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Impact of COVID-19 Pandemic on College Student Mental Health and Wellness

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Objective: To test the impact of the coronavirus disease 2019 (COVID) pandemic on the emotions, behavior, and wellness behaviors of first-year college students.

Method: A total of 675 first-year university students completed a full assessment of behavioral and emotional functioning at the beginning of the spring semester 2020. Of these, 576 completed the same assessment at the end of the spring semester, 600 completed at least 1 item from a COVID-related survey after the onset of COVID pandemic, and 485 completed nightly surveys of mood and wellness behaviors on a regular basis before and after the onset of the COVID crisis.

Results: Externalizing problems (mean = -0.19 , 95% CI = -0.06 to 0.33 , $p = .004$) and attention problems (mean = -0.60 , 95% CI = -0.40 to 0.80 , $p < .001$) increased after the onset of COVID, but not internalizing symptoms (mean = 0.18 , 95% CI = -0.1 to 0.38 , $p = .06$). Students who were enrolled in a campus wellness program were less affected by COVID in terms of internalizing symptoms ($\beta = 0.40$, SE = 0.21 , $p = .055$) and attention problems ($\beta = 0.59$, SE = 0.21 , $p = .005$) than those who were not in the wellness program. Nightly surveys of both mood ($\beta = -0.10$, SE = 0.03 , $p = .003$) and daily wellness behaviors ($\beta = -0.06$, SE = 0.03 , $p = .036$), but not stress ($\beta = 0.02$, SE = 0.03 , $p = .58$), were negatively affected by the COVID crisis. The overall magnitude of these COVID-related changes were modest but persistent across the rest of the semester and different from patterns observed in a prior year.

Conclusion: COVID and associated educational/governmental mitigation strategies had a modest but persistent impact on mood and wellness behaviors of first-year university students. Colleges should prepare to address the continued mental health impacts of the pandemic.

Key words: adolescence, COVID-19, young adulthood, wellness, substance use, college behavior change

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The novel coronavirus disease 2019 (COVID-19) emerged in Wuhan, China, in December 2019.¹ By January 20, 2020 the first confirmed case was identified in the United States in Washington State, and the first death was reported on February 29. By early March, most states had identified cases, and by mid-March state-wide school closures and stay-at-home orders were announced in many states. The rapid pandemic progression and the associated mitigation strategies up-ended millions of lives within weeks of the virus arriving in the United States. Early data from China suggest that the outbreak, as well as unprecedented government response, have had profound psychological impact on the general public.^{2,3} Many university and college students were displaced from their dormitories and peer groups, required to leave campus immediately—in many cases, without their belongings—and expected to continue their academic work as usual, remotely. The aim of the analysis is to understand the

effects of the pandemic and the resulting mitigation strategies on the emotional health and wellness of first-year university students.

There are a number of additional reasons why students in particular may be at risk. Many undergraduate students faced this disruption without a familiar routine and support to provide a sense of stability and coherence.⁴ More generally, late adolescence is a period of neurodevelopmental risk due to a developmental mismatch between mature subcortical regions (eg, nucleus accumbens, amygdala) associated with reward seeking and the experience of emotions and still-developing regulatory prefrontal cortical regions.^{5,6} This mismatch sets the stage for poorly regulated risk taking and emotional functioning.^{7,8} The risks are especially salient for college students, most of whom also experience a precipitous decrease in adult scaffolding and parental supervision and support. Not surprisingly, Cao *et al.*⁹ demonstrated that nearly one-fourth

(24.9%) of college students were found to be experiencing anxiety due to the COVID outbreak in China. Gender did not significantly impact COVID-related anxiety; however, living with parents, and having a steady family income, were protective against anxiety. Although only 0.55% of the sample had an acquaintance or relative infected with COVID, this personal connection was significantly predictive of the level of student anxiety.

The speed with which the pandemic has developed, the extent of the governmental and educational mitigation strategies, and the ongoing nature of the threat make this a unique experience. The closest comparisons for university and college students are the effects of natural disasters such as a hurricane or an earthquake. These events are collective, disruptive, and may pose an ongoing threat to safety. Commonly observed effects of such experiences include anxiety, depression, and stress,¹⁰⁻¹² but also low academic motivation.¹³ The perceived level of personal disruption of the event was closely tied to worse psychological outcomes.¹² It is not at all clear whether students' responses to COVID will follow a pattern similar to that observed with natural disasters such as Hurricane Katrina. Furthermore, most studies of responses to collective events have information only on the students' responses *after* the events, and thus are limited in their ability to inform how much functioning has changed from before the event. We found only 1 such study that had information on students from before the disaster, in which the investigators found that posttraumatic stress-related symptoms significantly increased after an earthquake and continued to remain significantly elevated at 7 weeks after the earthquake.¹⁴ To disentangle the effects of the event from the individual risk requires an experimental design in which individuals were sampled before the events.

In Vermont, the president of the University of Vermont (UVM) announced that the school would be shifting to remote learning indefinitely as of Wednesday, March 11, and a stay-at-home order was instituted for the state by Governor Scott on March 24. These announcements also occurred in the midst of an ongoing study of student emotional health and wellness. This provided a natural experiment with which to understand the effects of COVID and associated mitigation strategies on changes in individual emotional health and wellness behaviors. It was hypothesized that the onset of COVID and associated residential and educational disruptions would be associated with decreased emotional health and lower levels of wellness behavior.

Finally, a significant portion of the students in the study were enrolled in the UVM Wellness Environment (WE) program, a program created by Dr. Hudziak to support students in the transition to college and to encourage

students to make healthier decisions.¹⁵ This program involves educational and residential components to provide students access to and education about different wellness behaviors. Students are expected to live by a code that requires that they do not possess alcohol, drugs, or paraphernalia in their dormitories, thereby promoting a substance-free environment. It was hypothesized that students in this program may display fewer adverse effects of the COVID-related disruptions.

METHOD

Sample

This study is a subsample of a larger, ongoing student emotional health and wellness study at the University of Vermont (Figure S1, available online). Eligible participants for the larger study had to be full-time, first-year UVM undergraduates, aged 18 to 25 years, with an iPhone 5 or newer (for app compatibility). All participants completed an informed consent approved by the UVM institutional review board. A total of 675 students completed a full assessment of behavioral and emotional functioning at the beginning of the spring semester in 2020. Of these, 576 completed the same assessment at the end of the spring semester after the onset of COVID, 600 completed at least 1 item from a COVID-related survey, and 485 completed nightly surveys of mood and wellness behaviors on a regular basis both before and after the onset of the COVID crisis. About 67% of participants were enrolled in the UVM Wellness Environment (WE) program.

Assessment

COVID Survey. An additional questionnaire was added to end of the spring semester assessment in spring 2020 to evaluate students' response to the COVID pandemic.¹⁶ The survey was developed after the onset of the COVID crisis to characterize an individual's response to the crisis. The survey's items measured students' confidence in the state/federal government's response to and handling of the pandemic, their hopefulness that the crisis would be resolved and whether they had a good outlook for their future, whether they knew someone who became ill or died of the COVID virus, and the level of disruption that the pandemic had on their daily life. The full text of this survey, including survey questions and response options, is provided in Table S1, available online.

In-Depth Assessments. All participants completed 3 self-report survey batteries through the RedCap platform at the beginning of the fall semester, the beginning of the spring semester and the end of the spring semester. Although a number of measures were included, this study

focuses on results from the Brief Problem Monitor from the beginning and end of the spring semester. The Brief Problem Monitor (BPM/18-59) was introduced by Achenbach *et al.*¹⁷ A survey of 18 items, the BPM is intended to evaluate internalizing, attention, and externalizing problems in adults 18 to 59 years of age. Each of the 18 items appears on the Adult Self Report (ASR) and the Adult Behavior Checklist. It has been determined that BPM/18-59 can serve as an alternative or supplement to the ASR, particularly when frequent and brief assessments are needed.

Ecological Momentary Assessments. All participants in the study were asked to download an app to complete daily surveys across the school year.¹⁸ The daily survey was open from 7 pm to 11:59 pm every evening, and prompted participants to report on 21 health- and wellness-related behaviors from the day. Five wellness items (ie, minutes of exercise, minutes of screen time, nutritional quality of meals, hours of sleep, and amount of water consumed), and the 2 mood-scale items (mood, stress) from the spring semester are the focus of this analysis. The 5 wellness items were each dichotomized to indicate absence (0) or presence (1) of healthy choices and summed to form a cumulative wellness index. The full text of this survey, including survey questions, response options, and cut-off values, is provided in Table S2, available online.

Statistical Analyses

Descriptive statistics for demographic variables included age, involvement in the wellness program, gender, ethnicity, and subjective social status (SSS). A χ^2 test was conducted to examine the sample distribution in these demographic characteristics. The descriptive statistics of responses to the COVID survey were summarized, and the response difference in demographic variables mentioned above was tested. Change scores of pre- and post-COVID BPM were calculated, and the difference in participants with or without wellness program involvement was tested. All analyses of the daily surveys had to account for repeated, correlated observations within individuals. Correlation matrices were introduced to account for within-subject correlations using general estimating equations implemented in SAS PROC GENMOD, with an autoregressive covariance structure. In this approach, participant ID is introduced as a cluster (class) variable. Robust variance estimates (ie, sandwich-type estimates) adjusted the standard errors of the parameter estimates for the within-person nesting of observations. All analyses were conducted with SAS 9.4 software (SAS Institute, Cary, NC).¹⁹ The α value for significance testing was set at .05 for hypothesis testing.

RESULTS

Sample descriptive statistics including gender, ethnicity, and year in college were also collected on all participants, as well as the follow-up samples (Table 1). The sample has a racial/ethnic composition similar to that of the UVM student body, but a higher percentage of female students.

COVID survey

All participants were sent a COVID-specific survey as part of their end-of-the-year survey. This survey was completed by 600 of the study participants, or 88.9% of the participants who completed the assessment at the beginning of the spring semester ($n = 675$). Participants who completed the COVID survey were not different from those that did not in terms of gender, ethnicity, age, involvement in the wellness program, or SSS.

Figure 1a and 1b provide the responses of the students to the survey items. The majority of students (68.4%; $n = 384$) reported that they were not confident in the government's handling of COVID. Older students, just among first-year students, and those in the wellness program were more likely to report confidence in the government ($p = .008$ and $p = .05$, respectively). At the same time, 86.3% of students ($n = 490$) were hopeful that COVID would be resolved. Such optimism was not related to gender, ethnicity, SSS, or involvement in the wellness program. Almost all students (95.8%; $n = 536$) reported compliance with governmental rules and suggestions for conduct during the pandemic. Female students were slightly more likely to report compliance than male students (96.5% versus 93.3%, $p = 0.01$). The majority of students (75.2%; $n = 425$) found this compliance with governmental rules and suggestions easy. This ease of compliance was not associated with gender, ethnicity, SSS, or involvement in the wellness program.

In terms of the impact on their lives, 23.8% of the students ($n = 136$) knew someone who had tested positive for COVID, and 2.4% ($n = 14$) knew someone who had died of COVID. No group of students was more likely to report knowing someone who had tested positive for or died of COVID. Finally, students reported how disruptive COVID had been to them personally on a 10-point scale, ranging from "not at all disruptive" to "extremely disruptive." The mean level of disruptiveness was 7.8 ($SD = 2.1$), with 87.3% reporting a score of 6 or greater. This is not surprising, as all students were affected by shifting to remote learning and by the shutdown of the university campus. The level of disruptiveness was higher for younger students and those who were not involved in the wellness program.

Changes in Emotional and Behavioral Functioning

Participants completed the Brief Problem Monitor to assess emotional and behavioral functioning at the beginning of the spring semester before COVID and at the end of the spring semester. Of the 675 students who completed the BPM at the beginning of the spring, 576 completed the BPM at the end of the year (85.3%). There were no differences in attrition by sex, ethnicity, age, WE status, or SSS (Table 1).

The BPM produces scales for internalizing problems, attention problems, and externalizing problems. From the beginning of the spring to the end of the spring, there were modest improvements in internalizing symptoms (mean = 0.18, 95% CI = -0.1 to 0.38, $p = .06$) but decrements in externalizing problems (mean = -0.19, 95% CI = -0.06 to 0.33, $p = .004$) and attention problems (mean = -0.60, 95% CI = -0.40 to 0.80, $p < .001$). Moderation of COVID-related differences in BPM scales were also tested in relation to age, WE involvement, gender, ethnicity, and SSS. Only WE involvement moderated changes in BPM scale scores (Figure 2). The WE students experienced

improved internalizing symptoms ($\beta = 0.40$, SE = 0.21, $p = .055$) and less deteriorating attention over the spring semester as compared to students who were not in WE ($\beta = 0.59$, SE = 0.21, $p = .005$). Although there were no differences between these groups' scores at baseline on any BPM scale, WE students had lower attention problems scores at the end of the semester ($\beta = 0.94$, SE = 0.25, $p < .001$), and a similar trend was seen for internalizing problems ($\beta = 0.44$, SE = 0.25, $p = .07$). Finally, the more disruption that students experienced related to COVID, the greater the increase in their internalizing symptoms ($\beta = -0.13$, SE = 0.05, $p = .004$).

Changes in Daily Mood, Stress, and Wellness

Five-minute, nightly ecological momentary assessments were completed by participants throughout the spring semester before and after the onset of COVID, providing a high-resolution picture of potential changes in mood, stress, and wellness behaviors. In total, 485 first-year students completed 50% of the nightly surveys across the spring semester, or 71.8% of those completing the beginning of

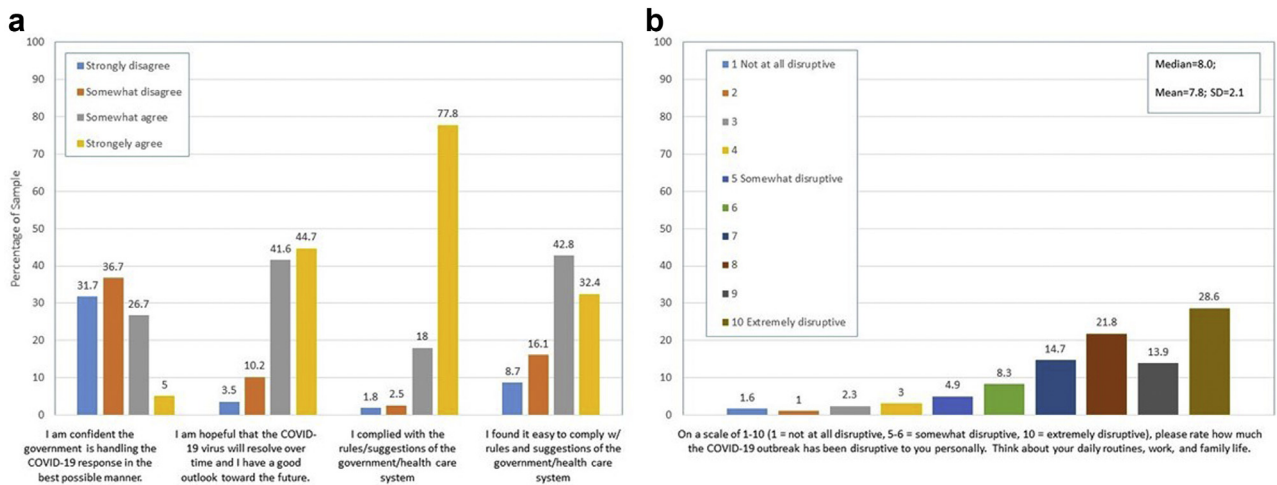
TABLE 1 Descriptive Information About First-Year College Sample

Characteristic	Beginning of spring sample (n = 675)		End of spring sample (n = 576)		p	EMA sample (n = 485)		p
	n	%	n	%		n	%	
Gender ^a								
Female	500	74.1	435	75.5	.32	367	75.8	.34
Male	172	25.5	139	24.1		117	24.2	
WE status								
WE	453	67.1	386	67.0	.87	328	67.6	.95
Non-WE	222	32.9	190	33.0		157	32.4	
Ethnicity								
African American	5	0.7	2	0.3	.62	2	0.4	.77
Asian	28	4.2	20	3.5		17	3.5	
White/Caucasian	604	89.5	523	90.8		439	90.5	
Latina/Latino	20	3.0	16	2.8		13	2.7	
Other	15	2.2	17	2.9		14	2.9	
Age, y								
18	618	91.4	532	92.0	.76	447	92.2	.17
19	51	7.6	39	6.8		35	7.2	
20	4	0.6	4	0.7		3	0.6	
21	2	0.3	2	0.4		0	0.0	
SES								
1-4	46	6.9	36	6.3	.56	29	6.0	.52
5-7	445	66.3	387	67.4		324	66.9	
8-10	180	26.8	151	26.3		131	27.1	

Note: EMA = ecological momentary assessments; SES = socioeconomic status; WE = involvement in wellness program.

^aA small number of students identified as other than male or female.

FIGURE 1 Descriptive Results of COVID Survey Items



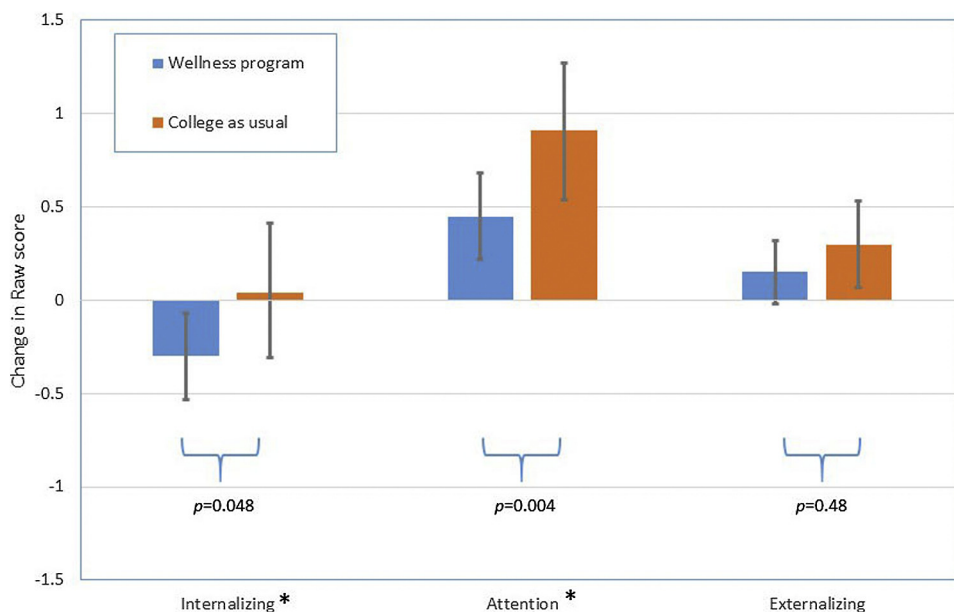
Note: Descriptive results from the items on the COVID survey administered at the end of the spring semester. (a) First 4 items related to the government response and individual compliance. (b) Disruptiveness of COVID to the student’s life personally. Please note color figures are available online.

the spring assessment. Those who routinely completed the daily surveys were not different in terms of gender, race/ethnicity, age, WE status, or SSS from those who did not.

Figure 3 displays the weekly survey values for overall mood, stress, and an index of 5 wellness behaviors. The vertical line indicates the week of spring break, when the

students were informed that on-campus instruction would be discontinued for the remainder of the spring semester. Each of these outcomes has been standardized to allow for comparison of all items on a single figure. There are 2 patterns. The first is similar for overall mood (in blue) and the wellness index (in orange), in which levels drop in the 2

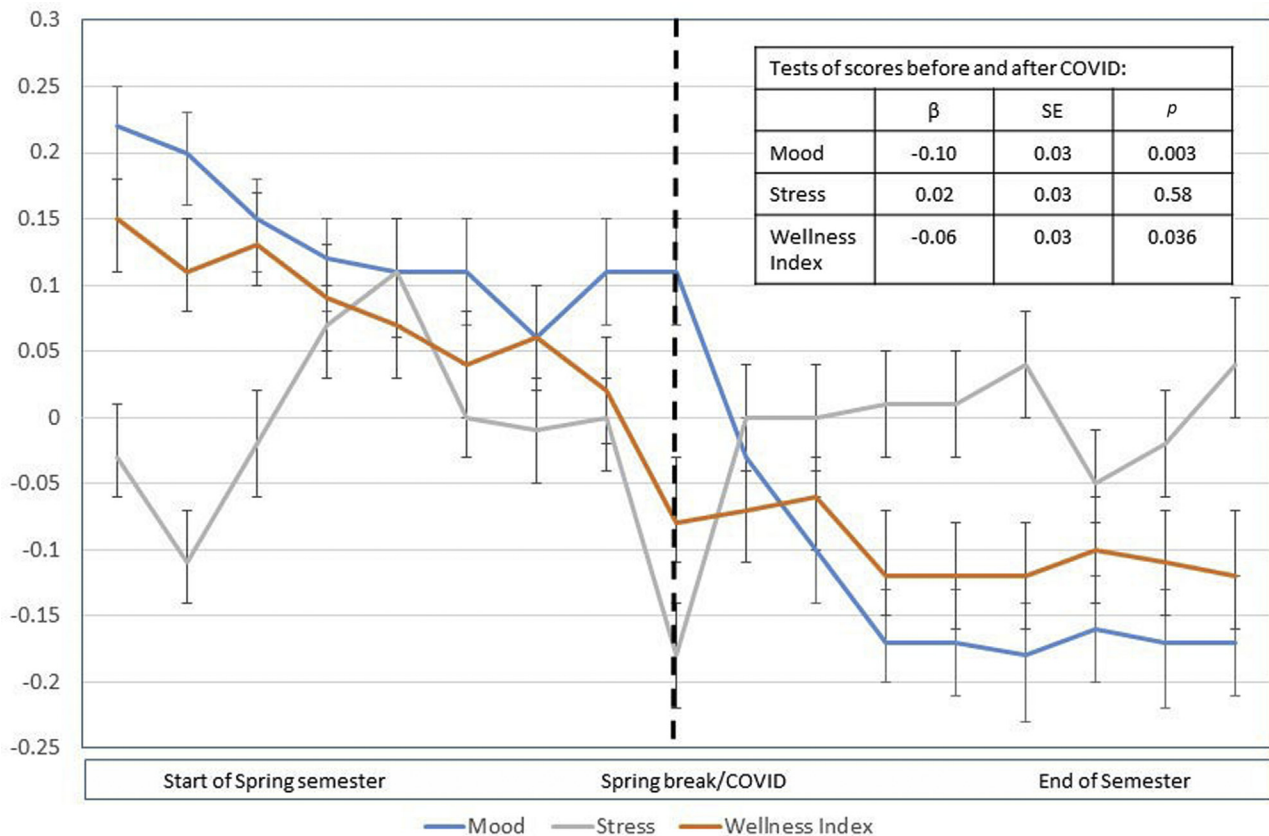
FIGURE 2 Changes in Brief Problem Monitor (BPM) Scale Scores After COVID Onset



Note: Displays changes in scores on different Brief Problem Monitor scales from the beginning of the spring semester before COVID to the end of the spring semester. Please note color figures are available online.

*p < .05.

FIGURE 3 Nightly Survey Results Across Spring Semester



Note: Result from nightly ecological momentary assessments throughout the spring semester. Vertical dashed line indicates spring break when on-campus learning was suspended. Please note color figures are available online.

to 3 weeks after spring break and then remain relatively steady through the end of the semester. This is consistent with a COVID-related drop in overall mood and wellness behavior. Follow-up analyses on the wellness index indicated drops in each of the 5 behaviors after COVID, including exercise minutes, nutritional quality, sleep, and hydration coupled with increases in screen time. The second pattern is for stress level (higher indicates more stress), in which the levels vary throughout the semester with no change from before to after COVID.

It is plausible that the observed change in mood and wellness behaviors is not uncommon after spring break. To test for this pattern, we analyzed UVM nightly survey data from spring 2018 for mood and wellness behavior (stress was not assessed that semester). In both cases, there was a significant difference, but in the direction of improved mood and wellness behavior after spring break.

Finally, we tested whether particular groups of students were vulnerable or resilient to the COVID-related changes.

Both mood and wellness changes were associated with how personally disruptive the crisis was for the student (mood: $\beta = 0.03$, $SE = 0.01$, $p = .02$, and wellness: $\beta = 0.02$, $SE = 0.01$, $p = .12$, respectively). There was little evidence of additional vulnerable groups for the overall wellness index. In the case of mood, there was trend-level associations for both gender and WE status ($\beta = 0.10$, $SE = 0.06$, $p = .09$, and $\beta = 0.09$, $SE = 0.05$, $p = .08$, respectively), in which the drop in mood was somewhat greater in female students and those not enrolled in the wellness program.

DISCUSSION

In addition to concerns for the health of oneself and loved ones, college students faced an interruption in their spring semester, in which on-campus learning and residential living were suspended. This study leverages an ongoing study of college life that was begun before COVID to study the impact of this disruption on emotional and behavioral

functioning. Despite subjective reports that the crisis was highly disruptive and that there was limited confidence in the government's handling of the crisis, these students (1) remained hopeful for the future and (2) reported very high levels of compliance with governmental laws and suggestions.

There were persistent negative effects on students' behavioral and emotional functioning, particularly externalizing and attention problems. These findings are consistent with those in students who have experienced natural disasters overall; but, notably, internalizing symptoms did not decline here as has been seen in prior work.¹⁰⁻¹² Also, students in the wellness program were less affected by COVID in terms of internalizing symptoms and attention problems. The nightly survey results of mood, stress, and daily wellness behaviors told a complementary story. Although these responses were highly stable within individuals, both mood and wellness behaviors were negatively affected by COVID. The overall magnitude of these COVID-related changes was modest but persistent across the rest of the semester and differed from patterns observed in a prior year.

One apparent inconsistency in our results was in the way in which stress levels were unaffected in the same daily survey that identified decreases in mood and wellness behaviors. Why should stress and mood levels vary differently? Here, our explanations rely more on conjecture than empirical data. One potential explanation lies in the return of students to home from living on campus. The transition from home to college has been identified as a significant social and academic stressor for many. The transition back home may, in turn, reduce the social stress of first-year college life. Academic stress may also have been minimized. After COVID, instructors at the University of Vermont were instructed to make additional accommodations to students, students were allowed to shift to pass/fail status, and the amount of instruction time decreased in many cases. Together, these 2 factors may have mitigated any overall increase in stress. At the same time, the pandemic and its uncertainty, isolation, and economic/health effects may be responsible for decreased mood and wellness behaviors. Regardless of the interpretation, these findings provide some evidence that closely related constructs of mood and stress are distinct and distinguishable in the context of the complexities of a pandemic and its effects.

In this study, there appears to be an advantage, albeit small, to being a part of the UVM WE learning community. Considering similar baseline scores, WE enrollment

was associated with improved internalizing problems and mitigated attention problem increases across COVID-related changes compared to college as usual students. The WE program is a neuroscience-inspired, incentivized behavioral change program that involves residential, educational, and digital interventions to promote wellness behaviors in a university setting.¹⁵ This program provided a measure of resilience in the face of COVID. It is not possible to clarify which aspect of the intervention was helpful, whether it be wellness practices themselves, the sense of community/social network,^{12,20} or students' pre-existing interest in health promotion.

This study was designed to provide a fine-grained picture of college life across the school year at UVM, but not to assess response to a pandemic such as COVID. The analysis completed is post hoc, but capitalizes on ongoing data collection to address these aims. The study was focused only on first-year college students at a single university. The racial/ethnic composition of the sample is similar to the UVM student body, but underrepresents nonwhite students as compared to the national average for colleges. Students were also required to have an iPhone 5. It is not clear whether the findings here will apply to university students with different socio-demographic profiles. Participation rates were high for a study with this type of intensive follow-up, but it is still possible that those who completed 50% or more of all daily surveys differed in ways not measured from participants who did not complete daily surveys regularly.

As universities prepare for the coming academic year, many are anticipating COVID-related adjustments, including on-campus social distancing and/or remote learning. Our study found that similar changes in spring 2020 resulted in modest but persistent psychological impacts. The greater the perceived disruption by COVID, the greater the impact. This disruption may increase for students as their families struggle with the economic conditions of the continued pandemic. Students, and particularly first-year students, may be in need of more institutional support than ever. In the face of similar challenges, other studies have suggested positive attitude and availability of faculty,²¹ and reduction of uncertainty via transparency of institutional information.^{9,21-23} These suggestions seem reasonable. Our study also supports 2 additional measures. If schools are tracking health symptoms, and most are, they also should take the opportunity to track emotional health; and if they have detailed protocols for supporting physical health, similar protocols should be in place to support mental health. Finally, there is an increasing role for college programs, such as the

UVM wellness program, that increase the sense of community within the student body and may aid in student resilience in the face of future deviations from and ongoing disruptions to typical college life.

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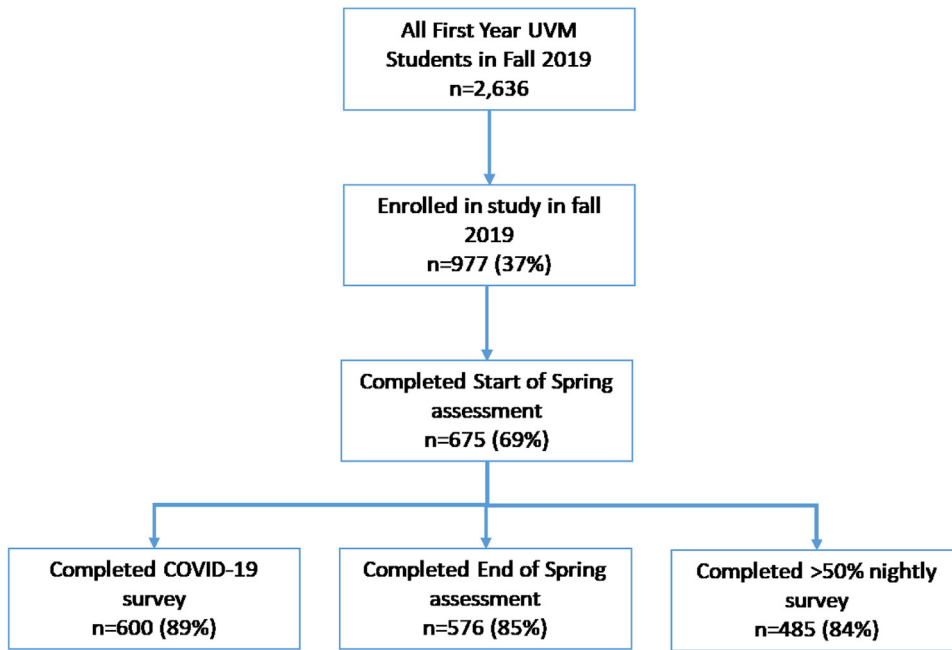
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FIGURE S1 Ascertainment Figure for Sample



Note: UVM = University of Vermont.

TABLE S1 COVID-19 Survey Items

Question	Response scale
I am confident the government is handling the COVID-19 response in the best manner possible	Strongly disagree, somewhat disagree, somewhat agree, strongly agree
I am hopeful that the COVID-19 virus will resolve over time and I have a good outlook toward the future	Strongly disagree, somewhat disagree, somewhat agree, strongly agree
I complied with the rules and suggestions of the government and health care system to remain at home to try to contain the virus	Strongly disagree, somewhat disagree, somewhat agree, strongly agree
I found it easy to comply with the rules and suggestions of the government and health care system to remain at home to try to contain the virus.	Strongly disagree, somewhat disagree, somewhat agree, strongly agree
Do you have a close friend or loved one who has tested positive for the COVID-19 virus?	Yes, No
This may be a difficult question, but has someone close to you lost their life due to the COVID-19 virus?	Yes, No
Please describe your relationship with this person (aunt, uncle, parent, neighbor, etc)	Free type
Please rate how much the COVID-19 outbreak has been disruptive to you personally. Think about your daily routines, work, and family life.	1–10

TABLE S2 Ecological Momentary Assessment Items

Question	Response scale
How was your day?	0–10
How was your stress level today?	0–10
Wellness	
How many minutes did you exercise?	0–180
How many minutes have you practiced mindfulness?	0–120
How many minutes did you play an instrument or sing today?	0–120
How would you describe the nutritional quality of your meals/snacks today?	Poor, Average, Good
How many hours of sleep did you get?	0–14
How many glasses of water did you have today?	0–12