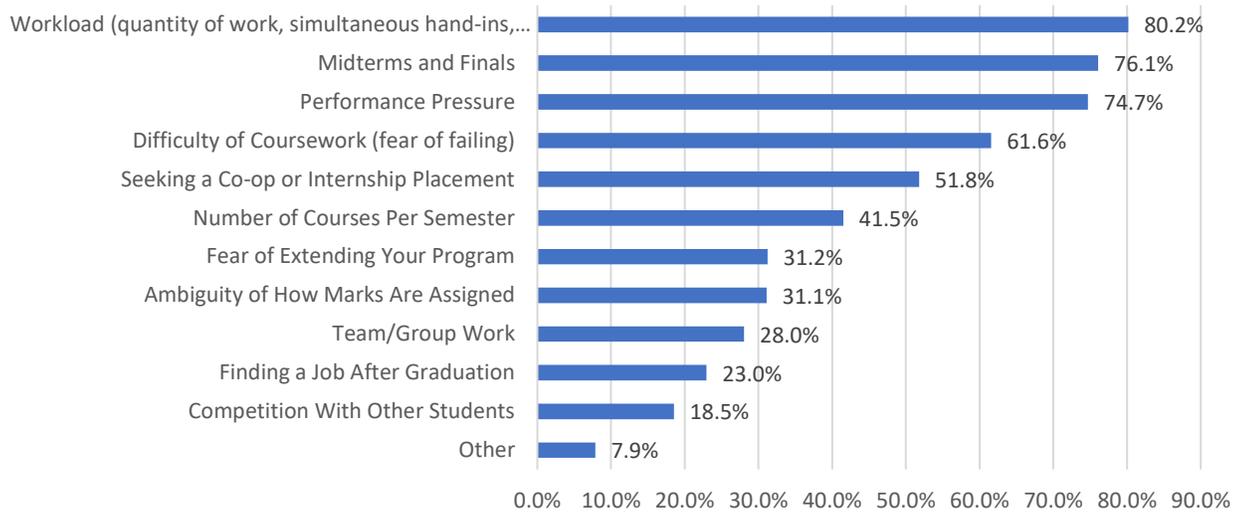
highest rate of suicide by occupation (32 per 100,000 people), and the highest by far among the major professions (lawyers ranked 11<sup>th</sup>, and doctors, dentists, and other health care professionals ranked 12<sup>th</sup>) (CDC 2012) .

Mental health issues among college students have a diverse range of causes, including family and peer relationships, adaptation to changes in lifestyle, and financial concerns related to the price of higher education. As a cause of higher rates of mental health issues among medical students, researchers also cite the additional stresses of dealing with sick, dying, or otherwise emotionally challenging patients (CFMS 2015). While engineering students do not confront this same set of issues, an explanation for their rates of mental health issues may be tied to the stress of academic workload in engineering programs. Engineering students are known to take larger course loads than other students, and the volume and structure of this workload represents an added stressor on students. For students across all areas of study, academic overload and pressure to succeed has been identified as a major cause of stress (MacKean 2011).

Stress is a physiological and cognitive response to pressures or perceived threats in an individual's environment, and in and of itself, stress is not a strictly negative phenomenon (Auclair 2017) (CASA 2017). Acute stress produces an intense and short-lived reaction which subsides after a perceived threat is resolved, and is part of a healthy response to stressors. However, chronic stress, which is developed under repeated and prolonged exposure to stressors, causes a longer-lasting and more problematic range of physiological responses, and may contribute to the development of mental health issues (Auclair 2017). Stress has long been associated with the high workload of engineering studies, and many practicing engineers will anecdotally cite the high stress of their academic training as an important factor in preparing them for professional practice. However, ensuring that the high stress level of engineering programs is not having severe negative impacts on the wellbeing of students should be a priority for those managing engineering education.

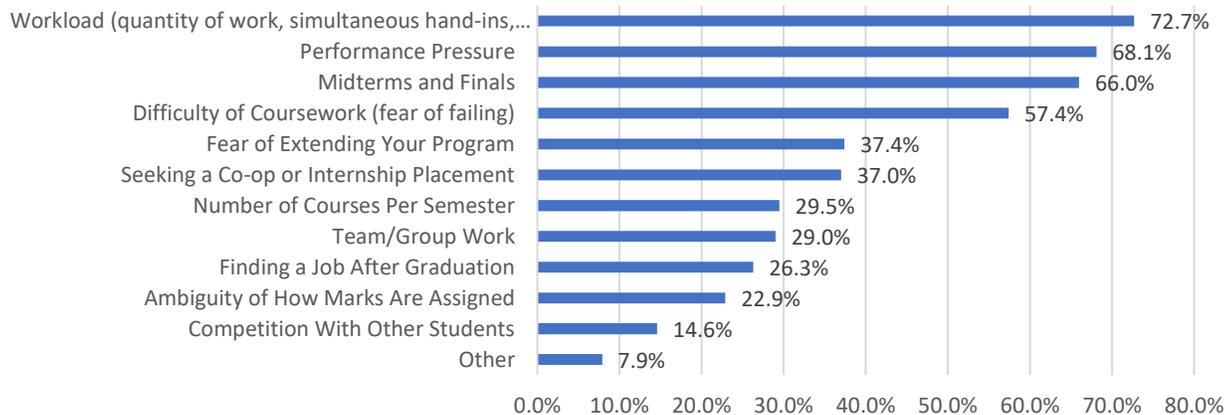
In the fall of 2017, the CFES surveyed 3936 students (~4.8% of all students) at 44 of Canada's accredited engineering schools, on a range of topics relating to their academic experience, including their perceptions of their own workload and mental health (CFES 2018). One question on the survey identified the elements of students' studies which caused them the greatest stress, and found that workload was the primary cause, followed by exams, performance pressure, and the difficulty of coursework. These results were consistent with a survey of Quebec engineering students completed by the Quebec Confederation for Engineering Student Outreach (QCESO) in 2016 (QCESO 2017). The results for both identical survey questions can be seen below in Figures 1 and 2. The CFES Survey also had students rate their stress level during a typical semester on a 5-point scale (very low, low, moderate, high, very high). The average student stress rating was 3.86 on the CFES Survey, and 3.92 on a corresponding question from the QCESO survey (CFES 2018) (QCESO 2017). Using a similar scale, the American College Health Association National College Assessment found an average score across all programs of 3.53, suggesting that engineering students have elevated levels of stress compared to general campus populations (ACHA 2017).

Figure 1: CFES National Student Survey Responses - "What elements of your studies cause you stress?"



(CFES 2018)

Figure 2: QCESO Survey on Mental Health, Work Load, and Stress of Quebec Engineering Students - "What elements of your studies cause you stress?"



(QCESO 2017)

Concerning the effect of this stress on students, the QCESO survey found that 65.7% of students considered the stress from their studies to have either a negative or very negative impact on them. Students then identified several negative consequences of their stress, ranging from difficulty sleeping (64.0%) and difficulty concentrating on tasks (56.1%) to taking non-prescribed medications and drugs (7.3%) and having suicidal thoughts (6.6%) (QCESO 2017). While the average Canadian sleeps 8.2 hours per night, and experts state that most adults need 7-9 hours of sleep per night to feel refreshed, only 10.1% of student respondents to the CFES survey reported getting over 8 hours of sleep on an average school night, with 34.6% reporting 6 hours of sleep, and 16.4% reporting 5 hours or less (Statistics Canada 2005) (CFES 2018). Short and inconsistent

sleep times can be both a cause and a symptom of high stress, and also impair academic ability (MacKean 2011). A common coping mechanism for student stress is increased and irregular use of alcohol and drugs (ACHA 2015). 18.9% of respondents to the QCESO survey also reported augmenting their alcohol intake as a consequence of their academic stress; in the context of common drinking cultures at Canadian engineering schools, this effect of student stress is particularly troubling.

Stress results were also magnified for female respondents to the CFES Survey, who reported a stress score of 4.08 compared to 3.75 for male students (see Figure 2). This is consistent with other research reporting higher rates of mental illnesses including depression and anxiety among women (MacKean 2011). From first year to graduation, the percentage of Canadian women in engineering drops from 23% to 20%, making it an important focus for advocates hoping to increase the percentage of women in the engineering profession (Cassidy 2017). If mental health issues are disproportionately impacting female students in engineering programs, then addressing the broader issue of student mental health is a necessary step in creating a healthier gender balance in the profession.

The CFES survey also found that higher workload was linked to several negative effects for students. Students taking more classes were less likely to get healthy levels of sleep, participate in extra-curricular activities, spend time with friends and family. Students who spent more than 30 hours per week in labs, tutorials, and lectures (representing 17.7% of all engineering students) spent 10% less time with friends and family than the average engineering student, and were twice as likely to get 4 hours of sleep or less per school night (CFES 2018). While an alarmingly high 50.0% of all engineering students reported that they did not have time to pursue non-class work or extra-curricular activities, this number increased to 65.5% in this highest regular workload bracket (CFES 2018). These effects of excessive academic workload are likely to contribute to feelings of distress at higher rates among students, and should be a cause for concern. Additionally, this highest bracket only measures the workload attributable to time spent in lectures, labs, and tutorials: 46.7% of students also reported spending over 20 hours per week on additional assignments and projects, with 17.0% of those students spending 30 hours or more (CFES 2018).

Negative mental health outcomes are a serious issue impacting student physiological health and academic success, and have far-reaching consequences including student suicide rates and the future diversity of the engineering profession. Engineering students deserve to study under academic conditions that do not compromise their health, and that give them the best opportunity to build successful futures from their degrees.

While the issue of engineering student mental health is large and complex, there are strategies that stakeholders in engineering education can begin to enact to improve student outcomes. On a macro-level, national institutions such as the CFES, Engineers Canada, and the National Council of Deans of Engineering and Applied Sciences (NCDEAS) can support more research into the specific mental health issues faced by engineering students, the relationship between workload and mental health, and how student mental health can be improved. The findings of this research, as well as the findings summarized in this paper, should provide an impetus to make any necessary changes to the operations engineering programs.

At the highest administrative level, it may be useful to consider amending the accreditation criteria for Canadian engineering schools to include minimum requirements for student mental health services, such as those required for the accreditation of Canadian medical schools. The Committee on Accreditation of Canadian Medical Schools (CACMS) Standards of Accreditation for medical programs dedicates its 12<sup>th</sup> standard to student health services, including section 12.3 which states that “a medical school [must have] in place an effective system of personal counseling for its medical students that includes programs to promote their well-being and to facilitate their adjustment to the physical and emotional demands of medical education” (CACMS

2017). Changes to the definition of Accreditation Units in order to account for total student learning time may also be effective in the reducing student stress related to academic workload, as is discussed more thoroughly in the CFES's official stance on engineering accreditation (CFES 2018).

At the level of engineering schools and programs, deans and faculties can make accommodations and investments into changes that support student mental health. Students should have easy access to counseling, mental health, and crisis intervention services facilitated by either their faculty or university. While course difficulty is often rightly a function of the important learning outcomes that a course imparts, faculties can make changes which decrease workload-related stress for students without impacting learning outcomes; this can be accomplished through small changes that allow more flexibility such as distributing deadlines and assignments more evenly throughout a semester, avoiding over-evaluation, establishing flexible guidelines for the re-scheduling of exams, and offering repeated courses in multiple semesters or as summer classes. The introduction of courses that provide credit for student design team participation, such as 4EX3 (Experiential Engineering Design course) at McMaster University, also assist with lowering academic stress while accounting for total learning time and encouraging students to participate in groups that support their professional development and healthy social interaction (McMaster Engineering 2017). Faculties can also track the total learning hours related to particular courses, and ensure that the required student inputs align with the credits earned from the course, so that certain course offerings do not require an imbalanced degree of student effort relative to their worth within a degree and expected learning outcomes. CFES and its members can assist in this effort by developing tools to track total learning time in engineering courses, similar to tools that have begun to be employed by some engineering schools in Quebec.

Both faculty and student leaders also have a role to play in changing the culture and stigma around mental health in their programs, so that students feel supported and are more likely to seek assistance with mental health issues. Engineering faculties can begin public discussions and education about mental health within their institutions, and train staff to recognize indicators of poor mental health among students and refer them to appropriate resources. Engineering student societies can host events and services that provide community supports for students, share practical advice about managing personal health and balancing course requirements, and review traditions and practices that might contribute to a culture of academic stress or substance abuse. They can also focus efforts on improving stress and mental health conditions for first year students through integration events, as new students face higher levels of stress due to their change in environment upon entering university. The CFES can help its members to coordinate and share resources and best practices in this area.

## **What the CFES is doing**

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- The CFES conducted a National Student Survey in 2017 to collect data on the mental health of engineering students, and to replicate some results of the QCESO student mental health survey, as part of a broader research effort on student workload and mental health.
- The CFES has run sessions and talks on student mental health, with a focus on student initiatives and student volunteer burnout, at its major events including CFES Congress and the Conference on Diversity in Engineering.

## **What the CFES plans to do**

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- The CFES will facilitate the sharing of best practices related to mental health between its member societies, and provide resources for its members to advocate for improvements to student mental

health and balanced workload at their respective institutions.

- The CFES will undertake a pilot project to track total hours of student workload at a limited number of programs within its member institutions.
- The CFES will pursue further research into the specific consequences of negative student mental health, and best practices for improving mental health at engineering schools.
- The CFES will evaluate how it can better promote student mental health internally through the operations and content of its events.

## Recommendations to Partners, Stakeholders, and Other Entities

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- The CFES calls on the Canadian Engineering Accreditation Board to investigate changes to accreditation criteria that better account for the full burden of student workload, and that require access to basic mental health services for all undergraduate engineering students.
- The CFES calls on the National Council of Deans of Engineering and Applied Sciences (NCDEAS) to encourage its members to work with the CFES and its member societies on improving the culture of mental health in their programs, including access to student resources, re-evaluations of program practices, and the review of course offerings to eliminate elements causing non-productive stress and workload.
- The CFES calls on Engineers Canada and the National Council of Deans of Engineering and Applied Sciences (NCDEAS) to partner with the CFES on research related to student mental health and workload, with the intention of clarifying the specific impacts of workload on the mental health of engineering students, and the best procedures for improving student mental health in engineering programs.
- The CFES calls on its partnered regional organizations (WESST, ESSCO, QCESO, ACES) to collaborate on future initiatives in student workload and mental health, potentially including a workload tracking system or a second national student survey.

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