

Title: The impact of COVID-19 on Academic Performance Among College Level Students.

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1 **ABSTRACT (150 words)**

2 **Objective:** The objective of this study is to assess the impact of COVID-19 on university students' academic
3 performance.

4
5 **Participants:** Our sample consisted of students 18 years old and above enrolled at least part-time during the
6 Spring 2020 semester.

7
8 **Methods:** This cross-sectional survey examined individual, social, and economic impacts of COVID-19 on
9 academic performance. We examined factors associated with a change in GPA between the two semesters.

10
11 **Results:** Most students reported no change in GPA. Students of color had a significantly increased odds of
12 reporting a decrease in GPA than non-Hispanic White students (OR=2.70, 95% CI: 1.01, 7.16). Students who
13 had someone close to them test positive for COVID-19 had an increased odds of reporting a decrease in GPA
14 (OR=1.85, 95% CI: 0.55, 5.93).

15
16 **Conclusion:**-Higher learning institutions may need to develop strategies to improve support for students that
17 have been socio-economically impacted by COVID-19.

18
19 **Key words:** Academic performance, COVID-19, GPA, students
20
21

1 INTRODUCTION

2 On January 8, 2020, the Chinese Center for Disease Control announced that a novel coronavirus was the
3 causative pathogen of Corona Virus Disease 2019 (COVID-19)¹. On January 30, 2020, the World Health
4 Organization (WHO) declared the COVID-19 outbreak. In response, there has been a worldwide effort to flatten
5 the curve with social distancing in order to reduce the rate of new cases and allow healthcare systems to
6 adequately respond to this pandemic. The COVID-19 pandemic required adjustments of daily activities at the
7 individual, household, and community levels.

8
9 Those who were diagnosed COVID-19 have a wide range of symptoms – ranging from being asymptomatic to
10 presenting with severe symptoms that appeared 2-14 days after exposure². Once an individual has been
11 diagnosed they have to isolate or self-quarantine for 10 to 20 days depending on the severity of their symptoms.
12 Close contacts – individuals who have been within 6 feet of someone who has COVID-19 for more than 15
13 minutes during their infectious period, would have to quarantine for 14 days starting from the date of last
14 exposure². Although these processes are necessary there has been a growing concern with loss of wages and
15 time away from activities due to the number of days required to be in isolation or quarantine whether you are
16 the person who contracted COVID-19 or a close contact. Beyond the issue of time, loved ones also have to take
17 the time to take care of household members who are in isolation or quarantine.

18
19 The COVID-19 pandemic has also socially and economically affected many individuals across the world.
20 Socially, people have had to limit social gatherings, activities and travel in order to reduce the spread of
21 COVID-19 which has diminished the social connectivity needed for wellbeing^{3,4}. In the US, millions of people
22 have filed for unemployment insurance, and trillions of dollars have been lost in revenue due to business
23 closures, furloughs, and suspended income generating activities^{5,6}. For those who maintained their employment,
24 employers offered flexible work arrangements and work-from-home where possible.

25
26 Higher education institutions were not exempt from the impacts of the pandemic and had to make adjustments
27 to learning environments in order to minimize the spread of COVID-19. On March 17, 2020, the US Centers for
28 Disease Control (CDC) recommended that higher education institutions consider short term suspension of all
29 campus activities including in-person classes⁷. In order to comply with the social distancing mandate, many
30 educational institutions moved to distance learning or a hybrid. Before the COVID-19 pandemic, fewer students
31 were enrolling in higher education institutions⁸ largely due to the increasing cost of higher education and
32 limited resources to pay for it⁹. However, students who do pursue a higher education still face many challenges.
33 Research has shown that the risk of student dropout is influenced by socioeconomic status, ethnicity, first year
34 GPA, academic integration, social integration and financial aid¹⁰. The majority of college students are facing
35 financial hardship and racial minority students have higher rates of financial hardship¹¹. Therefore, the
36 readjustments that the COVID-19 pandemic brings may exacerbate some of the challenges that students already
37 face, though these readjustments have not yet been studied. The pandemic may also affect factors that
38 contribute to the student experience such as academic commitments, changes in social support, management of
39 new responsibilities and navigation of unfamiliar situations¹².

40
41 Students not only face the individual, social, and economic challenges that the COVID-19 pandemic brings but
42 also the readjustment to their learning environment. Since the beginning of the pandemic, research shows that
43 students have had concerns regarding the transition to online learning that include: progress on projects due to
44 restrictions put in place to comply with social distancing, uncertainty of their grades under the online learning
45 environment, reduced motivation to learn, tendency to procrastinate, and uncertainty about graduation and their
46 future¹³⁻¹⁵. Students also reported difficulty in concentrating on academic work due to various distractions
47 including home environment factors such as interruptions by household members, navigating household duties
48 and academic work in the same space¹³⁻¹⁵. Other concentration issues include lack of accountability, digital
49 distractions (social media, internet, and video games) and concerns about physical and mental strain due to
50 prolonged focus on a computer screen¹³⁻¹⁵. Some students also reported concerns about technological
51 infrastructure, specifically poor internet connection^{15,16}.

1 Although some studies have highlighted the challenges other studies have reported some success in the
2 transition to distance learning. Other studies conducted during the COVID-19 pandemic regarding higher
3 education institutions' transition to distance learning show that the transition has been well received, students
4 are performing well¹⁷⁻¹⁹ and would prefer to continue with distance learning¹³. However, other learning aspects
5 remained a concern such as less effective teacher-student communication and interaction, difficulty performing
6 practical applications, and objectivity during examination (cheating)²⁰. The few studies in the literature on
7 academic performance during the COVID-19 pandemic used grade point averages (GPAs) as a measure of
8 academic performance. Academic performance has been measured in various ways such as using exam
9 scores^{17,19}, and grades¹⁸; although one study mentioned GPA in correlation to exam scores but the exam scores
10 were the measure of focus¹⁷.

11
12 Although there is research looking at the impacts of COVID-19 on academic performance, the research was
13 focused on the transition to the distant learning modality only¹³⁻²⁰ and not taking into account the individual,
14 social and economic impact of the pandemic. Furthermore, the current studies on the impact on COVID-19 on
15 college level students focus nursing¹⁹ and medical students^{13,17,20}, which is relatively a small proportion of
16 students and does not represent the majority of the college student body. Additionally, most of the current
17 studies have been conducted outside of the US. In this study we expand on the research examining the
18 association between individual, social and economic impacts of COVID-19 on academic performance on a
19 wider student body during this in the United States^{13,15-19,21}. The primary objective of this study is to assess the
20 individual, social, and economic impact of COVID-19 on academic performance measured by GPA among
21 college students.

22 **METHODS**

23 Population and Participants

24 This study was conducted at a large university in Arizona. Due to the COVID-19 pandemic many colleges and
25 universities across the United States converted from in-person instruction to an online-only instruction format.
26 This change occurred during March 2020 (Spring Break). Students who went home or travelled for the break
27 were instructed not to return to campus. The only students who were allowed to return to campus were
28 international students, those who never left the state for the break, or those who did not have a safe place to stay
29 off-campus. The goal of this study was to quantify the effect that this transition, caused by the COVID-19
30 pandemic, had on student academic performance.

31 Recruitment

32 The target population of this study consisted of students who were enrolled at least part-time during the Spring
33 2020 semester. We recruited participants to complete the study survey by contacting administrators at the
34 university across the campus. All enrolled students, regardless of academic level or program were invited to
35 participate in the study. The only exclusion criteria were if participants were not enrolled in the Spring 2020
36 semester. We also utilized official University social media platforms to recruit participants for the study. These
37 social media platforms were targeted in order to minimize the likelihood that individuals who aren't students
38 would complete the survey. To aid with recruitment, participants were informed that they would be entered into
39 a drawing for a \$50 gift card, and an Amazon Fire tablet. This study was approved by the University's
40 Institutional Review Board. All data were collected via an online survey response through the Qualtrics
41 software.

42 Measures

43 We examined whether the individual, social, and economic impacts of COVID-19 affected students' academic
44 performance during the Spring 2020 semester. Due to the unprecedented nature and effect of the COVID-19
45 pandemic, we were unable to identify a validated scale that adequately addressed individual, social, and
46 economic impacts in a way that suited our research question. As a result, we developed a set of survey questions
47 to address these areas in a way that would be applicable to the collegiate student population.

1 Individual impact of the pandemic was measured by the following multiple-choice question: “Have you tested
2 positive for COVID-19?” Possible responses included: “Yes, and the test was positive”, “Yes, and the test was
3 negative”, “Yes, and I have not received my test results”, “No, I was not tested”, “Prefer not to answer”. We
4 considered students who selected “Yes, and the test was positive” as having experienced the individual impact
5 of COVID-19.

6 7 *Social Impact of COVID-19*

8 The social impact of the COVID-19 pandemic was measured by the following multiple-choice questions: “Has
9 someone close to you tested positive for COVID-19? (parents, significant other, siblings, roommates)” where
10 possible responses included: “Yes”, “No”, “I don’t know”, and “Prefer not to answer”. We considered anyone
11 who responded “Yes” to this question as having experienced the social impact of COVID-19. We also asked
12 “Have any of the following people in your life been economically impacted by COVID-19? (i.e. loss of job, pay
13 cut, loss of grants or scholarships)”, where possible responses included: “No one in my life has been
14 economically impacted by COVID-19”, “Immediate family member has been impacted (i.e. partner, spouse,
15 parents, siblings, children)”, “Extended family members (i.e. Uncles, Aunts, Grandparents, Cousins)”, “Friends”,
16 “Coworkers”, “Others”, and “Prefer not to answer”. We considered anyone who indicated that immediate or
17 extended family members, friends, or coworkers were affected as having experienced the economic impact of
18 COVID-19.

19 20 *Economic Impact of COVID-19*

21 In order to measure the economic impact of COVID-19 on students we asked the following questions: “During
22 the Spring 2020 semester, were you employed?” (where possible responses were “Yes”, “No”, and “Prefer not
23 to answer”), “Have you been economically impacted by COVID-19? (i.e. loss of job, pay cut, loss of grants or
24 scholarships) and the possible responses were “Yes”, “No”, and “Prefer not to answer”, and finally “Please
25 select how you were economically impacted by COVID-19”, where the possible responses were “Full loss of
26 employment”, “Loss of work hours”, “Furlough”, “Other”, and “Prefer not to answer”. Participants who
27 responded “Yes” to being employed, “Yes” to being economically impacted by COVID-19, and selected either
28 “full loss of employment”, “loss of work hours”, or “furlough” were considered to be economically impacted by
29 the pandemic.

30 31 *Academic Performance*

32 We measured academic performance using self-reported GPA for the Fall 2019 and Spring 2020 semesters. We
33 also utilized parts of the validated Academic Success Inventory for College Students (ASICS) questionnaire
34 pertaining to personal motivation and concentration. We anticipated that the closure of the campus would lead
35 to changes in student work environments, and we sought to quantify how students adjusted to the mandatory
36 change in learning modality and study environment. We also anticipated that the change to the online format
37 would challenge student concentration, and we sought to quantify if this change impacted academic
38 performance.

39 40 *Primary Outcome*

41 The primary outcome of interest in this study is the change in academic performance measured by self-reported
42 GPA between the Fall and Spring semesters of the 2019-2020 academic year. Change in academic performance
43 was measured by subtracting the Spring 2020 GPA from the Fall 2019 GPA. This “difference” variable was
44 categorized into three levels: no change in GPA, positive change (increase in GPA), and negative change
45 (decrease in GPA) for further analysis.

46 47 *Predictors*

48 We also collected data on variables that were potential predictors on the relationship between individual, social,
49 and economic impact of COVID-19 and academic performance include access to computer and internet for
50 school work (measured as a dichotomous variables: yes or no), changes in the environment in which the student
51 completes school work (dichotomous: yes or no), academic level (categorical: undergraduate, graduate), race/
52 ethnicity (categorical), age (categorical), and academic motivation (measured as a dichotomous variables: agree

1 or disagree) and academic concentration (measured as a dichotomous variables: agree or disagree) which were
2 drawn from the ASICS questionnaire.
3

4 Analysis

5 We collected data on demographic variables including age, gender, race/ethnicity, year in school, enrollment
6 status (full-time versus part-time), access to the internet, access to a computer, and employment status. We also
7 collected data concerning academic success using the ASICS questionnaire. Descriptive analyses were
8 conducted to summarize the sample of students who completed the survey. We also conducted a logistic
9 regression with academic performance as the outcome. Individual, social, and economic impacts of COVID-19,
10 demographics, academic concentration and academic motivation were the predictor variables. We examined the
11 odds ratios of either reporting an increase or a decrease in GPA compared to a no change in GPA between the
12 Fall 2019 and Spring 2020 semester. All analyses were conducted using SAS University Edition.
13
14

15 RESULTS

16 **Table 1. Descriptive Statistics for University of Arizona Students Who Completed the Survey**

	N = 1166 ¹	%
Student Age		
18 – 22	683	58.6
22 – 24	111	9.5
25 – 29	143	12.3
30 – 34	51	4.4
35 – 39	32	2.7
40 – 44	23	2
45+	18	1.5
Race/ Ethnicity		
Non-Hispanic White	531	45.5
Non-Hispanic Black	31	2.7
Hispanic	237	20.3
American Indian/ Alaska Native	17	1.5
Asian	108	9.5
Other	27	2.3
Gender		
Male	257	22
Female	782	67.1
Non-binary	24	2.1
Relationship Status		
Single	689	59.1
Married	83	7.1
Engaged	20	1.7
In a Committed Relationship	248	21.3

Is Claimed as a Dependent		
Yes	564	48.4
Arizona Residency		
Resident	776	66.5
Non-Resident	207	17.8
International Student	77	6.6
Academic Level		
Undergraduate	827	70.9
Masters	106	9.1
Doctoral	115	9.9
Enrollment Status		
Full-Time	979	84
Part-Time	64	5.5
How many years have you been in your academic program?		
0 – less than 1 Years	293	25.1
1-2 Years	415	35.6
3- less than 5 Years	342	29.3
More than 5 Years	19	1.6
Receives Academic Support for a Disability	98	8.4
Fall GPA		
GPA 1.0 – 2.0	13	1.1
2.1 – 2.4	28	2.4
2.5 – 3.0	85	7.3
3.1 – 3.4	150	12.9
3.5 – 4.0	590	50.6
Spring GPA		
GPA 1.0 – 2.0	11	0.9
2.1 – 2.4	16	1.4
2.5 – 3.0	77	6.6
3.1 – 3.4	150	12.9
3.5 – 4.0	606	52
Pass/Failed a Class	287	24.6
Number of Classes Pass/Failed		
1-2 Classes	217	18.6
3 – 4 Classes	47	4

3 or More Classes	17	1.5
COVID Testing		
Tested, Positive Result	12	1
Tested, Negative Result	48	4.1
Tested, Unknown Result	10	0.9
Not Tested	40	3.4

¹We utilized skip logic in the design of the survey, therefore, not all participants responded to all the questions reported above.

As shown in **Table 1**, of the 1166 students most were undergraduates (70.9%), female (67.1%), single (59.1%), dependents (48%), and state residents (66%). The racial/ethnic make-up of the students consisted of Non-Hispanic White (45%), Hispanic (20%), Asian (9.5%), and Non-Hispanic Black, AI/AN and other racial/ethnic together were 6%. Notably, more students reported a GPA in the highest category (3.5-4.0) in the Spring 2020 semester (52.0%) than in the Fall 2019 semester (50.2%). Of the study participants 70 (6%) had been tested for COVID-19, but only 12 (1.0%) of participants had received a positive COVID-19 test.

Table 2. Adjusted Logistic Regression Comparing Demographic by Change in GPA.

	Decrease in GPA ¹ N = 68 Adjusted OR (95% CI)	Increase in GPA ¹ N = 104 Adjusted OR (95% CI)
Demographic Variables		
Race/ Ethnicity		
Non-Hispanic White	Reference	Reference
Hispanic	1.30 (0.49, 3.44)	1.19 (0.53, 2.66)
Other	2.70 (1.01, 7.16)	0.61 (0.19, 1.95)
Academic Level	0.57 (0.19, 1.67)	0.88 (0.39, 2.00)
Number of Classes Pass/ Failed		
0 Classes	Reference	Reference
1-2 Classes	1.69 (0.91, 3.13)	1.21 (0.73, 2.00)
3-4 Classes	3.04 (1.14, 8.09) *	1.39 (0.54, 3.58)
5 or More	10.35 (2.86, 37.44) *	0.96 (0.11, 8.32)
Access to computer	0.91 (0.62, 1.33)	0.83 (0.57, 1.21)
Access to internet	0.58 (0.43, 0.80) *	1.02 (0.77, 1.36)
Changes in Environment for Schoolwork	1.73 (0.59, 5.09)	0.72 (0.38, 1.32)

¹OR were obtained by comparing “Decrease in GPA” and “Increase in GPA” categories to “No Change in GPA” category not displayed.

*Bolded OR are statistically significant

In **Tables 2-4**, the reference category is students who reported no change in GPA. Using this group as the reference in these analyses, we compared it to the group of students who reported decreased GPA and the group of students who reported increased GPA from Fall 2019 to Spring 2020. Table 2 shows these comparisons by demographic variables that we believed would impact academic performance. When we compared the demographics of students who reported no change in GPA to those who reported decreased GPA, we found that

1 students who were from non-Hispanic black, AI/AN, Asian and other racial/ethnic groups had a significantly
 2 increased odds of reporting a decrease in GPA than those who were non-Hispanic White with an odds ratio of
 3 2.70 (95% CI: 1.01, 7.16). Additionally, compared to students who did not pass/fail any classes, students who
 4 reported choosing to use the pass/fail option for 3-4 classes or 5 or more classes were significantly more likely
 5 to report a decrease in GPA between the two semesters with an odds ratio of 3.04 (95% CI: 1.14, 8.09) and
 6 10.35 (95% CI: 2.86, 37.44) respectively. Students who had access to the internet had a decreased odds of
 7 reporting a decrease in GPA with an odds ratio of 0.58 (95% CI: 0.43, 0.80). When we compared the
 8 demographic variables of students who reported increased GPA to those who reported no change in GPA, we
 9 did not identify any characteristics that were significantly associated with reported increase in GPA.

10
 11 **Table 3. Logistic Regression Comparing Individual, Economic, and Social Impact of COVID-19 by Change in GPA.**

	Decrease in GPA ¹ N = 68 Adjusted OR (95% CI)	Increase in GPA ¹ N = 104 Adjusted OR (95% CI)
Model 1: Individual COVID-19 Impact		
Tested for Positive for COVID-19	1.17 (0.21, 6.41)	1.5 (0.26, 8.58)
Model 2: Individual + Economic COVID-19 Impact		
Tested for Positive for COVID-19	1.11 (0.18, 6.71)	1.42 (0.22, 9.02)
Close to you tested Positive	1.85 (0.55, 5.93)	0.88 (0.46, 1.68)
Close to you Economically Impacted by COVI-19	1.09 (0.73, 1.64)	0.92 (0.61, 1.37)
Model 3: Individual + Economic + Social COVID-19 Impact		
Tested for Positive for COVID-19	2.48 (0.31, 19.71)	1.05 (0.11, 9.56)
Close to you tested Positive	1.69 (0.34, 8.28)	0.74 (0.31, 1.76)
Close to you Economically Impacted by COVID-19	1.02 (0.60, 1.73)	1.03 (0.59, 1.80)
Employed	2.87 (0.59, 14.09)	0.14 (0.02, 0.93)*
Financial Aid Change	0.15 (0.01, 1.49)	0.08 (0.004, 1.81)
Personal Economic Impact	0.67 (0.14, 3.17)	0.83 (0.12, 5.70)

¹ OR were obtained by comparing “Decrease in GPA” and “Increase in GPA” categories to “No Change in GPA” category not displayed.

*Bolded OR are statistically significant

12 Using the group of students who reported no change in GPA as the reference population, we conducted logistic
 13 regression analyses comparing individual, economic, and social impacts of COVID-19 among students who
 14 reported increased GPA and students who reported decreased GPA, displayed in Table 3. We found that testing
 15 positive for COVID-19 was not significantly associated with either an increase or a decrease in reported GPA,
 16 OR=1.17 (0.21, 6.41) and OR=1.5 (0.26, 8.58), respectively. In a second model, we considered the social
 17 impact of COVID-19 in addition to the individual impact. We found that decreased GPA was associated with
 18 having someone close to you test positive for COVID-19, but this association is not statistically significant (OR:
 19 1.85, 95% CI: 0.55, 5.93). In that same model, testing positive for COVID-19 was associated with increased
 20

GPA, though this was also not statistically significant (OR=1.42, 95% CI: 0.22, 9.02). Finally, in a third model, we considered individual, social, and economic impacts of COVID-19 on academic performance. Our results indicate that reporting a decrease in GPA was associated with testing positive for COVID-19, having someone close to you test positive for COVID-19, and being employed though these associations were not statistically significant, with odds ratios of 2.48 (0.31, 19.71), 1.69 (0.34, 8.28), and 2.87 (0.59, 14.09) respectively. We also found that reporting an increase in GPA was associated with not having someone close to you test positive for COVID-19, and not experiencing a change in financial aid status were non-significantly associated with an increase in GPA. Interestingly, reporting an increase in GPA was negatively associated with being employed with an odds ratio of 0.14 (95% CI: 0.02, 0.93).

Table 4. Logistic Regression Comparing Academic Success Variables by Change in GPA.

	Decrease in GPA ¹ N = 68	Increase in GPA ¹ N = 104
	Adjusted OR (95% CI)	Adjusted OR (95% CI)
Model 2: ASICS Variables		
Concentration		
It was easy to keep my mind from wandering	1.32 (0.47, 3.67)	1.18 (0.57, 2.45)
I got easily distracted	2.63 (0.61, 11.23)	0.70 (0.31, 1.56)
I had an easy time concentrating	0.99 (0.25, 3.88)	1.19 (0.50, 2.79)
I had a hard time concentrating	0.66 (0.15, 2.86)	0.88 (0.35, 2.23)
Motivation		
Personal problems kept me from doing well	0.16 (0.04, 0.55)*	0.43 (0.21, 0.89)*
I would have done much better in this class if I - didn't have to deal with other problems in my life	0.35 (0.09, 1.32)	1.88 (0.89, 3.94)
I had some personal difficulties that affected my- performance	1.82 (0.08, 1.67)	1.06 (0.47, 2.38)

¹OR were obtained by comparing “Decrease in GPA” and “Increase in GPA” categories to “No Change in GPA” category not displayed.

*Bolded OR are statistically significant

Using the group of students who reported no change in GPA as the reference population, we conducted logistic regression models comparing ASICS variable responses of students who reported decreased GPA and those who reported increased GPA. As displayed in Table 4, we found that the variables measuring concentration were not associated with either an increase or a decrease in GPA. Notably, although not statistically significant, being easily distracted was associated with decreased GPA, (OR: 2.63, 95% CI: 0.61, 11.23), and being easily distracted was negatively associated with increased GPA (OR: 0.70, 95% CI: 0.31, 1.56). When we examined academic motivation, we found a statistically significant association between decreased GPA and students reporting that personal problems kept them from doing well with an odds ratio of 0.16 (0.04, 0.55). We also found that this association between personal problems and academic performance was true among students who reported increased GPA, OR=0.43 (0.21, 0.89).

DISCUSSION

The abrupt transition to distance learning during the COVID-19 pandemic brought about new challenges for university students. In this study we sought to examine the impact of COVID-19 on academic performance among university students. Overall, our findings indicate that most students did not experience a change in GPA

1 between the Fall 2019 and Spring 2020 semesters. However, we found an increase in the number of students
2 reporting a GPA in the highest category (3.5-4.0) between the two semesters. Academic concentration during
3 this COVID-19 pandemic did not translate to any significant impacts on GPA. Academic motivation was not
4 associated with a change in GPA. Reporting a decrease in GPA was associated with being a student of a
5 racial/ethnic minority, using the pass/fail option for more than 3 classes, having limited access to the internet,
6 and having personal problems that interfered with academic performance. Interestingly, no factors were
7 positively associated with reporting increased GPA, but we observed a negative association between being
8 employed and having personal problems that interfered with academic performance.

9
10 Our findings are consistent with a study conducted among university students in Spain where researchers saw a
11 positive increase in academic performance as a result of the online learning methodology²¹. The authors noted
12 that the online methodology changed students' learning strategies, such that before COVID-19 students did not
13 study on a continuous basis but because of the shift to online learning, learning strategies changed to a more
14 continuous habit, improving their efficiency²¹. Although students were distracted at times it did not deter them
15 from performing well due to the continuous learning habit introduced by the online learning modality.

16
17 We also found that students of color were at an increased odds of reporting a decrease in GPA between Fall
18 2019 and Spring 2020 in comparison to non-Hispanic white students. Although it is important to note that the
19 sample size for minority racial/ethnic groups in this study was small and that there may be other contributing
20 factors not assessed in this study. However, the notion is consistent in the literature that shows communities of
21 color have been disproportionately affected by COVID-19 in the occurrence of new cases and
22 socioeconomically as well^{22,23}. The stress of these realities, not directly researched in this study, could have
23 contributed to our findings. A survey among college students during the COVID-19 pandemic showed that 81%
24 of college students were facing financial hardship and racial minority students had higher rates of financial
25 hardship as well as increased food and housing insecurity⁴.

26
27 Although our findings did not show any significant impacts on GPA among people who tested positive for
28 COVID-19, we noted that having someone close to them testing positive for COVID-19 was associated with a
29 non-significant increased odds of reporting a decrease in GPA. This is in line with findings of a nationwide
30 study among US college-level students which illustrated that students were more stressed about COVID-19's
31 health implications for their family and the American society than for themselves²⁴. We also found that students
32 who were employed had a statistically significant decreased odds of reporting an increase in GPA. The COVID-
33 19 response where we have lockdowns, social distancing, and hygiene regulations affected the structure and
34 operations of businesses and institutions²⁵. Employers and employees have had to discuss flexibility of their
35 employment and implications on careers²⁵. The impact of employment on a student's GPA, raises some
36 concern's students may be facing. More immediate concerns include, if working from home is not possible
37 there is the fear of contracting COVID-19 while going to work or at work. If working from home is possible,
38 then there is the challenge of navigating the home environment and schoolwork in the same space. More
39 distally, the implications of future employment upon completion of their education.

40
41 Our findings have future implications for college enrollment, in terms of considering future expansion of
42 distance learning in historically traditional in-person learning. In a national student survey, among high school
43 juniors and seniors who planned on attending college/university prior to March 1, 2020, 8% decided to no
44 longer attend a traditional 4 year institution in Fall 2020 due to COVID-19 and 20% of high school seniors
45 reported they are likely/highly likely to not attend college in Fall 2020²⁶. The national student survey also found
46 that 14% of current college students surveyed reported they are unlikely or unsure if they will return to their
47 institution in Fall 2020 as a result of COVID-19²⁶. Current and future students' understanding that students are
48 performing well with the online modality even with some of the stressors of the pandemic could be encouraging
49 and improve enrollment in higher education. Institutions should also be conscious of the racial and
50 socioeconomic disparities that COVID-19 has exacerbated and how it may affect their student body differently
51 in order to provide tailored support for academic success.

1 Strengths of this study lie in the expansion of distance learning research on a wider, more diverse student body
2 than previous research. We also add to the limited research on the impact of COVID-19 on academic
3 performance on college level students in the US. Methodologically, we had a larger sample size relative to other
4 studies of this type. We also used the GPA as an objective measure to assess academic performance and the
5 Academic Success Inventory for College Students (ASICS) scale to contextualize our findings. Our study was
6 not without limitations. The collection of GPA as a categorical variable instead of a continuous variable resulted
7 in a lower sensitivity to detect incremental changes in GPA. The small sample size contributed to greater
8 variability in that point estimates from our analyses, highlighting the need for further studies in this area. The
9 goal of this analysis was to assess how individual, social, and economic impacts of COVID-19 independently
10 interacted with academic performance and thus we did not consider how the interaction between predictors
11 influenced the overall outcome however, it is an important next step to understand the interrelationships
12 between predictors and how that influences the outcome. Another limitation is that not all survey participants
13 completed the survey, leading to missing data. Though missingness was not associated with any of the
14 outcomes we examined in our study, it did increase uncertainty in our study conclusions.

15
16 Since we conducted this study soon after higher institutions moved to distance learning and collected data on
17 impacts of GPA midway through a regular semester, a future longitudinal study where we study the long-term
18 impacts of the COVID-19 pandemic on college level students' academic performance will be informative.

20 **Ethics approval and consent to participate**

21 This study was approved by the University of Arizona (UA) Human Subjects Institutional Review Board (IRB).

23 **Declaration of interest statement**

24 The authors declare that they have no conflicting interests.

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27 None.

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