

COVID-19 pandemic stress and resilience in female college students: a multigroup comparative study of in-person versus online enrolments

By: [Tsz Lun \(Alan\) Chu](#), Betty A. Rock-Ackley

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Abstract:

Objective College students, especially females, reported worsened mental health during the COVID-19 pandemic. This multigroup comparative study aimed to explore stress and resilience of female college students between in-person and online enrolments, as well as with and without mental health diagnoses, at early and later stages of the pandemic.

Method Participants were 32 female undergraduate students ($M_{age} = 23.75$, $SD = 6.13$) from three classes – Spring 2020 in-person, Spring 2020 exclusively online, and Spring 2021 exclusively online enrolments – in a midwestern regional university in the U.S. They completed two surveys, four weeks apart between Times 1 and 2, quantitatively and qualitatively assessing perceived stressors, stress levels, and resilience. Frequency analyses, Wilcoxon signed-rank tests, and Mann-Whitney U tests were conducted by class.

Results Overall, the most reported stressors in Time 1/Time2 were school (25.83%/26.36%), family (16.67%/18.33%), and lifestyle (16.67%/15.00%). On average, students with mental health diagnoses perceived more stressors, especially at the onset of the pandemic, than those without. Findings were presented and interpreted using cross-case analysis, suggesting that the pandemic stress and resilience depended upon students' enrolment format and associated stressors.

Conclusions This study offered practical implications for addressing student stressors during a crisis, across in-person and online enrolments, through targeted interventions.

Keywords: COVID-19 | female college students | online enrollment | distance learning | stress and resilience

Article:

Key points

What is already known about this topic:

1. College students increasingly reported elevated stress and mental health issues during the pandemic, negatively impacting females more than males.
2. The transition from in-person to online education at the onset of the pandemic added stress to students' lives.
3. People with mental health diagnoses tend to have negative appraisals and lower levels of resilience to regulate stress than those without diagnoses.

What this paper adds:

1. This study implemented a case study approach to take a deeper look at female college students' pandemic stressors and resilience to inform personalized interventions.
2. Female students who enrolled exclusively online before the pandemic reported fewer school stressors but more family stressors during the pandemic than those who enrolled in person.
3. Findings across all three classes suggest that the female students with mental health diagnoses perceived more stressors and higher stress levels than those without diagnoses across pandemic stages.

Introduction

The COVID-19 pandemic impacted people's physical and mental health globally. Meta-analyses revealed that the prevalence of anxiety and depression across countries increased to about 33% by May 2020 (Salari et al., Citation2020). Further, women, particularly those aged 21–40, were more vulnerable to stress, anxiety, and depression than men and other age groups (see Salari et al., Citation2020). College students increasingly reported worsened mental health, with female students indicating greater increases in academic and general stress, depression, and substance use than their male counterparts (Clabaugh et al., Citation2021; Fruehwirth et al., Citation2021; Kim et al., Citation2021; Liu, Pinder-Amaker, et al., Citation2020). In addition to disruptions from the “stay at home” orders, stress was elevated, especially for female students who rely more on social networks than their male counterparts (Conley et al., Citation2020), when college education transitioned to entirely online coursework and social isolation (Clabaugh et al., Citation2021). Beyond school-related stressors, examples of family and lifestyle stressors experienced by college students include concerns about their own, as well as friends ‘and family’s, health and safety, economic uncertainty, and availability of food and household goods (Clabaugh et al., Citation2021; Hagger et al., Citation2020).

Despite the shared experience of added stress, student responses and experiences varied. For instance, the COVID-19 Adult Resilience Experiences Study revealed that one-third of U.S. college students who had to relocate (and adapt to online courses), a major school-related stressor during the pandemic, showed more pandemic-related grief and anxiety symptoms than those who did not (Conrad et al., Citation2021). In addition, female college students reported higher levels of distraction and stress and worse coping than their male counterparts (Clabaugh et al., Citation2021). This gender difference exacerbated the pre-pandemic phenomenon of U.S. female

college students already having higher rates of depression, anxiety, and other mental health challenges than their male counterparts (Conley et al., Citation2020; Fruehwirth et al., Citation2021), partially due to greater academic and lifestyle stressors (e.g., living environment, social activities, diet) and lower general self-efficacy and self-esteem among female than male college students (Acharya et al., Citation2018; Conley et al., Citation2020; Soysa & Wilcomb, Citation2015). Therefore, it is imperative to understand the type of stressors female college students – the target sample in this study – experienced that influenced their well-being throughout the pandemic to inform interventions for future epidemics or crises.

The transactional theory of stress (Lazarus & Folkman, Citation1984) states that stress is a perceived imbalance between the demands of a situation and a person's resources. People assess demands based on their interpretation and interactions with the environment, which result in different types of primary and secondary appraisals and stress responses (Lazarus & Folkman, Citation1984). Primary appraisals are people's evaluations of situations and events in relation to their well-being as benign (positive), irrelevant (neutral), and challenging or threatening (negative). Threat appraisals were negatively, and challenge appraisals were positively, related to well-being during the early stages of the pandemic (Zacher & Rudolph, Citation2021). On the other hand, secondary appraisals evaluate the perceived controllability of the situations and events (Lazarus & Folkman, Citation1984). Controllable-by-self and controllable-by-others appraisals are controllable perceptions associated with improved well-being, whereas uncontrollable appraisals are associated with declines in well-being during the pandemic (Zacher & Rudolph, Citation2021). For example, sudden, uncontrollable changes in the environment, such as the shift from in-person to online education or work and increased risks of getting sick for an individual or their significant others during the early stages of the pandemic, were likely to be appraised as a threat, which caused greater stress and anxiety (Fu et al., Citation2020).

People with mental health diagnoses, such as anxiety, depression, and post-traumatic stress disorder (PTSD), tend to have cognitive bias with more frequent threat appraisals of stressors and uncertainties (Mathews & MacLeod, Citation2005). Their appraisals might exacerbate the perceived demands and negative consequences of a crisis (Taha et al., Citation2014). Additionally, college students might not have access to mental health services, generally through in-person campus counselling centres, during the early stages of the pandemic (Kim et al., Citation2021; Liu, Pinder-Amaker, et al., Citation2020). Coupled with a loss of in-person interactions, social support from friends, lifestyle routines, and other campus resources, college students with mental health diagnoses are likely to appraise the pandemic consequences as uncontrollable, leading to greater stress and anxiety (Conrad et al., Citation2021; Hou et al., Citation2021). For instance, a longitudinal analysis of seven studies with 205,084 participants from four European countries demonstrated that younger individuals and those who previously had a mental health diagnosis reported worse mental health during the early stages of the pandemic than those who did not (Varga et al., Citation2021).

The pandemic consequences were, however, not universal since some college students had always taken online courses and never had in-person interactions with instructors and classmates, even pre-pandemic. As many as 35.3% (6.9 million) of all U.S. college students enrolled in online courses in 2018, and 16.6% (3.3 million) did so exclusively (National Center for Education Statistics, Citation2019). Although research has examined college students' stress and mental health during the pandemic, to our knowledge, none has differentiated in-person and online students. Footnote1 The pandemic and the shift to online education could potentially cause more stressors for in-person students who experienced more transitions and unpredictability in their

learning, potential relocation, and daily routines than for online students who might have indeed gained more access to campus services (e.g., online counselling, exercise classes) and instructors (Conrad et al., Citation2021; Patterson et al., Citation2021). Additionally, in-person students experiencing a decrease in social connectedness, and students with a mental health diagnosis, might be less likely to attend online classes (Khawar et al., Citation2021; Patterson et al., Citation2021). Thus, to better understand college students' experience during the pandemic, we took a deeper look at the stressors among in-person versus online students, with and without mental health diagnoses, in this study.

Other than stressors and appraisals, resilience—the ability to bounce back from stressful situations – influences perceived situational demands, resources, and subsequent stress responses (Lazarus, Citation1993). Numerous studies have demonstrated that resilience is related to more positive, and less negative, indicators of mental health and that it is particularly important for mitigating mental health challenges among female adults and people in adversity (see Hu et al., Citation2015). In a young adult sample (N = 1,004) across all 50 U.S. states, Killgore et al. (Citation2020) found that resilience was lower during the first weeks of the pandemic (early April 2020) than pre-pandemic times and among people with more severe anxiety, depression, and pandemic-related worries. Similarly, in another young adult sample (N = 898) across 50 states, Liu, Zhang, et al. (Citation2020) revealed that 72% of the participants reported low levels of resilience; those with lower resilience tended to score above the anxiety and depression cut-offs from mid-April to mid-May 2020. Additionally, resilience at the early stages of the pandemic positively predicted post-traumatic growth at later stages (September 2020 to March 2021; Hyun et al., Citation2021). These findings corroborate the idea that resilience is crucial during the pandemic. However, research has yet to examine how resilience might vary across pandemic stages among those with and without mental health diagnoses. Thus, we investigated resilience and stress from earlier to later pandemic stages as appraisals might become more positive and controllable.

To expand the literature, this study implemented a case study approach to examine how mental health and enrolment (in-person vs. online) statuses might play a role in perceived stressors, stress levels, and resilience in U.S. female college students. This approach facilitated an understanding of the pandemic's impacts on a target population vulnerable to stress and mental health challenges amid the pandemic and beyond (Clabaugh et al., Citation2021; Kim et al., Citation2021; Liu, Pinder-Amaker, et al., Citation2020). Three research questions (RQs) were proposed:

1. What were female students' stressors during the earlier (Spring 2020) and later (Spring 2021) stages of the pandemic?
2. How might stressors, stress levels, resilience, and their corresponding changes, vary across in-person and exclusively online enrollments?
3. How might stressors, stress levels, resilience, and their corresponding changes, vary across female students with and without mental health diagnoses?

Method

Design

This study employed a multigroup comparative study design, a useful approach for understanding the features of a situation, event, or phenomenon (Yin, Citation2014), such as college students'

experiences during the pandemic. Researchers can investigate individuals, groups of people, organizations, programs, and so on, as cases (Stake, Citation2006). In a multigroup study, researchers compare and contrast cases across contexts using cross-case analysis of multiple data sources and extreme case analysis (Yin, Citation2014). To address our research questions and explain the phenomenon of pandemic stress and resilience, we selected three classes of female college students.

Participants and classes

The overall sample consisted of 32 undergraduate students aged 18–40 ($M_{age} = 23.75$, $SD = 6.13$), who self-identified as female from a U.S. midwestern regional university. During their participation, the students were enrolled in a psychology course taught by the first author. The three classes were selected within the same university to compare female students (a) enrolled in in-person and exclusively online courses and (b) with and without mental health diagnoses.

Class 1 involved a course that started in person, meeting twice a week in the Spring 2020 semester. On March 11 (the seventh week of the 14-week semester), the World Health Organization declared a global pandemic due to COVID-19 outbreaks across countries; the university announced that all in-person courses would be converted to online delivery, synchronously or asynchronously, for one week. On March 17, the university announced a further extension of online delivery through the end of the semester and urged all students to move out of campus housing. After assessing student needs within the course, the first author decided to meet synchronously online and modify the assignments accordingly (e.g., in-person quizzes to online discussions). Participants were 12 female students ($M_{age} = 23.17$; $SD = 7.55$), including 10 self-identifying as White/Caucasian, one as Hispanic/Latinx, and one as multiracial (White and Black/African American); six reported having at least one mental health diagnosis.

Class 2 involved a course conducted asynchronously online throughout the Spring 2020 semester. The timeline of this class was the same as that of Class 1, except for no changes in course delivery or residence relocation due to the exclusively online enrolments. Participants were eight female students ($M_{age} = 26.50$; $SD = 6.07$), including six self-identifying as White/Caucasian, one as Hispanic/Latinx, and one as multiracial (White and Asian); five reported having at least one mental health diagnosis.

Class 3 involved a course conducted asynchronously online, with the same course structure and requirements as in Class 2, throughout the Spring 2021 semester. Based on the campus guidelines and decisions made by the department, all undergraduate courses were conducted online from Fall 2020 to Spring 2021. Thus, the students enrolled in online courses exclusively. By the time of data collection, the students had taken online courses for a minimum of two semesters; various COVID-19 vaccines were made available to the public, including young adults. Participants were 12 female students ($M_{age} = 22.50$; $SD = 4.23$), including seven self-identifying as White/Caucasian, two as Asian, one as Hispanic/Latinx, one as Black/African American, and one as multiracial (White/Caucasian and Asian); four reported having at least one mental health diagnosis.

Data collection

After obtaining the university's Institutional Review Board (IRB) approval, the first author informed students of the study through course announcements. The study was hosted on the SONA

System that the psychology department used to recruit and manage participant pools for research. Within one week, students self-selected into the study to complete an anonymous online survey for the first wave of data collection (Time 1)—early April 2020 for Classes 1 and 2 and mid-February 2021 for Class 3. Four weeks later, the first author sent out another announcement to remind students to complete another anonymous online survey for the second wave of data collection (Time 2)—early May 2020 for Classes 1 and 2 and mid-March 2021 for Class 3. On both surveys, participants entered an ID code unknown to the researchers for matching the survey responses.

Participants received extra credit points automatically through the SONA System, which offered other survey opportunities for extra credit. Given that 25–35 female students enrolled in each course, the response rate was between 30–50%. Both surveys consisted of identical items for this study, including self-reported demographic information (i.e., gender, race/ethnicity, and age), formal mental health diagnoses, the following measures, and additional items as part of a larger study of the pandemic’s impacts on students.

Pandemic stressors

Participants answered an open-ended question, “What were the top five stressors that you had over the past four weeks?”, by typing up to five stressors they perceived, from the most severe stressor to the least in order.

Perceived stress

Participants responded to a single-item measure of stress symptoms, “Stress means a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because their mind is troubled all the time. Do you feel this kind of stress over the past four weeks?”, validated by A. L. Elo et al. (Citation2003) using four adult samples on a Likert scale from 1 (not at all) to 5 (very much).

Resilience

Participants responded to the 10-item version of the Connor-Davidson Resilience Scale (CD-RISC 10; Campbell-Sills & Stein, Citation2007), which assessed their perceptions of how they dealt with stressful situations (e.g., “I can deal with whatever comes my way”), using a Likert scale from 0 (rarely true) to 4 (true nearly all the time). This measure has been shown valid and reliable in young adult populations (e.g., Campbell-Sills et al., Citation2009). The Cronbach’s alphas of the scores at Times 1 and 2 ($\alpha = .89$ and $.86$, respectively) of this study indicated good internal reliabilities. The scores for the 10 items were summed for data analyses.

Data analysis

Prior to the main analyses, we checked the data for missing values, outliers, and normality. We also computed descriptive statistics for the study variables and bivariate correlations between stress and resilience by class. Then, we performed inductive and deductive qualitative content analysis (S. Elo & Kyngäs, Citation2008) to code participants’ written pandemic stressors, using published pandemic stress articles as a guide (Clabaugh et al., Citation2021; Hagger et al.,

Citation2020). The second author started inductive coding for the first wave of data; the first author checked the codes, highlighted inconsistencies, and then discussed with the second author to reach agreements on the initial codes. Afterwards, the second author conducted deductive coding to categorize both the first and second waves of data; the first author checked the data until intercoder agreements were reached on the final codes.

To answer RQ1, we performed frequency analyses to determine the main stressors in each class. To answer RQ2, we conducted Wilcoxon signed-rank tests with the exact p values to examine changes in the number of stressors and levels of stress and resilience in each class of in-person or exclusively online students. To answer RQ3, we conducted Mann-Whitney U tests with exact p values to investigate whether the study variables at Times 1 and 2, and their changes, differed between participants with and without mental health diagnoses in each class. To further answer RQ2 and RQ3 using cross-case comparisons across Classes 1 and 2 with data collected within the same timeframe, we conducted two-way repeated-measures ANOVAs to compare the number of stressors and levels of stress and resilience between in-person and online enrolments as well as students with and without mental health diagnoses. Statistical significance was determined using $\alpha = .05$. Small, medium, and large effect sizes were respectively determined using $\eta^2 = .10, .30, \text{ and } .50$ (Rosenthal & Rubin, Citation2003), and $\eta^2 = .01, .06, .14$ (Cohen, Citation1988).

Results

Data screening indicated that the data had no missing values and were normally distributed with $-1 < \text{skewness and kurtosis} < 1$. Table 1 presents the descriptive statistics of the study variables. On average, the number of perceived stressors was high at the early stage of the pandemic. Correlation analyses indicated that resilience at Time 2 was positively associated with resilience at Time 1 ($r = .61, p < .001$) and negatively associated with stress at Time 1 ($r = -.37, p = .04$) and Time 2 ($r = -.38, p = .04$).

Qualitative content analysis revealed eight categories of stressors: (1) school (e.g., “switching to online classes”); (2) family (e.g., “taking care of my family”); (3) physical health (e.g., “the risk of contracting COVID in public spaces”); (4) mental health (e.g., “fighting my depression every day due to being stuck at home”); (5) work (e.g., “changes in work schedule”); (6) lifestyle (e.g., “moving back home”); (7) general worries (e.g., “uncertainties about the future”); and (8) finances (e.g., “not having income”). Overall, at both Times 1 and 2, participants reported school stressors the most (25.83% and 26.36%), followed by family (16.67% and 18.33%) and lifestyle (16.67% and 15.00%) stressors.

Class 1

The 12 female students reported 41 stressors at Time 1 and 41 again at Time 2, of which 13 and 10, respectively, were school stressors; 10 and nine, respectively, were family stressors. At Time 1, five students mentioned switching to online courses and navigating technology was a major stressor; four stated having to move back home and being with family. At Time 2, new common stressors that emerged included a lack of social life or support due to isolation ($n = 3$) and extra schoolwork or presentations ($n = 4$).

Wilcoxon signed-rank tests revealed no significant changes in the number of stressors ($M = 3.42$ vs. 3.25), $z = -0.70, p = .59$, $\eta^2 = -.20$, level of stress ($M = 3.67$ vs. 3.33),

Table 1. Mean and standard deviations of stress and resilience at Time 1 and Time 2.

		T1 Stressors	T2 Stressors	T1 Stress	T2 Stress	T1 Resilience	T2 Resilience
Class 1	MH diagnoses (<i>n</i> = 6)	4.17 (0.98)*	3.67 (1.21)	3.83 (0.75)	3.83 (0.98)*	24.83 (8.72)	26.83 (7.41)
	No MH diagnoses (<i>n</i> = 6)	2.67 (1.03)*	2.83 (1.17)	3.50 (1.23)	2.83 (0.98)*	25.83 (3.66)	27.17 (4.22)
Class 2	MH diagnoses (<i>n</i> = 5)	5.00 (0.00)*	4.60 (0.55)	3.80 (0.84)	4.00 (0.71)	19.00 (7.68)	26.40 (3.29)
	No MH diagnoses (<i>n</i> = 3)	3.33 (0.58)*	3.00 (2.65)	3.67 (0.58)	2.33 (1.53)	26.00 (6.00)	28.33 (6.51)
Class 3	MH diagnoses (<i>n</i> = 4)	4.25 (0.96)	4.00 (1.16)	4.50 (1.00)*	3.75 (1.26)	26.25 (4.27)	22.00 (3.16)*
	No MH diagnoses (<i>n</i> = 8)	3.50 (1.85)	2.50 (2.00)	3.38 (1.06)*	3.00 (0.76)	29.63 (2.39)	27.25 (3.45)*

**p* < .05 indicates significant differences between MH and no MH diagnoses based on Mann-Whitney U tests. MH = mental health; T1 = Time 1; T2 = Time 2. Standard deviations in parentheses.

Table 2. Frequencies of stressors in female college students at Time 1 and Time 2.

		School	Family	Physical health	Mental health	Work	Lifestyle	General worry	Finances
Class 1	MH diagnosis (<i>n</i> = 6)	24.00% (27.27%)	28.00% (31.82%)	4.00% (4.55%)	12.00% (4.55%)	0.00% (4.55%)	20.00% (13.64%)	4.00% (4.55%)	8.00% (9.09%)
	No MH diagnosis (<i>n</i> = 6)	43.75% (21.05%)	18.75% (10.53%)	12.50% (10.53%)	0.00% (0.00%)	6.25% (10.53%)	0.00% (15.79%)	6.25% (5.26%)	12.50% (26.32%)
Class 2	MH diagnosis (<i>n</i> = 5)	12.00% (20.83%)	24.00% (37.50%)	12.00% (8.33%)	4.00% (0.00%)	8.00% (12.50%)	12.00% (16.67%)	16.00% (0.00%)	12.00% (4.17%)
	No MH diagnosis (<i>n</i> = 3)	30.00% (33.33%)	0.00% (0.00%)	0.00% (0.00%)	0.00% (0.00%)	30.00% (22.22%)	10.00% (11.11%)	10.00% (0.00%)	20.00% (33.33%)
Class 3	MH diagnosis (<i>n</i> = 4)	12.50% (31.25%)	18.75% (12.50%)	6.25% (18.75%)	0.00% (0.00%)	18.75% (12.50%)	18.75% (6.25%)	12.50% (0.00%)	12.50% (18.75%)
	No MH diagnosis (<i>n</i> = 8)	35.71% (30.00%)	3.57% (10.00%)	3.57% (10.00%)	0.00% (0.00%)	10.71% (0.00%)	28.57% (30.00%)	14.29% (20.00%)	3.57% (0.00%)

MH = mental health; Values listed are in the form of Time 1 (Time 2).

$z = -1.16$, $p = .40$, $\text{requisite} = -.33$, and resilience ($M = 35.33$ vs. 37.00), $z = 1.75$, $p = .07$, $\text{requisite} = .50$, from Time 1 to 2, though the effect size for resilience was considered large. For the two students with the most increases in resilience, one of them (increased from 24 to 33) did not have mental health diagnoses and changed from having three school and family stressors to one lifestyle stressors (“social life”); the other one (increased from 19 to 26) had generalized anxiety disorder and depression and changed from having four stressors including mental health and friendship concerns to three stressors related to family, school, and work. Their stress levels further decreased along with increases in resilience. The student with the most decrease in resilience (from 42 to 38) who did not have mental health diagnoses lost a family member at Time 1 and was furloughed between Times 1 and 2.

Mann-Whitney U tests indicated that the students with mental health diagnoses perceived significantly more stressors at Time 1, $z = 2.10$, $p = .03$, $\text{requisite} = .60$, and higher levels of stress at Time 2, $z = 1.86$, $p = .03$, $\text{requisite} = .54$, than those without diagnoses (see Table 2) with large differences. No significant differences in other variables were found between the two groups. However, the variabilities of resilience in the group with mental health diagnoses during both Times 1 and 2 were twice as large as those in the group without diagnoses.

Class 2

The eight female students reported 35 stressors at Time 1 and 33 at Time 2, of which six and nine, respectively, were family stressors; six and eight, respectively, were school stressors. At Time 1, five students mentioned that work schedule changes or layoff from jobs were a major stressor; four stated COVID-specific worries and concerns, such as “concerns of how the pandemic will impact the future of the world” and “abiding by new rules”. At Time 2, more lifestyle stressors emerged, including changes in sleep, workout, and work/home routines ($n = 4$) and various relationship issues (e.g., wedding, missing family/friends; $n = 3$).

Wilcoxon signed-rank tests revealed no significant changes in the number of stressors ($M = 4.38$ vs. 4.00), $z = -0.71$, $p = .75$, $\text{requisite} = -.25$, and level of stress ($M = 3.75$ vs. 3.38), $z = -0.65$, $p = .67$, $\text{requisite} = -.23$, from Time 1 to 2. On the other hand, resilience increased significantly ($M = 31.62$ vs. 37.13), $z = 2.53$, $p = .008$, $\text{requisite} = .90$, with a very large effect. Indeed, none of the students had a decline in resilience. The three students with the most increases in resilience all had anxiety and depression diagnoses. The one with the most drastic increase (increased from 18 to 32) also had PTSD and changed from having five stressors (“uncertainty about the wedding, worries about passing classes, loss of work and income, fighting depression due to being stuck at home, and feeling lazy and not doing enough at home”) to four (“cancellation of the wedding, schoolwork, a lack of exercise, and a lack of motivation to do things at home”); her stress level also dropped from 5 to 4 subsequently. The other two students (increased resilience from 19 to 28 and 16 to 24) had the similar changes from having five to four stressors, with one less family stressor.

Mann-Whitney U tests indicated that the female students with mental health diagnoses perceived significantly more stressors at Time 1, $z = 2.58$, $p = .02$, $\text{requisite} = .91$ than those without diagnoses (see Table 2), with a large difference. No significant differences were found in other variables between the two groups. Yet, the variabilities of stress and resilience in the group without mental health diagnoses during both Time 2 were twice as large as those in the group with diagnoses.

Class 3

The 12 female students reported 44 stressors at Time 1 and 36 at Time 2, of which 12 and 11, respectively, were school stressors; 11 and seven, respectively, were lifestyle stressors. At Time 1, four students mentioned that continuing online courses was a major stressor; five stated physical health-related worries, including “the possibility of contracting and spreading the virus” and “working healthcare with COVID residents”. At Time 2, new school and lifestyle stressors emerged, including graduate school applications or graduation plans ($n = 3$) and the inability to see friends and classmates ($n = 4$).

Wilcoxon signed-rank tests revealed no significant changes in the number of stressors ($M = 3.75$ vs. 3.00), $z = -1.38$, $p = .25$, $r_{\text{equivalent}} = -.40$, and level of stress ($M = 3.75$ vs. 3.25), $z = -1.04$, $p = .36$, $r_{\text{equivalent}} = -.30$, from Time 1 to 2. However, resilience declined significantly ($M = 38.50$ vs. 35.50), $z = -2.14$, $p = .04$, $r_{\text{equivalent}} = -.62$, with a large effect. Indeed, none of the students had an increase in resilience. The two students with the most decreases in resilience both had anxiety and depression. One of them (decreased from 29 to 19) unexpectedly had the same amount and types of stressors (online courses, work, and moving) but an increase in stress level (from 3 to 4) from Time 1 to 2. The other student (decreased from 27 to 20) changed from having four stressors (“money, inability to connect in person, fear of getting sick, loss of loved ones”) to five with an additional work stressor. On the other hand, one student who had no stressors at both Times 1 and 2 maintained relatively high resilience ($26/40$) and low stress levels ($2/5$) at both times.

Mann-Whitney U tests indicated that the female students with mental health diagnoses had higher levels of stress at Time 1, $z = 1.67$, $p = .05$, $r_{\text{equivalent}} = .59$, and lower resilience at Time 2, $z = -2.23$, $p = .01$, $r_{\text{equivalent}} = -.64$, than those without diagnoses (see Table 2) with large differences. No significant differences were found in other variables between the two groups, although the variabilities of the number of stressors in the group without mental health diagnoses during both Times 1 and 2 were twice as large as those in the group with diagnoses.

Comparisons across Classes 1 and 2

The two-way repeated-measures ANOVA comparing in-person and online enrolments in Spring 2020 indicated a significant result in resilience, Wilks' $\lambda = .79$, $F(1, 18) = 4.80$, $p = .04$, $\eta^2 = .21$, with a large effect. Specifically, the students with exclusively online enrolments had a significantly larger increase in resilience from Time 1 to Time 2 ($M_{\text{change}} = 0.55$ vs. 0.17 ; see Figure 1) than those with in-person enrolments. In contrast, no significant ANOVA results were found for the number of stressors, Wilks' $\lambda = .99$, $F(1, 18) = 0.13$, $p = .73$, $\eta^2 = .01$, and level of stress, Wilks' $\lambda = 1.00$, $F(1, 18) = 0.01$, $p = .94$, $\eta^2 = .00$.

The two-way repeated-measures ANOVA comparing participants with and without mental health diagnoses in Spring 2020 indicated a significant result in level of stress, Wilks' $\lambda = .79$, $F(1, 18) = 4.85$, $p = .04$, $\eta^2 = .21$, with a large effect. Specifically, the students without mental health diagnoses had a significantly larger decrease in their perceived level of stress from Time 1 to Time 2 ($M_{\text{change}} = -1.00$ vs. 0.08 ; see Figure 2) than those with diagnoses. In contrast, no significant ANOVA results were found for the number of stressors, Wilks' $\lambda = .97$, $F(1, 18) = 0.52$, $p = .48$, $\eta^2 = .03$, and resilience, Wilks' $\lambda = .92$, $F(1, 18) = 1.64$, $p = .22$, $\eta^2 = .08$.

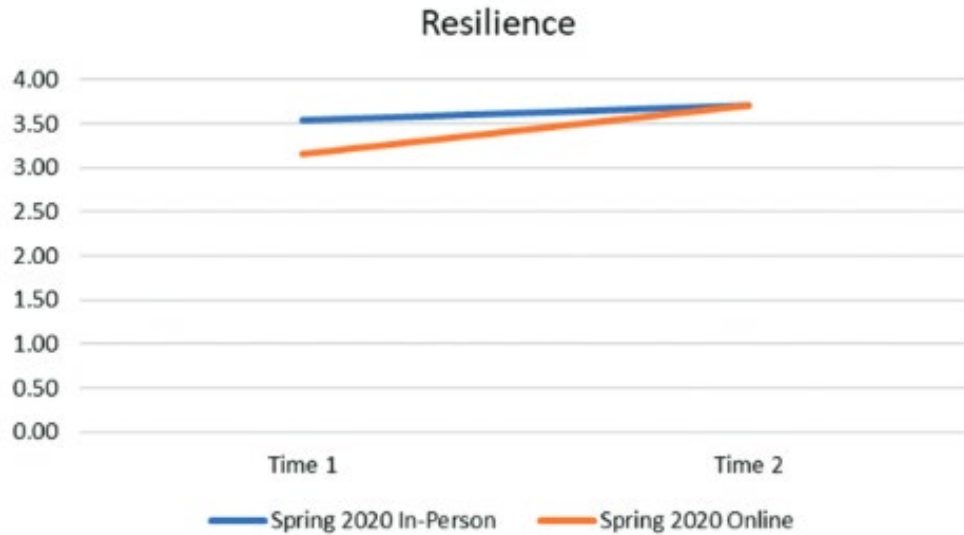


Figure 1. Estimated marginal means of resilience for Classes 1 and 2 at Time 1 and Time 2 based on the significant repeated-measures ANOVA.



Figure 2. Estimated marginal means of stress level for the Class 1 and 2 students with and without mental health diagnoses at Time 1 and Time 2 based on the significant repeated-measures ANOVA.

Discussion

This multigroup comparative study aimed to fill the research gap by exploring stress and resilience in female college students, a population particularly vulnerable to mental health challenges, during the earlier and later stages of the pandemic. To consider in-person versus online enrolments, and the potential role of existing mental health diagnoses, this study compared three classes – Spring 2020 in-person enrolment, Spring 2020 exclusively online enrolment, and Spring 2021 exclusively

online enrolment – revealing differences in the stressors and resilience based on the female students' mental health and enrolment statuses. The female students who were enrolled exclusively online and did not have mental health diagnoses in Spring 2020, on average, showed more adaptive stress responses to the pandemic than those who were enrolled in person prior to the pandemic and had mental health diagnoses. In addition, resilience increased regardless of the female students' mental health and enrolment statuses in Classes 1 and 2, yet those enrolled exclusively online (i.e., Class 2) had a significantly larger increase.

Perceived stressors during earlier and later pandemic stages (RQ1)

The number of stressors was relatively similar across all three classes, indicating both proximal and distal impacts of the pandemic, particularly on academic stress relevant to online learning and the loss of interactions with instructors and classmates. Two types of stressors, however, did shift slightly. Fewer family stressors were reported in Spring 2021 compared to Spring 2020, during which quite a few female students in Class 1 indicated parents, lack of privacy at home, and chores at home as primary stressors. This finding is consistent with research attributing many college students' stress to their adaptations to family situations after moving back home or the inability to move back to campus after the "stay at home" orders (Conrad et al., Citation2021). In contrast, more lifestyle stressors were reported in Spring 2021 than Spring 2020 due to inability to do the same activities or have a social life as college students normally did, evidenced by the Class 3 female students mentioning not having usual vacations, in-person interactions, and leisure activities as their main stressors. Female college students, who tend to seek social support as a way of coping (Conley et al., Citation2020), might realize more about the loss of social interactions after several major holidays than at the pandemic onset. Another important finding to note was the decline in the female students' resilience in Spring 2021, which could be attributed to decreased post-traumatic growth in the midst of adversity that regressed over time (Hu et al., Citation2015; Hyun et al., Citation2021). More specifically, Hu et al.'s (Citation2015) meta-analysis showed that resilient characteristics tend to fully manifest when faced with greater adversity, and Hyun et al. (Citation2021) found that post-traumatic stress symptoms and pandemic-related worries, which were higher during the early stages of the pandemic, predicted more post-traumatic growth.

Individual and organizational strategies must be incorporated to intervene in lifestyle changes that might last for a period during a pandemic or other crises. Faculty and staff in higher education can encourage female students to find ways to maintain or replace their typical routines while learning remotely (Hou et al., Citation2021), such as exercising with friends virtually using mobile applications (e.g., Peloton). To reduce family stressors, female students could be provided with action-oriented strategies to nourish their relationships and shared beliefs and routines with their family, which promote family resilience and individual resilience (Prime et al., Citation2020). Faculty and staff could reach out to female students, especially those who have to relocate or stay with their family, to offer informational and logistical support that enhance or restore social interactions (Killgore et al., Citation2020). Additionally, faculty and staff could share general information about free or low-cost, internet-accessible social support programming, some of which could target mental health challenges (Auerbach et al., Citation2018).

Stressors, stress levels, and resilience between in-person and exclusively online enrolments (RQ2)

Noticeable differences were observed between the female students who were enrolled in person and exclusively online; those enrolled exclusively online reported fewer school stressors but more family stressors. An explanation for fewer school stressors is that online students' coursework was not changed and thus did not require adjustments (Conrad et al., Citation2021; Hou et al., Citation2021), as the majority of the in-person female students (i.e., Class 1) reported online coursework being a major stressor. Yet, exclusively online students were generally older and had more family obligations (e.g., child care), especially for females (Burcin et al., Citation2019), and thus needed more family adjustments than traditional in-person students during the pandemic. Quite a few Class 2, and some Class 3, female students indicated worries about their children's online learning and health as their main stressors. On the other hand, the maturity of the Class 2 online female students – the only class with a significant increase in resilience from Time 1 to Time 2— might have provided them with more internal resources to be resilient by appraising the stressful situations as challenges, rather than threats, and as controllable (Hu et al., Citation2015).

To support exclusively online students not targeted in existing well-being interventions (Burcin et al., Citation2019), university faculty and staff should communicate with and educate them, female in particular, on how to effectively utilize campus resources (Liu, Pinder-Amaker, et al., Citation2020). Since campus resources such as mental health services and recreational activities switched to virtual formats, online students have had better access to these resources than ever before. Considering a larger mix of traditional in-person and exclusive online students in future online courses, faculty and staff need to be aware of their different stressors and provide flexibility to female students with work or family obligations that detract from coursework. This awareness and flexibility could help mitigate lifestyle and family stressors, and school stressors in turn, reported by many Class 2 and 3 female students. Furthermore, instructors can implement positive psychology strategies, such as gratitude and growth mindset, to facilitate adaptive appraisal of stressors, instructor – student relationships, and resilience (Chu, Citation2022).

Stressors, stress levels, and resilience between students with and without mental health diagnoses (RQ3)

The findings across all three classes suggest that the female students with mental health diagnoses perceived more stressors and higher stress levels than those without across pandemic stages. During the early stage of the pandemic, the female students with mental health diagnoses had a more difficult time reducing their stress level compared to those without. Many of the female students with mental health diagnoses in both Classes 1 and 2 reported depression and anxiety, as well as sleep and other health habits, as their main stressors. This result corroborates more threat appraisals in people with mental health diagnoses (Mathews & MacLeod, Citation2005). Yet, the female students with the most improvements in resilience were those with mental health diagnoses, potentially due to a lower baseline resilience and more post-traumatic growth from perceiving greater adversity, as previously mentioned. These increases in resilience also aligned with decreases in general worries among those female students.

To intervene with female college students with mental health diagnoses during this pandemic or future crises, educating them on adaptive primary and secondary appraisals (e.g., viewing stressors as controllable challenges) and coping strategies might help promote stress

reduction and the development of resilience (Lazarus & Folkman, Citation1984; Lazarus, Citation1993). For instance, faculty and staff can teach female students problem-focused strategies by properly modifying routines and schedules and emotion-focused strategies by emphasizing social support and self-care (Hou et al., Citation2021). These strategies can mitigate the preoccupied anxious and depressed thoughts that lead to a downward spiral. They can also help enhance post-traumatic growth and resilience in female students with mental health diagnoses who are going through adversity.

Taken together, our three research questions and corresponding findings provide important practical implications for university faculty and staff to consider when intervening with various groups of female college students in future crises. The influence of the pandemic may fade due to vaccination, yet online education and enrolments may continue to grow. Therefore, it would be important to examine how stress and resilience, and interventions that address them, may change over time. To do so, a case study approach could be implemented to assess localized needs and develop more personalized interventions, such as strategies for changing primary and secondary appraisals, that work for the target female college populations recruited for the study.

Conclusion

This study adds to the growing literature on stress and resilience in college students, female in particular, during the COVID-19 pandemic. Despite its novelty and contributions, the study has several limitations: (a) selecting a female college sample that might not be representative of other types of institutions, (b) collecting data over two time points instead of more that could better represent changes in stress levels and resilience, (c) using a single item instead of multiple items to measure stress and not having assessed primary and secondary appraisals directly, and (d) having confounding variables (e.g., mental health diagnoses, instructor support for online courses) that could have influenced participants' responses. To conclude, the pandemic had proximal and distal impacts on college students' academic endeavours that would last until teaching and learning could be "back to normal". To understand the long-term implications of the pandemic and future crises, researchers and practitioners ought to assess the causes and mechanisms behind stress and anxiety rather than solely their levels. To promote stress management and resilience across mental health and enrolment statuses, university faculty and staff need to develop and implement individualized interventions that emphasize student diversity (e.g., first-generation, online learners) beyond gender and race/ethnicity and that reimagine education during the new normal. Incorporating proactive interventions and preventive strategies could help diverse colleges and college students prepare for any future crises as small as a recession and as big as a pandemic, and anything in between.

Notes

1. Note that in-person versus online students are defined by their enrolment status prior to the pandemic.

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