

Effects of COVID-19 on Stress and Mental Health of Community College Pre-Engineering Students

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Abstract—This research full paper presents screening rates for mental health issues and life-stress events in engineering-focused community college students during the initial phases of the COVID-19 pandemic in the US. Specifically, it attempts to answer the following research questions: 1) What is the overall rate of various mental health conditions among engineering-focused community college students, 2) What effects has the pandemic had on baseline stress levels engineering-focused community college, and 3) What effects has the pandemic had on quality of life, such as sleep habits and financial security of engineering-focused community college students?

Data for this paper was collected via survey from May–July 2020 and includes responses from 84 students at 24 community colleges. The survey itself was a compilation of several widely-used instruments for measuring overall mental health and stress levels in a population. These instruments include the Kessler-6 for psychological distress, the PHQ for anxiety, depression, and eating disorders, the PC-PTSD for PTSD-like symptoms, and the SRRS for inventorying stressful life events.

Among the major findings, 32% of respondents reported a major change in financial situation, 27% reported loss of employment, and 13% reported ceasing formal schooling because of the COVID-19 pandemic. Additionally, 32% of respondents reported that the COVID-19 pandemic worsened their housing security situation, 38% reported that COVID-19 has worsened their food security situation, and 36% report that COVID-19 has decreased their ability to access instruction, course materials, or course supplies. Finally, of respondents who completed at least one mental health screening instrument, 70% screened positive for at least one potentially diagnosable condition, while only 9% reported ever receiving a mental health diagnosis.

Index Terms—Community College, Mental Health, Disability, Accessibility, Equity, Inclusion, Wellness

I. INTRODUCTION

Numerous studies have shown that COVID-19 has had a negative impact on engineering students in four-year programs [1]–[6]. The effects of COVID-19 on engineering-focused students in community colleges, however, have been less well studied.

Community colleges provide an important pipeline into STEM-fields in the United States. Data shows nearly half of recent Bachelor degrees in STEM were awarded to students who had attended community college [7], [8]. Community colleges also tend to serve higher proportions of students

from marginalized racial and social groups than four-year institutions, and, through transfer programs, are an important driver of diversity in U.S. higher education and engineering programs [7], [9]. Therefore, it is critical for the health and diversity of the overall U.S. engineering education system to understand how the pandemic affected engineering-focused community college students and to identify where they may need additional support.

To that end, this paper presents data on the mental health and quality of life of engineering-focused community college students. Data was collected from May–July 2020—the first semester COVID-19 was known to be widespread in the United States. Specifically, this work attempts to answer the following three research questions:

- RQ 1) What is the overall rate of various mental health conditions among engineering-focused community college students?
- RQ 2) What effects has the pandemic had on baseline stress levels engineering-focused community college, and
- RQ 3) What effects has the pandemic had on quality of life, such as sleep habits and financial security of engineering-focused community college students?

Our research relies on widely-used population-scale survey instruments to measure mental health screens for diagnosable conditions among community college students. We use a modified version of the Social Readjustment Rating Scale to inventory stressful life events faced by engineering-focused community college students due to the COVID-19 pandemic [10].

II. BACKGROUND

Even before COVID-19, mental health in college students has been an area of major concern: both the number of students facing mental health challenges and the severity of the challenges faced by students are on the rise [11], [12].

In this area, community college students have historically been worse-off than their peers in four year institutions. These students often have access to fewer institutional mental health resources than their peers in four-year institutions and, on average, suffer from more severe mental health challenges [13]. Indeed, as few as 7% of community colleges report that students have access to an on-campus psychiatrist [11].

This material is based upon work supported by the National Science Foundation under Grant No. 1929478, 1929484, and 2029206.

Within higher education, mental health in engineering programs has become an area of interest. While previous work does not indicate that engineering students are more likely to experience mental health issues [14], [15], engineering students are less likely to seek help for mental health issues [16], and engineering programs have been found to foster cultures of stress and shame [17]–[19]. Unfortunately, the authors have been unable to find previous research exploring whether these trends exist in the community college setting, leaving a knowledge gap that this paper hopes, in part, to address.

With the onset of the COVID-19 pandemic, mental health for all college students has likely worsened. While still an area of active research, some early studies have reported increased rates of eating disorders, anxiety, and depression among four-year college students during the pandemic [4], [5], [20]. Research into the mental health of engineering students specifically highlights that these students faced high levels of life-stress [3].

The authors were unable to locate research concerning the effects of COVID-19 on the mental health of community college students specifically; however, based on pre-COVID trends it may be reasonable to expect that community college students were impacted by COVID in significantly negative ways. Community colleges tend to have higher proportions of students from lower socioeconomic backgrounds, students from under-served racial and ethnic backgrounds, and first-generation students than four-year colleges [7], [9]. Community colleges also act as a starting point for roughly half of college students with physical disabilities [21]. Research has shown that these groups disproportionately suffered negative health and economic consequences as a result of the COVID-19 pandemic [14], [22]–[25]. This is in addition to the long body of research documenting the unique barriers these groups faced pre-COVID in higher education and engineering in particular [26]–[30]. Additionally, the relative lack of mental health resources offered by community colleges likely means that these students have fewer resources available to them to get through any COVID-precipitated mental health issues. Therefore, it is important to survey community college students directly to determine how the pandemic has affected this population.

III. METHODS

A. Survey Design

The data presented here was collected as part of a larger study to measure the mental health and life stress of engineering students in the United States [1]–[3].

The study design is similar to one used previously to measure pre-COVID mental health in engineering students [31]. Respondent mental health is measured using a number of validated population scale surveys. The Patient Health Questionnaire (PHQ) is used to measure anxiety, depression, and eating disorders [32]. PTSD-like symptoms are captured by the PC-PTSD instrument [33]. All other mental disorders are measured by the Kessler-6, a six question screening instrument designed to detect whether a respondent may be suffering

from any diagnosable mental health condition [34]. These instruments have been widely used and thoroughly explored in the literature, and therefore will not be discussed in detail here.

A modified version of the Social Readjustment Rating Scale (SRRS) is used to measure respondents’ stress as a result of COVID-19 [10]. The original instrument asked respondents to report which stressful life events from a set list they had experienced in the previous year. Numerical scores associated with each stressful life event were used to compute a total stress score for each respondent. This work, however, uses the modified SRRS to inventory stressful life events student encountered due to COVID. The questions in our modified SRRS are shown in Table I.

TABLE I
STRESSFUL LIFE EVENTS IN THE MODIFIED SRRS SCALE

Stressful life event
Ceasing formal schooling
Changing to a new school
Death of a close family member
Death of a close friend
Death of spouse or serious partner
Ending a romantic relationship
Foreclosure on mortgage or loan
Living with new people
Losing job or internship offer
Major change in church activity
Major change in eating habits
Major change in financial state
Major change in health or behavior of a family member
Major change in living conditions
Major change in number of arguments with romantic partner
Major change in number of family get-togethers
Major change in sleep habits
Major change in social activities
Major change in type/amount of recreation
Major change in work/school hours or conditions
Major change in work/school responsibilities
Major personal injury or illness
Mandatory quarantine
Sexual difficulties/major changes in sexual activities
Taking on a loan

The instrument also asks respondents about whether their food security, housing security, and ability to access instruction were negatively affected by, improved by, or unaffected by COVID-19 and their school’s response to it. Finally, the instrument collects demographic information on categories including gender, race, sexuality, and parents’ highest level of education.

B. Participants and Data Collection

With IRB approval, the survey instrument was broadly disseminated to students across the United States in May of 2020. To reach as many students as possible as quickly as possible, the survey was largely distributed with the help of organizations—including The Society for Women Engineers and The American Indian Sciences and Engineering Society—and through online communities meant for engineering students, including GradCafe’s Engineering Students Forum and Reddit’s */r/EngineeringStudents* sub-Reddit. Authors also used

personal and professional connections to disseminate the survey, and the survey recruitment information was sent to the email lists of several ASEE chapters. To recruit community college students specifically, survey recruitment information was sent to ASEE Pacific Southwest's 2-Year College email list with the hope that recipients might forward the survey information on to their students.

In hopes of increasing participation rates and recruiting a broad cross-section of two- and four-year engineering students, we offered a \$5 Amazon gift card for the first 1000 respondents completing the survey.

As a result of both offering an incentive and using public-facing recruitment channels like Reddit, we received a number of fake responses to the survey. To account for this, we rejected all responses from those who did not provide a valid ".edu" email address associated with the institutions they purported to attend. We also discarded responses from respondents who submitted more than once.

After cleaning the data, we were left with 83 respondents from 23 community colleges. The respondent population was largely white, male, cis-gendered, and heterosexual. A detailed demographic breakdown of respondents is shown in Table II.

TABLE II
EXPANDED DEMOGRAPHIC INFORMATION.

Demographic	Respondents
Race or Ethnicity	
White (not Hispanic)	52
Hispanic or Latin(x)	15
Asian	7
Black or African American	3
American Indian or Alaska Native	2
Other	4
Gender	
Men	61
Women	22
Sexuality	
Heterosexual	78
LGBTQA	4
Bisexual	3
Gay	1
Disability	
Learning disability	7
Physical disability	10
Parents' Education	
Bachelor's degree	19
Completed some college	19
Post-Bachelor's Training	16
High-school diploma or equivalent	11
Associate's degree	11
Some formal schooling	6
Other Factors	
Diagnosed with mental health condition	8
Veteran of Armed Forces	7

C. Data Analysis

To address research question 1, positive screen rates were computed for the Kessler, PHQ, and PC-PTSD instruments. Respondents were not required to answer every question, leading to some incomplete screens. If the respondent provided enough information on a screen to conclusively give a positive or negative screen, their response for the screen was kept;

otherwise, their response for that screen was omitted. For the Kessler 6, the scoring threshold for moderate psychological distress proposed and validated by Prochaska et al. [35] is used in addition to the standard scoring threshold for major psychological distress. With the screening instruments, certain conditions are mutually exclusive: a respondent with a positive screen for major depressive disorder automatically receives a negative screen for other depressive disorder. The same holds true for major vs. moderate psychological distress as measured by the Kessler-6.

A series of logistic regressions were run to determine which populations were statistically more or less likely to screen positive for a mental health screen. Due to the relatively small sample size and relative lack of diversity among respondents, the regression analyses were not able to converge on a solution when all demographic groupings were considered. Therefore, regressions were limited to considering race, gender, physical disability, and parents' education. Further, both race and parents' education were recoded into fewer categories to allow for convergence. Race was recoded into "White (not Hispanic)," "Hispanic or Latin(x)," or "Other." Parents' Education was simplified into "First generation college student" containing all respondents without a parent with a four-year degree, and "Bachelor's or higher" containing respondents with at least one parent who completed at least a bachelor's degree. The regression baselines for each category were chosen to represent the historically privileged populations, as summarized in Table III.

TABLE III
BASELINE POPULATIONS FOR REGRESSION

Regression Category	Baseline
Race/Ethnicity	White, non-Hispanic
Education	Bachelor's or higher
Physical disability	No

TABLE IV
SRRS EVENT WITH TOO FEW POSITIVE SCREENS FOR REGRESSION ANALYSIS

SRRS event excluded from analysis
Ceasing formal schooling
Death of a close family member
Death of spouse or serious partner
Foreclosure on mortgage or loan
Major personal injury or illness
Sexual difficulties/ major changes in sexual activities

To address research question 2, we computed the number of positive screens for each stressful life event faced by students. Regression analysis was completed to determine which demographic groups were more or less likely to experience each life event. Due to the small number of positive responses, regressions were unable to converge for the life events shown in Table IV.

Research question 3 is addressed using similar methods to research question 2. Regressions are used to determine which

groups are most likely to face worse food security, housing security, and access to instruction.

D. Limitations

There are several limitations to this study. First, the sample size is small, potentially limiting the general applicability of the results. Additionally, due to the small sample size, our ability to detect demographic differences is limited to a few categories within race, gender, and parents' highest level of education. Also, because of the way participants were recruited, we have no way of knowing how well our respondent pool represents the broader community of engineering-focused community college students. Despite these concerns, we believe that the trends found in the data are worth the consideration of the engineering education community and administrators looking to better understand the challenges faced by their students.

IV. RESULTS

The overall screening rates for various mental health conditions and the 95% confidence intervals are shown in Figure 1. The screening rates indicate that 72% of respondents who completed all instruments screen positive for one or more mental health condition (excluding Kessler Moderate).

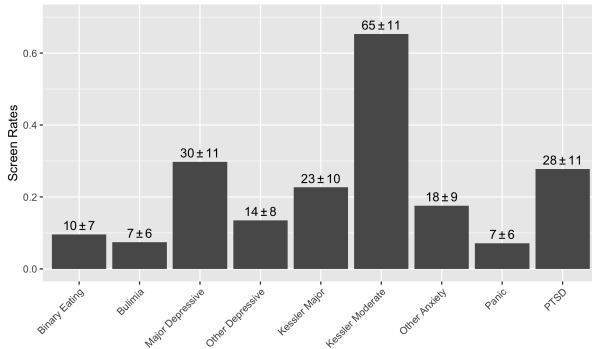


Fig. 1. Positive screen rates with 95% confidence intervals for all respondents.

Overall 88% of respondents screen positive from at least a moderate level of psychological distress as measured by the Kessler 6, with 43% screening positive for a depressive disorder, 21% screening positive for an anxiety disorder, 28% screening positive for PTSD-like symptoms, and 18% screening positive for an eating disorder. Due to the relatively small sample size, however, the confidence intervals on any measure are large, indicating that actual positive screen rates could be significantly lower or higher than reported by this sample.

Running a logistic regression on the mental health screens versus demographic factors showed that respondents identifying as women were statistically less likely ($p = .05$) to screen positive for moderate psychological distress than respondents identifying as men. Respondents identifying as a race and ethnicity other than White and Latin(x) were statistically more likely ($p = .01$) to screen positive for major psychological

distress, and less likely ($p = .005$) to screen positive for moderate psychological distress than the baseline White identifying population. First-generation status and having a physical disability were not statistically significant predictors of mental health screens for this sample.

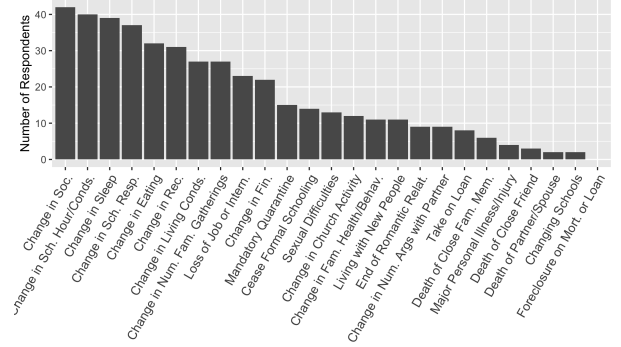


Fig. 2. Frequency of stressful life events experienced due to COVID-19 pandemic.

The stressors reported by respondents on the modified SRRS are shown in Figure 2. The results of the logistic regression analysis are summarized in Table V. From the regressions, respondents who identified as non-white and non-Hispanic were significantly more likely to face several stressful life events as a result of COVID-19 and their institution's response to it. On the other hand, respondents whose parents' highest level of education was less than a four year degree were significantly less likely to face changes in school responsibilities, schooling hours and conditions, and sleep habits. Respondents reporting a physical disability were statistically more likely to report the death of a friend as a result of COVID-19.

TABLE V
POPULATIONS SIGNIFICANTLY ($p < .05$) MORE OR LESS LIKELY TO EXPERIENCE A STRESSFUL LIFE EVENT

Population	More likely	Less likely
Non-White, non-Latin(x)	Finances Social life Sleeping Fam gatherings Eating	
First gen. college		School responsibilities School hours/conditions Sleeping
Physical disability	Death of friend	

TABLE VI
CHANGES TO RESPONDENTS FOOD SECURITY, HOUSING SECURITY, AND INSTRUCTION ACCESS

Category	Worse	No change	Improved
Food	31	44	7
Housing	26	47	9
Instruction	29	46	7

Finally, the results of our questions on how the COVID-19 pandemic and respondents' schools' response to it affected food security, housing security, and instruction security are shown in Table VI. In each category, roughly a third of respondents reported worse outcomes as a result of the pandemic and their institution's response to it. A small number of respondents, however, found that their situation improved from where it was pre-COVID. Regression results indicate that Hispanic and Latin(x) identifying respondents were significantly less likely to experience worsened food insecurity ($p = .04$). Results also show that while first generation college students were more likely to experience worsened housing security ($p = .015$), they were less likely than the baseline population to experience worsened instructional access ($p = 0.01$).

V. DISCUSSION

Our sample of engineering-focused community college students showed very high rates of mental health issues, with 72% of respondents who completed all instruments screening positive for at least one potentially DSM diagnosable condition, and 88% of respondents screening positive for moderate or major psychological distress. On a per-condition basis, however, most of the positive screen rate numbers are in line with what has been reported pre-pandemic for four-year engineering students [36]. While our respondents show significantly increased rates of major depression versus pre-COVID-19 samples, these screening rates are similar to rates of major depression reported for four-year STEM students during the pandemic [6]. Therefore, given the study's small sample size, on a per condition basis, it does not appear as though engineering-focused community college students suffered from significantly higher rates of mental wellness issues than their four-year peers during the onset of the COVID-19 pandemic. Given the documented disparity in mental health access between two- and four-year student populations [11], [13], however, it is likely that two-year students have fewer resources to manage any mental health issues. Indeed, while 72% of our two-year respondents who completed all instruments had at least one positive screen for a diagnosable mental health condition, only 9% of those respondents reported ever receiving a clinical diagnosis for a mental health condition. This contrasts with reported diagnosis rates of 16% for four-year engineering students [36].

From a life-stress events perspective, many of the commonly reported items—including change in socialization, change in work or school hours and responsibilities, change in recreation—were likely a direct result of public health measures designed to mitigate COVID-19. While stressful, these experiences are likely shared by a wide swath of the population, and may have already started to mitigate as many areas in the U.S. have relaxed COVID-related restrictions since the survey was conducted.

Other reported events are more worrisome. The high number of respondents reporting change in sleep patterns may be predictive of problems as sleep problems have been associated with both poor mental health [37] and lower academic

performance [38]. While the SRRS does not measure whether changes in sleep are for the better or for the worse, and while a decrease in in-person socialization and parties may allow for healthier sleep habits among some college-aged adolescents, this is an area that may warrant more research and possible intervention. Additionally, the high number of respondents reporting factors like loss of job, major change in financial situation, and cessation of schooling may all point to a deteriorating standard of living and loss of opportunity for respondents as a result of COVID-19.

Regression analysis shows that respondents from non-Hispanic marginalized racial and ethnic groups are more likely than their majority white peers to face a large number of stressful life events as a result of COVID-19. This potentially points to the need for more interventions to support engineering-focused community college students from these communities.

Perhaps surprisingly, first-generation respondents (defined as having no parents with a Bachelor's degree) were less likely than non-first-generation respondents to face change in school responsibilities, hours and conditions, and sleeping patterns than their peers. To the extent that parents' education is a proxy for socio-economic status in the United States, it may be that some first-generation respondents were already struggling before COVID-19, so the pandemic and its associated economic challenges produced less of an overall shock on these individuals than their peers. Along socio-economic lines, first-generation students and their families may have received relatively more benefit from pandemic-related measures like eviction moratoriums and stimulus payments. Regardless, further investigation of this trend is warranted to see what policies if any had highly supportive effects on first-generation engineering-focused community college students.

Finally, and potentially most seriously, respondents reporting a physical disability were significantly more likely to report the death of a friend as a result of COVID-19. Existing literature also indicates that those with physical disabilities face worse risks of infection and outcomes from COVID-19 due to both co-morbidity and environmental factors [39]. Given their increased risks from COVID-19, the traumatic nature of losing a friend and the struggles, and the barriers already faced by individuals with physical disabilities in higher education and engineering [28], [30] this group could likely benefit from added institutional support and resources.

The results of the basic needs and instruction access questions paint a particularly grim picture of quality of life for engineering-focused community college students during the COVID-19 pandemic. 51% of respondents report that COVID-19 either caused or worsened housing insecurity issues, and 61% reported that the pandemic caused or worsened food insecurity issues. These findings are particularly troubling since food and housing insecurity are both known to have negative effects on mental health and academic performance [40]–[42]. Additionally, 57% of respondents reported issues with accessing instruction or instructional materials due to the pandemic, potentially indicating that they are not able to fully engage with their learning experience. Interestingly,

respondents identifying as Hispanic were less likely than the baseline population to suffer from food insecurity. Also, while first-generation respondents were more likely to suffer housing insecurity than their peers, they were also less likely to experience worsened access to instruction than their peers; potentially mitigating some of the negative academic consequences they might otherwise have faced.

VI. CONCLUSIONS

This work explored the mental health and wellness in engineering-focused community college students during the early stages of the COVID-19 pandemic. The data indicates that this population faces significant mental health challenges, with up to 72% of respondents screening positive for at least one diagnosable condition. The fact that only 9% of these same respondents report ever receiving a mental health diagnosis indicates that there is likely significant unmet need for mental health services and interventions among this community. While the generalizability of this recommendation may be limited by the relatively small sample size, these findings are consistent with previous literature examining overall mental health and access to mental health resources among all college students.

This work also examined stressful life events respondents faced due to COVID-19, and how COVID-19 impacted respondents' ability to meet needs including housing, food, and instruction access. The results here are discouraging. More than half of respondents reported that their food and housing security has been worsened as a result of COVID-19, and 48% of respondents reported a major change in sleep habits. Issues in these areas have previously been shown to correlate with lower mental health and worse academic outcomes [37], [38], [40]–[42]. When combined with the finding that 57% of respondents experienced worsened access to instruction, it seems likely that the COVID-19 pandemic had a major negative impact on quality of life and ability to succeed academically among engineering-focused community college students.

As the community college students affected by initial wave of the pandemic finish their programs and look to transfer to four-year institutions, it is imperative that programs admitting these transfer students offer resources and interventions to help these students successfully finish their degrees. It is also important for community colleges to look for ways to increase mental health and basic needs resources available to their students so that they are better able to meet ongoing mental health needs.

ACKNOWLEDGMENT

We would sincerely like to thank our student participants for their time and openness, and our undergraduate statistics students for their help with data analysis techniques and scripts. This material is based upon work supported by the National Science Foundation under grants EEC #1929478, #1929484, and #2029206. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the

author and do not necessarily reflect the views of the National Science Foundation.

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