

11-9-2020

Changes in Depression and Physical Activity Among College Students on a Diverse Campus After a COVID-19 Stay-at-Home Order

Courtney Coughenour

University of Nevada, Las Vegas, courtney.coughenour@unlv.edu

Maxim Gakh

University of Nevada, Las Vegas, maxim.gakh@unlv.edu

Jennifer R. Pharr

University of Nevada, Las Vegas, jennifer.pharr@unlv.edu

Timothy Bungum

University of Nevada, Las Vegas, tim.bungum@unlv.edu

Follow this journal for additional works at: <https://digitalscholarship.unlv.edu/>

Sharon Jalene
University of Nevada, Las Vegas, sharon.jalene@unlv.edu

 Part of the [Psychiatric and Mental Health Commons](#)

Repository Citation

Coughenour, C., Gakh, M., Pharr, J. R., Bungum, T., Jalene, S. (2020). Changes in Depression and Physical Activity Among College Students on a Diverse Campus After a COVID-19 Stay-at-Home Order. *Journal of Community Health* 1-9.

<http://dx.doi.org/10.1007/s10900-020-00918-5>

This Article is protected by copyright and/or related rights. It has been brought to you by Digital Scholarship@UNLV with permission from the rights-holder(s). You are free to use this Article in any way that is permitted by the copyright and related rights legislation that applies to your use. For other uses you need to obtain permission from the rights-holder(s) directly, unless additional rights are indicated by a Creative Commons license in the record and/or on the work itself.

This Article has been accepted for inclusion in Public Health Faculty Publications by an authorized administrator of Digital Scholarship@UNLV. For more information, please contact digitalscholarship@unlv.edu.

1 This is a pre-print of an article published in Journal of Community Health. The final
2 authenticated version is available online at: <https://www.springer.com/journal/10900>

3 **Title: Changes in Depression and Physical Activity Among College Students on a Diverse
4 Campus After a COVID-19 Stay-at-Home Order**

5
6 **Authors:** Courtney Coughenour, PhD; Maxim Gakh, JD, MPH; Jennifer R. Pharr, PhD; Timothy
7 Bungum, DrPH; Sharon Jalene, PhD

8

9 1. **Courtney Coughenour**, PhD, MPH (*corresponding author*)

10 Assistant Professor

11 School of Public Health, University of Nevada, Las Vegas (UNLV)

12 Mail Stop 3063, 4700 S. Maryland Parkway, Suite 335

13 Las Vegas, NV 89119, USA

14 courtney.coughenour@unlv.edu 702-895-4278 (phone) 702-895-5184 (fax)

15 2. **Maxim Gakh**, JD, MPH

16 Assistant Professor

17 School of Public Health, University of Nevada, Las Vegas (UNLV)

18 Mail Stop 3063, 4700 S. Maryland Parkway, Suite 335

19 Las Vegas, NV 89119, USA

20 maxim.gakh@unlv.edu 702-895-5472 (phone) 702-895-5184 (fax)

21 3. **Jennifer R. Pharr**, PhD

22 Associate Professor

23 School of Public Health, University of Nevada, Las Vegas (UNLV)

24 Mail Stop 3063, 4700 S. Maryland Parkway, Suite 335
25 Las Vegas, NV 89119, USA
26 jennifer.pharr@unlv.edu 702-895-2006 (phone) 702-895-5184 (fax)

27 4. **Timothy Bungum**, DrPH

28 Professor
29 School of Public Health, University of Nevada, Las Vegas (UNLV)
30 Mail Stop 3063, 4700 S. Maryland Parkway, Suite 335
31 Las Vegas, NV 89119, USA
32 tim.bungum@unlv.edu 702-895-4986 (phone) 702-895-5184 (fax)

33 5. **Sharon Jalene**, PhD

34 Assistant Dean of Undergraduate Affairs
35 School of Integrated Health Sciences, University of Nevada, Las Vegas (UNLV)
36 Mail Stop 3019, 4505 S. Maryland Parkway
37 Las Vegas, NV 89154, USA
38 sharon.jalene@unlv.edu 702-895-3946 (phone) 702-895-1356(fax)

39 **Author Contributions:** All authors contributed to the study conception and design,
40 material preparation, data collection, and analysis. All authors also contributed to the first
41 draft of the manuscript, commented on revisions of the manuscript, and read and
42 approved the final manuscript.

43

44 This is a pre-print of an article published in Journal of Community Health. The final
45 authenticated version is available online at: <https://www.springer.com/journal/10900>

46

47 **Title: Changes in Depression and Physical Activity Among College Students on a Diverse**
48 **Campus After a COVID-19 Stay-at-Home Order**

49 **Abstract:** The numerous negative health impacts of COVID-19, which include expected changes
50 to psychiatric illness and physical activity (PA), are disproportionately distributed in the United
51 States. Mental illnesses and physical inactivity are prevalent among U.S. college students.
52 This study examined whether there was a change in minutes of PA and depression scores after a
53 stay-at-home order and examined predictors of these changes. An online survey was sent to all
54 undergraduate and graduate students attending a large, diverse university via an electronic
55 newsletter. The survey requested information about demographic and academic data,
56 cardiorespiratory fitness, and depression symptoms. Paired t-tests and logistic regression were
57 employed. Our sample (n=194) was predominantly female (73%), young (mean age of 25), not a
58 sexual minority (82%), and had a mean 3.4 GPA. Students reported worse depression scores
59 ($p < 0.01$) and fewer minutes of PA ($p = 0.01$) after the stay-at-home order. There was a small but
60 significant ($p = 0.04$) correlation between changes in total minutes of PA and depression scores.
61 Senior ($p = 0.05$) and Hispanic ($p = 0.03$) students were less likely to report worsening depression
62 scores than freshmen and white students, respectively. Asian students were significantly more
63 likely than white students to report decreased PA. This study suggests that COVID-19 and its
64 consequences may be contributing to reduced PA and greater depression symptoms in college
65 students and that sub-groups have been affected differently. Targeted interventions to promote
66 PA and support mental health may bolster the ability for resilience of college students.

67

68 **Key Words:** COVID-19; college students; mental health; physical activity; depression

69 **Introduction**

70 The COVID-19 pandemic has disrupted global health systems and services [1] and
71 upended economies across the world [2]. It has so far led to at least 21 million cases and 755,786
72 deaths worldwide in far less than its first year [3]. The global response to COVID-19 includes a
73 race to roll out testing, trace contacts, quarantine and isolate individuals, slow the movement of
74 people, reduce person-to-person interactions, develop a vaccine, find effective medical
75 interventions, and bolster public health and healthcare systems. Yet the consequences of
76 COVID-19, especially in the longer-term, are just beginning to bear out [4]. The United States
77 has been impacted especially hard by this pandemic, with over 167,000 deaths and well over 5.2
78 million cases of COVID-19 as of mid-August – and counting [5]. While U.S. federal efforts
79 include tracking the disease, boosting research, overseeing vaccine development, and attempting
80 to stimulate the economy [6], responses of U.S. state and local governments have varied and
81 include efforts to restrict the movement and gathering of people as well as closing and tightly
82 controlling re-opening of businesses and organizations, including academic institutions [7].

83 Not surprisingly to health professionals, COVID-19 is affecting populations
84 disproportionately [8]. For example, Gupta and colleagues determined that some of the main risk
85 factors for mortality related to COVID-19 for critically-ill patients include pre-existing medical
86 conditions such as coronary heart disease, cancer, acute organ dysfunction, and obesity as well as
87 older age, being male, and admission to a hospital with fewer intensive care unit beds [9]. These
88 inequities, however, run deeper than just pre-existing health conditions. Some of the most
89 impacted communities in the U.S. have been racial and ethnic minorities, particularly African
90 Americans, Hispanics, American Indians, Alaskan Natives, and Pacific Islanders [8,10]. COVID-
91 19 has highlighted existing social and economic disparities, which are typically attributed to pre-

92 existing health conditions and disparities in housing and employment [8,10]. In addition, our
93 understanding of how COVID-19 impacts vulnerable populations is just beginning to unfold. For
94 instance, COVID-19 may create barriers for individuals with opioid use disorder to access
95 medications and services, and perhaps lead to increases in opioid overdoses [11].

96 As the pandemic continues, an important sub-population that deserves study, though
97 typically healthy and robust, are college students. College students have escaped neither COVID-
98 19 infections nor its other consequences. In a March to May 2020 survey of over 18,000 U.S.
99 students across 14 campuses, few students reported confirmed (0.6%), probable (1.7%), and
100 possible (13%) cases of COVID-19 [12]. However, outbreaks among college students have
101 occurred [13].

102 Furthermore, the impacts of COVID-19 on the health and well-being of college students
103 go well beyond contracting the disease. About two-thirds of students recently surveyed reported
104 that they were “very/extremely concerned” about the pandemic’s duration, that individuals they
105 cared about would contract COVID-19, and increased financial stress [12]. They also reported
106 increases in anxiety and depression, and academic performance suffering due to mental health
107 concerns [12]. These results are consistent with findings by Huckins and colleagues, who found
108 that U.S. college students exhibited greater anxiety and depression and increased sedentary
109 behavior in the first few months of the COVID-19 pandemic [14]. Because of the major stressors
110 associated with COVID-19, such as the imposition of unfamiliar public health measures,
111 potential financial losses, and the reality of life in a pandemic, there will likely be an uptick in
112 psychiatric illness in the general population [15]. Since college students are already a high-risk
113 population for depression, suicide, and suicide ideation [16, 17, 18, 19, 20, 21], they warrant
114 study at this time.

115 Even before the start to this pandemic, depression was a major problem among college
116 students. For those who pursue higher education, the inherent demands of academic
117 performance, adjustments to independent living, and financial stress can intensify negative
118 affects [22]. Aggregated data from a 2013 meta-analysis [19] indicate that approximately 35.0%
119 of students experience moderate to severe depression while in universities. Comparatively, the
120 National Institute of Mental Health reports that approximately 7.1% of American adults had a
121 major depressive episode in the last year (ages 18 to 25 - 13.1%; ages 26 to 49 - 7.7%; ages 50+ -
122 4.7%) [23]. In a diverse college environment, demographic factors, including sex [24, 25],
123 sexual orientation [26, 27] and race and ethnicity [24, 28, 29] can exacerbate symptoms. Birth-
124 sex designation and sexual orientation are also associated with reported depression [24, 25, 26].
125 Male college students are more likely to self-silence symptoms of depression compared to
126 females [24], and female college students routinely report higher levels of depression and stress
127 than males but are more likely to seek help [25]. Students in a sexual gender minority (SGM)
128 also report higher levels of depression [26, 30]. Research studies [31, 32, 33] and literature
129 reviews [34, 35, 36] indicate that depression is two to four times more prevalent in SGM
130 populations and bisexual individuals are the most vulnerable to depression and depression-
131 related suicide [34, 36]. Race and ethnicity are also associated with increased levels of reported
132 depression in some cases [28, 29, 37]. Asian-American college students report significantly
133 higher rates of depression than Caucasian American students [29], which is concerning because
134 Asian-Americans are more likely to quell depressive symptoms than other ethnic groups [24].
135 African American students, with equivalent socioeconomic status to their peers, experience
136 higher levels of depression [28]. Hispanic students also have been found to have higher rates of
137 depression at predominantly Caucasian [37] and ethnically diverse universities [37, 38].

138 Physical activity can be a powerful counterforce against depression. The general benefits
139 of physical activity for adults are well documented and include improved mental health and brain
140 health. Other benefits include weight management; reduced risk of developing cardiovascular
141 disease, Type 2 diabetes, and certain cancers; improved bone and muscle health; and reduced
142 risk of all-cause mortality [39]. However, a systematic review of the literature suggests that over
143 half of undergraduate students in the U.S. and Canada do not meet physical activity guidelines
144 [40]. A fall 2019 survey of over 38,000 U.S. college students found that 67.6% of respondents
145 met guidelines for aerobic activity but only 40.3% met both aerobic activity and strength training
146 standards [41, 42]. Since college students are overburdened with depression, and physical
147 activity can both prevent depression and reduce its symptoms [43, 44], it is critical to study how
148 depression and physical activity among college students are changing during the COVID-19
149 crisis.

150 In light of the COVID-19 pandemic and the lingering and inter-related issues of physical
151 activity and depression among college students, the purpose of this study was to: (1) determine if
152 there was a change in participants' physical activity minutes prior to versus after stay-at-home
153 orders were issued in the State of Nevada, (2) determine if there was a change in depression
154 scores prior to versus after stay-at-home orders, and (3) understand predictors of depression
155 score and physical activity changes among college students.

156 **Methods**

157 *Study Design, Setting, and Participants*

158 This cross-sectional study was conducted at one of the most racially diverse universities
159 in the United States located in Southern Nevada between May 7th and May 28, 2020. A request
160 for students to complete an online survey hosted through Qualtrics was sent to students as part of

161 a weekly e-newsletter that is disseminated to all student email addresses. The request was sent
162 about one month after the state governor issued a stay-at home-order and the university campus
163 closed, with all classes being converted to remote instruction. Participants were both graduate
164 and undergraduate students over the age of 17. They were able to complete the 10-minute survey
165 anonymously and some received extra credit in a course for participating.

166 ***Ethical Approval***

167 This study was approved by the University of Nevada, Las Vegas, Institutional Review
168 Board. Prior to starting the survey, participants were provided informed consent materials and
169 had to click “agree” to participate in the survey.

170 ***Data Sources and Measures***

171 Participants were asked to provide demographic information, including age, sex, sexual
172 orientation, and race/ethnicity in addition to student information, such as class standing
173 (freshman, sophomore, junior, senior, graduate student) and current grade point average (GPA).
174 Participants were asked questions about the minutes of physical activity that they typically
175 engaged in during a normal week prior to the formal stay-at-home order issued on March 31st
176 and during a typical week since the stay-at-home order. A series of questions from a previously-
177 validated, non-exercise algorithm were used to estimate their cardiorespiratory fitness (eCRF)
178 [45]. Lastly, participants were asked a series of questions from the Patient Health Questionnaire -
179 PHQ-9 focused on the same two timeframes: prior to the stay-at-home order and during the two
180 weeks before completing the survey but after issuance of the stay-at-home order.

181 ***Estimated Cardiorespiratory Fitness***

182 A previously published non-exercise algorithm that can be employed to estimate
183 cardiorespiratory fitness (eCRF) was used in this study. It has been found to be predictive of

184 depression among college students [46]. It has also been found to be reasonably accurate in
185 predicting sex-specific relative VO₂ peak in healthy adults [45]. Variables in the algorithm
186 include age, body composition (body mass index or waist circumference), resting heart rate
187 (RHR), and a physical activity index (PA-I). The resulting data are reported in relative terms
188 (mL • kg⁻¹ • min⁻¹). To obtain the PA-I, questions regarding exercise frequency, duration, and
189 intensity were scored and weighted according to a previously published PA-I [45]. For RHR,
190 participants were asked to be seated while completing the survey and to measure their RHR after
191 five minutes of quiet sitting. Because of inconsistent self-reported waist circumference
192 measurements and difficulty in obtaining the measurement (e.g. tape measures not available), the
193 body mass index (BMI) model was selected to be used for this study:

194 Men (R² = 0.59, SEE = 5.8): $92.05 - (0.327 \text{ AGE}) - (0.933 \text{ BMI}) - (0.167 \text{ RHR}) + (0.257 \text{ PA-I})$

195 Women (R² = 0.57, SEE = 5.1): $70.77 - (0.244 \text{ AGE}) - (0.749 \text{ BMI}) - (0.107 \text{ RHR}) + (0.213$
196 PA-I)

197 *Patient Health Questionnaire (PHQ-9)*

198 The PHQ-9 is a brief, validated depression questionnaire used for screening, monitoring,
199 and measuring the severity of symptoms and is appropriate for both research and clinical practice
200 [47]. Nine questions incorporate Diagnostic and Statistical Manual of Mental Disorders, Version
201 Four (DSM-IV) criteria. Participants were asked to report the frequency of problems occurring
202 two weeks prior to March 31st (before issuance of the stay-at-home order) and during the two
203 weeks prior to taking the survey (after issuance of the stay-at-home order). Responses for each
204 question were scored from 0 – 3 (0 = Not at All, 1 = Several Days, 2 = More than Half the Days,
205 or 3 = Nearly Every Day, respectively). Internal reliability (Cronbach's $\alpha = 0.89$) and test-retest
206 reliability (kappa of 0.84) have been reported as excellent for the PHQ-9 [48]. The total score on

207 this instrument can range from 0 (lowest depression) to 27 (highest depression). We used the
208 total score for this analysis.

209 ***Variables***

210 The variables of interest included total weekly physical activity minutes and PHQ-9
211 scores prior to and after issuance of the stay-at-home order. To achieve aim 3, additional
212 variables used in the logistic regression model included characteristics found to impact
213 depression scores among college students in previous work (eCRF, GPA, sexual orientation [46],
214 sex [24], age [23], and class standing [49]).

215 ***Statistical Analysis***

216 Paired t-tests were used to determine if there were differences in total physical activity
217 minutes and PHQ-9 scores prior to and after issuance of the stay-at-home order. We calculated
218 the pre-post difference in total physical activity minutes and PHQ-9 scores and conducted a
219 correlation analysis between PHQ-9 difference and total physical activity minutes difference.
220 Lastly, we dichotomized PHQ-9 and physical activity difference scores into a binary outcome
221 where 0 = PHQ-9 score got better or stayed the same and 1 = PHQ-9 score got worse and where
222 0 = physical activity stayed the same or increased and 1 = physical activity decreased. Logistic
223 regression was used to model these outcomes using the previously mentioned covariates to
224 determine what might predict the change in PHQ-9 scores or minutes of physical activity. We
225 used SPSS version 24 to complete these analyses.

226 **Results**

227 Our sample consisted of 194 participants who completed both the PHQ-9 and weekly
228 minutes of physical activity questions. Demographic and academic characteristics are provided
229 in Table 1. The participants' mean age was 25 years old and participants had a relatively high

230 mean GPA at 3.4. Nearly three-fourths of the participants were female (72%) and the majority
 231 were not a sexual or gender minority. Sixty-three percent of the participants had a worse (higher)
 232 PHQ-9 score after the stay-at-home order was issued compared to before its issuance (Table 1).

233 Paired t-tests revealed a statistically significant difference in both PHQ-9 scores and
 234 weekly minutes of physical activity prior to versus after issuance of the stay-at-home order, with
 235 a mean PHQ-9 score prior to stay-at-home orders of 5.58 compared to a mean post order score of
 236 9.61 ($t=9.14$, $p<0.01$). Participants reported significantly fewer weekly minutes of physical
 237 activity with an average of 409 minutes prior to the stay-at-home order and a mean of 330
 238 minutes post stay-at-home order ($t=2.58$, $p=0.01$). There was a significant but small correlation
 239 between the change in weekly physical activity minutes and the change in PHQ-9 scores
 240 (Pearson correlation = -0.151 , $p=0.04$).

241 Our logistic regression analyses found few significant associations between the potential
 242 predictor variables and the change in PHQ-9 score or weekly physical activity minutes (Table 2
 243 and Table 3). For change in PHQ-9 score, being a senior and being Hispanic was associated with
 244 a decreased probability of PHQ-9 score getting worse compared to the reference groups of
 245 freshmen and White (Table 2). For change in weekly physical activity minutes, being Asian was
 246 associated with an increased probability of decreased minutes of physical activity compared to
 247 the reference group of White (Table 3).

248

249 **Table 1: Participant Demographic and Student Characteristics and Paired t-tests Results**
 250 **from a spring 2020 survey conducted at a diverse urban campus (n=194).**
 251

Continuous Variables	Mean (SD)	
Age	25.11 (7.84)	
Grade point average (GPA)	3.4118 (0.46)	
Estimated cardiorespiratory fitness (eCRF)	66.02 (44.70)	
Categorical Variables	N (%)	

Sex		
Male	53 (27.3)	
Female	140 (72.2)	
Transgender	1 (0.5)	
Sexual Gender Minority		
Yes	35 (18.0)	
No	159 (82.0)	
Race		
White	71 (36.6)	
Asian	46 (23.7)	
Black	25 (12.9)	
Hispanic	34 (17.5)	
Other	17 (8.7)	
Class Standing		
Freshman	16 (8.2)	
Sophomore	26 (13.4)	
Junior	64 (33.0)	
Senior	48 (24.7)	
Graduate/Other	40 (20.6)	
Change in PHQ-9 Score		
No change or better	71 (36.6)	
Worse	123 (63.4)	
Paired T-tests	Mean (SD)	t-test (p-value)
PHQ-9 Score		9.14 (p<0.01)
PHQ-9 score prior to the order	5.58 (4.80)	
PHQ-9 score after the order	9.61 (6.91)	
Minutes of Physical Activity		2.58 (p=0.01)
Minutes of physical activity prior to the order	409.31 (420.77)	
Minutes of physical activity after the order	330.82 (353.18)	

252

253 **Table 2: Univariate Logistic Regression Results Examining Factors Related to a Change in**
254 **Patient Health Questionnaire (PHQ-9) Score from a spring 2020 survey conducted at a**
255 **diverse urban campus (n=194).**

Continuous Variables	B	S.E.	Wald	p-value	Exp(B)
Change in physical activity minutes	-0.001	0.00	1.978	0.160	0.999
Age	-0.02	0.02	0.78	0.38	0.98
GPA	0.47	0.32	2.08	0.15	1.60
eCRF	0.03	0.02	2.21	0.14	1.03

Categorical Variables					
Class standing					
First-year	REF	REF	REF	REF	REF
Sophomore	-0.47	0.78	0.36	0.55	0.63
Junior	-0.96	0.69	1.91	0.17	0.39
Senior	-1.38	0.70	3.87	0.05	0.25
Graduate/Other	-0.85	0.72	1.38	0.24	0.43
Race	-0.09	0.09	0.92	0.34	0.92
White	REF	REF	REF	REF	REF
Asian	-0.49	0.40	1.52	0.22	0.61
Black	-0.53	0.49	1.19	0.28	0.59
Hispanic	-0.94	0.43	4.68	0.03	0.39
Other	-0.24	0.57	0.19	0.67	0.78
SGM					
No	REF	REF	REF	REF	REF
Yes	0.44	0.41	1.17	0.28	1.56
Sex	0.10	0.33	0.10	0.75	1.11
Male	REF	REF	REF	REF	REF
Female	0.06	0.33	0.03	0.87	1.06
Transgender*					

256 REF = reference group. * = cell size too small for analysis. GPA=grade point average,

257 eCRF=estimated cardiorespiratory fitness

258

259 **Table 3: Univariate Logistic Regression Results Examining Factors Related to a Change in**
260 **Physical Activity Minutes from a spring 2020 survey conducted at a diverse urban campus**
261 **(n=194).**

Continuous Variables	B	S.E.	Wald	p-value	Exp(B)
Change in PHQ-9 score	0.036	0.024	2.174	0.140	1.036
Age	-0.02	0.02	0.49	0.48	0.99
GPA	0.51	0.36	2.04	0.15	1.67
eCRF	0.03	0.02	2.55	0.11	1.03
Categorical Variables					
Class standing					
Freshman	REF	REF	REF	REF	REF

Sophomore	-0.86	0.77	1.21	0.27	0.42
Junior	-1.130	0.71	2.52	0.11	0.32
Senior	-0.69	0.73	0.90	0.34	0.50
Graduate/Other	-1.15	0.74	2.417	0.12	0.32
Race					
White	REF	REF	REF	REF	REF
Asian	0.84	0.40	4.35	0.04	2.32
Black	0.11	0.47	0.06	0.81	1.12
Hispanic	0.18	0.44	0.17	0.68	1.20
Other	0.57	0.54	1.10	0.29	1.76
SGM					
No	REF	REF	REF	REF	REF
Yes	-0.00	0.38	0.00	0.99	1.00
Sex					
Male	REF	REF	REF	REF	REF
Female	-0.282	0.34	0.70	0.40	0.75
Transgender*					

262 REF = reference group. * = cell size too small for analysis. GPA=grade point average,
263 eCRF=estimated cardiorespiratory fitness

264 Discussion

265 This study aimed to determine if there was a change in participants' physical activity
266 minutes prior to versus after stay-at-home orders were issued in the State of Nevada, to
267 determine if there was a change in depression as measured by PHQ-9 scores prior to versus after
268 stay-at-home orders, and to understand if traditional predictors of depression scores among
269 college students predicted changes in physical activity and depression scores. The most
270 interesting findings from this study were that there was a significant decrease in self-reported
271 minutes of physical activity and worse depression scores in survey participants after the stay-at-
272 home order was issued compared to before the order. Additionally, many characteristics that
273 have previously been shown to impact depression among college students were not significant
274 predictors of worsening depression scores among participants in this study.

275 Hispanic students were less likely than white students to have a worse PHQ-9 score after
276 the stay-at-home order was issued. Previous studies have found that Hispanic students
277 experience cultural stressors that may negatively affect their mental health [37, 38, 50]. For
278 example, after controlling for “general college stress,” Hispanic students had “minority-related
279 stress,” or negative experiences “linked to social, physical, or cultural attributes salient to the
280 specific minority group individuals identify or are identified with” that was uniquely associated
281 with depression [37]. Additionally, Hispanic students are more likely to display the cultural
282 value of familism [51] and are more likely to live at home during college [52]. Previous research
283 has found that familism was protective against depressive symptoms in Hispanic college students
284 and stressed the importance of facilitating such cultural values [50, 53]. It is possible that the
285 stay-at-home order enabled some students to spend more time with their families, possibly
286 buffering some of the negative mental health outcomes, though further investigation is needed.

287 College seniors were also less likely to have increased PHQ9 scores compared to
288 freshmen. The COVID-19 pandemic is unprecedented and likely to exacerbate or cause new
289 mental health and stress-related disorders [54], and there is consequently a need to adapt and/or
290 cope with resultant major changes. One potential explanation for the variances in PHQ9 scores
291 by class standing is that the ability to regulate emotions and deploy coping mechanisms increase
292 with age [55]. Additionally, previous studies have found that older adults (except for the oldest
293 old) have lower rates of mental illness compared to young adults [56, 57]. Thus, seniors may be
294 better “equipped” to handle the stresses of the abrupt adjustments that are required in times of
295 pandemics. Alternatively, it may be that those students who endure to the standing of college
296 senior are more equipped to handle obstacles and stressors. Research indicates that students who
297 are successful in college have higher emotional and social intelligence [58, 59, 60]. And while it

298 is estimated that only about 60% of students earn a bachelor's degree within 6 years at the same
299 institution where they started [61], the majority of those who drop out or transfer do so within the
300 first 2 years [62]. Thus, those who are still enrolled and taking courses as a senior likely have a
301 better ability to cope, higher emotional and social intelligence, and consciously chose to remain
302 at said university.

303 We found that the mean minutes of physical activity were significantly less after the stay-
304 at-home order was issued. While it is possible that the types of physical activities that students
305 were participating in changed, for example, the shut-down of activity centers such as indoor
306 gyms may have resulted in increases in outdoor physical activities or in-home exercise, this does
307 not seem to have led to more overall minutes of physical activity. This is consistent with Huckins
308 and colleagues who used motion sensors in smart phones to track college student's pre- and post-
309 COVID-19 changes and found students to be more sedentary [14], and with Tison and colleagues
310 who used daily step counts from smart phone accelerometers and found that steps decreased
311 worldwide after the declaration of the global pandemic [63]. This particular finding is
312 concerning, as physical activity has consistently been found to prevent depression [43] and
313 reduce depression symptoms in those with mental illness [44]. Given the high rates of depression
314 in college students overall and the worsening depression scores post stay-at-home orders,
315 examining ways to maintain or increase physical activity are warranted.

316 It is interesting to note that Asian students were more likely than White students to have a
317 decrease in weekly minutes of physical activity after the stay-at-home order. There are at least
318 two possibilities of why this might have occurred. Although we do not know the specific reasons
319 for the reduction in physical activity among members of this group, unprovoked assault on
320 Asians was observed at this point of the pandemic [64]. The effects of news reports, which had

321 made it clear that the COVID-19 originated in China, combined with xenophobic statements
322 from politicians have heightened existing racist attitudes towards Asians [65]. To that end, a
323 national news magazine reported several examples of threatening incidents that Asian-Americans
324 living in New York City [66] experienced. Because neighborhood incivilities have been shown
325 to suppress physical activity among Asian-Americans [67], it is likely that aggression toward
326 members of this ethnic group was a factor in decreasing their physical activity after the stay-at-
327 home order. Recommendations to reduce xenophobic responses to epidemics include providing
328 accurate information about the disease and speaking out against negative behaviors, such as
329 using caution with regard to narratives that amplify the stigmatization of groups. It should also
330 be stressed that pandemics are a time for solidarity and unity that are based on understanding
331 rather than ignorance [65].

332 A second potential factor in the pronounced drop in physical activity among Asian
333 students are the behaviors shown by citizens of China, Japan, and Korea. Although little is
334 known about the behavior of Asian-Americans in a time of crisis, those in the three mentioned
335 countries have been shown to exhibit high levels of compliance with stay-at-home orders, mask-
336 wearing, and handwashing directives [68]. If Asians residing in America were similar in
337 conforming to the stay-at-home orders, it is likely that their opportunities for physical activity
338 would have been attenuated and resulted in a reduction of the behavior. Our findings highlight
339 the need to study the physical activity of Asian Americans, especially in times of crisis, and also
340 to study larger societal structures.

341 This study adds to the understanding of how COVID-19 has impacted college students to
342 date. Its strengths include the use of validated tools to measure depression and physical activity,
343 analysis of predictors of depression and physical activity, and the ability to focus on distinct and

344 formal pre- and post-periods of analysis, since all groups have been affected by COVID-19 and it
345 is therefore impossible to locate an “unexposed” group. However, the results of this study should
346 be interpreted in the context of its limitations. First, the survey relied on a self-reported data, and
347 therefore survey responses may be impacted by recall or social desirability bias. Second, it is
348 possible that the sample is not fully representative, and it is therefore unclear how generalizable
349 these findings are to other college populations: the 194 survey respondents attended one
350 university, self-selected to participate, and were disproportionately female.

351 The continued impacts of COVID-19 on college students remains largely unknown.
352 Nevertheless, this study suggests that COVID-19 and its consequences may be contributing to
353 reduced physical activity and greater depression symptoms in college students. This study also
354 highlights that among heterogenous college populations, different student groups experience
355 COVID-19 and its consequences differently. It is imperative to continue to research and monitor
356 physical activity and mental health among college students to understand how best to intervene
357 and support this population as we respond to, and eventually recover from, the COVID-19
358 pandemic. In the meantime, targeted interventions that promote physical activity and support
359 mental health may bolster the ability of college students to cope with these uncertain times and to
360 remain resilient.

361

362 **Compliance with Ethical Standards**

363 **Disclosures of Potential Conflicts of Interest:**

364 *Funding:* No funding was received to complete this study.

365 *Conflicts of Interest:* The authors declare that they have no conflict of interest.

366

367 **Research Involving Human Participants and Informed Consent:** This study was
368 approved by the University of Nevada, Las Vegas Institutional Review Board. Prior to
369 starting the survey, participants were provided informed consent materials and had to
370 click “agree” to participate in the survey.

371

372

373 **References**

- 374 1. World Health Organization. (2020, June 1). *COVID-19 significantly impacts health services*
375 *for noncommunicable diseases*. [https://www.who.int/news-room/detail/01-06-2020-covid-19-](https://www.who.int/news-room/detail/01-06-2020-covid-19-significantly-impacts-health-services-for-noncommunicable-diseases)
376 [significantly-impacts-health-services-for-noncommunicable-diseases](https://www.who.int/news-room/detail/01-06-2020-covid-19-significantly-impacts-health-services-for-noncommunicable-diseases).
- 377 2. The World Bank (2020, June 8). *The global economic outlook during the COVID-19*
378 *pandemic: a changed world*. [https://www.worldbank.org/en/news/feature/2020/06/08/the-](https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world)
379 [global-economic-outlook-during-the-covid-19-pandemic-a-changed-world](https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world).
- 380 3. World Health Organization. (2020, August 15). *Coronavirus disease (COVID-19) situation*
381 *report 208*. [https://www.who.int/docs/default-source/coronaviruse/situation-](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200815-covid-19-sitrep-208.pdf?sfvrsn=9dc4e959_2)
382 [reports/20200815-covid-19-sitrep-208.pdf?sfvrsn=9dc4e959_2](https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200815-covid-19-sitrep-208.pdf?sfvrsn=9dc4e959_2).
- 383 4. Mahase, E. (2020). COVID-19: What do we know about “long COVID”? *The BMJ*, 370.
384 doi: 10.1136/bmj.m2815.
- 385 5. U.S. Centers for Disease Control & Prevention. (2020, August 15). *Cases in the U.S.*
386 <https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html>.
- 387 6. U.S. Government. (2020, July 28). *Government response to coronavirus, COVID-19.*
388 <https://www.usa.gov/coronavirus>.
- 389 7. Gostin, L. O., & Wiley, L. F. (2020). Governmental public health powers during the COVID-
390 19 pandemic: Stay-at-home orders, business closures, and travel restrictions. *JAMA*, 323(21),
391 2137-2138. doi:10.1001/jama.2020.5460.
- 392 8. van Dorn, A., Cooney, R. E., & Sabin, M. L. (2020). COVID-19 exacerbating inequalities in
393 the US. *Lancet*, 395(10232), 1243-1244. doi: 10.1016/S0140-6736(20)30893-X.
- 394 9. Gupta, S., Hayek, S. S., Wang, W., Chan, L., Mathews, K. S., Melamed, M. L., Brenner, S.
395 K., Leonberg-Yoo, A., Schenck, E. J., Radbel, J., Reiser, J., Bansal, A., Srivastava, A., Zhou,

- 396 Y., Sutherland, A., Green, A., Shehata, A. M., Goyal, N., Vijayan, A., Velez, J., ... STOP-
397 COVID Investigators (2020). Factors associated with death in critically ill patients with
398 coronavirus disease 2019 in the US. *JAMA Internal Medicine*, e203596. Advance online
399 publication. doi:10.1001/jamainternmed.2020.3596.
- 400 10. Hooper, M. W., Nápoles, A. M., & Pérez-Stable, E. J. (2020). COVID-19 and racial/ethnic
401 disparities. *JAMA*, 323(24):2466–2467. doi:10.1001/jama.2020.8598.
- 402 11. Volkow, N. D. (2020). Collision of the COVID-19 and addiction epidemics. *Annals of*
403 *Internal Medicine*, 173(1), 61-62. <https://doi.org/10.7326/M20-1212>.
- 404 12. The Healthy Minds Network & the American College Association. (2020). *The impact of*
405 *COVID-19 on college student well-being*.
406 https://www.acha.org/documents/ncha/Healthy_Minds_NCHA_COVID_Survey_Report_FI
407 [NAL.pdf](https://www.acha.org/documents/ncha/Healthy_Minds_NCHA_COVID_Survey_Report_FI_NAL.pdf).
- 408 13. Lewis, M., Sanchez, R., Auerbach, S., Nam, D., Lanier, B., Taylor, J., Jaso, C., Nolan, K.,
409 Jacobs, E.A., Hudson, F.P., Bhavnani, D (2020). COVID-19 outbreak among college
410 students after a spring break trip to Mexico - Austin, Texas, March 26-April 5, 2020.
411 *MMWR. Morbidity and Mortality Weekly Report*, 69(26), 830–835.
412 <https://doi.org/10.15585/mmwr.mm6926e1>.
- 413 14. Huckins, J. F., daSilva, A. W., Wang, W., Hedlund, E., Rogers, C., Nepal, S. K., Wu, J.,
414 Obuchi, M., Murphy, E. I., Meyer, M. L., Wagner, D. D., Holtzheimer, P. E., & Campbell,
415 A. T. (2020). Mental Health and behavior of college students during the early phases of the
416 COVID-19 pandemic: Longitudinal smartphone and ecological momentary assessment study.
417 *Journal of Medical Internet Research*, 22(6), e20185. <https://doi.org/10.2196/20185>.

- 418 15. Pfefferbaum, B., & North, C. S. (2020). Mental health and the COVID-19 pandemic. *The*
419 *New England Journal of Medicine*, 383(6), 510–512.
420 <https://doi.org/10.1056/NEJMp2008017>.
- 421 16. Buchanan, J. L. (2012). Prevention of depression in the college student population: A review
422 of the literature. *Archives of Psychiatric Nursing*, 26(1), 21-42.
- 423 17. Stallman, H. M. (2010). Psychological distress in university students: A comparison with
424 general population data. *Australian Psychologist*, 45(4), 249-257.
- 425 18. Mazurek Melnyk, B., Slevin, C., Militello, L., Hoying, J., Teall, A., & McGovern, C. (2016).
426 Physical health, lifestyle beliefs and behaviors, and mental health of entering graduate health
427 professional students: Evidence to support screening and early intervention. *Journal of the*
428 *American Association of Nurse Practitioners*, 28(4), 204–211. [https://doi.org/10.1002/2327-](https://doi.org/10.1002/2327-6924.12350)
429 [6924.12350](https://doi.org/10.1002/2327-6924.12350).
- 430 19. Ibrahim, A. K., Kelly, S. J., Adams, C. E., & Glazebrook, C. (2013). A systematic review of
431 studies of depression prevalence in university students. *Journal of Psychiatric*
432 *Research*, 47(3), 391–400. <https://doi.org/10.1016/j.jpsychires.2012.11.015>.
- 433 20. Roberts, S. J., Glod, C. A., Kim, R., & Houchell, J. (2010). Relationships between
434 aggression, depression, and alcohol, tobacco: implications for healthcare providers in student
435 health. *Journal of the American Academy of Nurse Practitioners*, 22(7), 369–375.
436 <https://doi.org/10.1111/j.1745-7599.2010.00521.x>.
- 437 21. Thompson-Ebanks, V. (2017). Leaving college prematurely: The experiences of
438 nontraditional-age college students with depression. *Journal of College Student Retention:*
439 *Research, Theory & Practice*, 18(4), 474-495.

- 440 22. National Institute of Mental Health (2012). *Depression and college students*.
441 <https://infocenter.nimh.nih.gov/pubstatic/NIH%2012-4266/NIH%2012-4266.pdf>.
- 442 23. National Institute of Mental Health (2019 February). *Major depression*.
443 <https://www.nimh.nih.gov/health/statistics/major-depression.shtml>.
- 444 24. Gratch, L. V., Bassett, M. E., & Attra, S. L. (1995). The relationship of gender and ethnicity
445 to self-silencing and depression among college students. *Psychology of Women*
446 *Quarterly*, 19(4), 509-515.
- 447 25. Aycock, K.J. (2011). *Coping resources, coping styles, mastery, social support, and*
448 *depression in male and female college students* [Doctoral dissertation, Georgia State
449 University]. ProQuest Dissertations Publishing.
450 <http://search.proquest.com/docview/899269041/>.
- 451 26. Peltzer, K., & Pengpid, S. (2016). Minority stress among lesbian, gay, bisexual, and
452 transgender (LGBT) university students in ASEAN countries: Associations with poor mental
453 health and addictive behavior. *Gender and Behaviour*, 14(3), 7806-7815.
- 454 27. Oswald, S. B., & Lederer, A. M. (2017). Beyond depression and suicide: The mental health of
455 transgender college students. *Social Sciences*, 6(1), 20.
- 456 28. Salami, T. K., & Walker, R. L. (2014). Socioeconomic status and symptoms of depression
457 and anxiety in African American college students: The mediating role of
458 hopelessness. *Journal of Black Psychology*, 40(3), 275-290.
- 459 29. Young, C. B., Fang, D. Z., & Zisook, S. (2010). Depression in Asian–American and
460 Caucasian undergraduate students. *Journal of Affective Disorders*, 125(1-3), 379-382.

- 461 30. Eldahan, A. I., Pachankis, J. E., Rendina, H. J., Ventuneac, A., Grov, C., & Parsons, J. T.
462 (2016). Daily minority stress and affect among gay and bisexual men: A 30-day diary
463 study. *Journal of Affective Disorders, 190*, 828-835.
- 464 31. Witcomb, G. L., Bouman, W. P., Claes, L., Brewin, N., Crawford, J. R., & Arcelus, J.
465 (2018). Levels of depression in transgender people and its predictors: Results of a large
466 matched control study with transgender people accessing clinical services. *Journal of*
467 *Affective Disorders, 235*, 308-315.
- 468 32. Fingerhut, A. W., Peplau, L. A., & Gable, S. L. (2010). Identity, minority stress and
469 psychological well-being among gay men and lesbians. *Psychology & Sexuality, 1*(2), 101-
470 114.
- 471 33. Scott, R. L., Lasiuk, G., & Norris, C. (2016). The relationship between sexual orientation and
472 depression in a national population sample. *Journal of Clinical Nursing, 25*(23-24), 3522-
473 3532.
- 474 34. Ross, L. E., Salway, T., Tarasoff, L. A., MacKay, J. M., Hawkins, B. W., & Fehr, C. P.
475 (2018). Prevalence of depression and anxiety among bisexual people compared to gay,
476 lesbian, and heterosexual individuals: A systematic review and meta-analysis. *The Journal of*
477 *Sex Research, 55*(4-5), 435-456.
- 478 35. Plöderl, M., & Tremblay, P. (2015). Mental health of sexual minorities. A systematic
479 review. *International Review of Psychiatry, 27*(5), 367-385.
- 480 36. Pompili, M., Lester, D., Forte, A., Seretti, M. E., Erbuto, D., Lamis, D. A., Amore, M., &
481 Girardi, P. (2014). Bisexuality and suicide: A systematic review of the current literature. *The*
482 *Journal of Sexual Medicine, 11*(8), 1903–1913. <https://doi.org/10.1111/jsm.12581>.

- 483 37. Arbona, C., & Jimenez, C. (2014). Minority stress, ethnic identity, and depression among
484 Latino/a college students. *Journal of Counseling Psychology*, *61*(1), 162–168.
485 <https://doi.org/10.1037/a0034914>.
- 486 38. Jardin, C., Mayorga, N. A., Bakhshaie, J., Garey, L., Viana, A. G., Sharp, C., Cardoso, J. B.,
487 & Zvolensky, M. J. (2018). Clarifying the relation of acculturative stress and
488 anxiety/depressive symptoms: The role of anxiety sensitivity among Hispanic college
489 students. *Cultural Diversity and Ethnic Minority Psychology*, *24*(2), 221–
490 230. <https://doi.org/10.1037/cdp0000175>.
- 491 39. U.S. Centers for Disease Control & Prevention. (2020, August 11). *Benefits of physical*
492 *activity*. <https://www.cdc.gov/physicalactivity/basics/pa-health/index.htm>.
- 493 40. Irwin J. D. (2004). Prevalence of university students' sufficient physical activity: a systematic
494 review. *Perceptual and Motor Skills*, *98*(3 Pt 1), 927–943.
495 <https://doi.org/10.2466/pms.98.3.927-943>.
- 496 41. American College Health Association (2020). *National College Health Assessment Fall 2019*
497 *reference group executive summary*. [https://www.acha.org/documents/ncha/NCHA-](https://www.acha.org/documents/ncha/NCHA-III_Fall_2019_Reference_Group_Executive_Summary.pdf)
498 [III_Fall_2019_Reference_Group_Executive_Summary.pdf](https://www.acha.org/documents/ncha/NCHA-III_Fall_2019_Reference_Group_Executive_Summary.pdf).
- 499 42. American College Health Association (2020). *National College Health Assessment Fall 2019*
500 *reference group data report*. [https://www.acha.org/documents/ncha/NCHA-](https://www.acha.org/documents/ncha/NCHA-III_FALL_2019_REFERENCE_GROUP_DATA_REPORT.pdf)
501 [III_FALL_2019_REFERENCE_GROUP_DATA_REPORT.pdf](https://www.acha.org/documents/ncha/NCHA-III_FALL_2019_REFERENCE_GROUP_DATA_REPORT.pdf).
- 502 43. Mammen, G., & Faulkner, G. (2013). Physical activity and the prevention of depression: a
503 systematic review of prospective studies. *American Journal of Preventive Medicine*, *45*(5),
504 649–657. <https://doi.org/10.1016/j.amepre.2013.08.001>.

- 505 44. Rosenbaum, S., Tiedemann, A., & Ward, P. B. (2014). Meta-analysis physical activity
506 interventions for people with mental illness: a systematic review and meta-analysis. *Journal*
507 *Clinical Psychiatry*, 75(0), 1-11.
- 508 45. Nes, B. M., Janszky, I., Vatten, L. J., Nilsen, T. I., Aspenes, S. T., & Wisløff, U. (2011).
509 Estimating V·O₂ peak from a nonexercise prediction model: the HUNT Study,
510 Norway. *Medicine and Science in Sports and Exercise*, 43(11), 2024–2030.
511 <https://doi.org/10.1249/MSS.0b013e31821d3f6f>.
- 512 46. Jalene, S., Pharr, J., Shan, G., & Poston, B. (2019). Estimated cardiorespiratory fitness is
513 associated with reported depression in college students. *Frontiers in Physiology*, 10, 1191.
514 <https://doi.org/10.3389/fphys.2019.01191>.
- 515 47. Spitzer, R. L., Kroenke, K., & Williams, J. B. (1999). Validation and utility of a self-report
516 version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental
517 Disorders. Patient Health Questionnaire. *JAMA*, 282(18), 1737–1744.
518 <https://doi.org/10.1001/jama.282.18.1737>.
- 519 48. Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief
520 depression severity measure. *Journal of General Internal Medicine*, 16(9), 606–613.
521 <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- 522 49. Iorga, M., Dondas, C., & Zugun-Eloae, C. (2018). Depressed as freshmen, stressed as
523 seniors: The relationship between depression, perceived stress and academic results among
524 medical students. *Behavioral Sciences*, 8(8), 70. doi:10.3390/bs8080070.
- 525 50. Corona, R., Rodríguez, V. M., McDonald, S. E., Velazquez, E., Rodríguez, A., & Fuentes, V.
526 E. (2017). Associations between cultural stressors, cultural values, and Latina/o college
527 students' mental health. *Journal of Youth and Adolescence*, 46(1), 63-77.

- 528 51. Katiria Perez, G., & Cruess, D. (2014). The impact of familism on physical and mental health
529 among Hispanics in the United States. *Health Psychology Review*, 8(1), 95–127.
530 <https://doi.org/10.1080/17437199.2011.569936>.
- 531 52. Ovink, S. M., & Kalogrides, D. (2015). No place like home? Familism and Latino/a-white
532 differences in college pathways. *Social Science Research*, 52, 219–235.
533 <https://doi.org/10.1016/j.ssresearch.2014.12.018>.
- 534 53. Castillo, L. G., Conoley, C. W., & Brossart, D. F. (2004). Acculturation, White
535 marginalization, and family support as predictors of perceived distress in Mexican American
536 female college students. *Journal of Counseling Psychology*, 51(2), 151.
- 537 54. Horesh, D., & Brown, A. D. (2020). Traumatic stress in the age of COVID-19: A call to
538 close critical gaps and adapt to new realities. *Psychological Trauma: Theory, Research,*
539 *Practice and Policy*, 12(4), 331–335. <https://doi.org/10.1037/tra0000592>.
- 540 55. Aldwin, C. (2011). Stress and coping across the lifespan. *The Oxford Handbook of Stress,*
541 *Health, and Coping*, 15-34.
- 542 56. Kessler, R. C., Mickelson, K. D., Walters, E. E., Zhao, S., & Hamilton, L. (2004). Age and
543 depression in the MIDUS survey. In O.G. Brim, C.D. Ryff & R.C. Kessler (Eds.). *How*
544 *healthy are we: A national study of well-being at midlife* (pp. 227-251). University of
545 Chicago Press.
- 546 57. Westerhof, G. J., & Keyes, C. L. (2010). Mental illness and mental health: The two continua
547 model across the lifespan. *Journal of Adult Development*, 17(2), 110–119.
548 <https://doi.org/10.1007/s10804-009-9082-y>.

- 549 58. Holt, S. (2007). *Emotional intelligence and academic achievement in higher*
550 *education* [Doctoral dissertation, Pepperdine University]. ProQuest Dissertation Publishing.
551 <http://search.proquest.com/docview/304707083/>.
- 552 59. Sparkman, L., Maulding, W., & Roberts, J. (2012). Non-cognitive predictors of student
553 success in college. *College Student Journal*, 46(3), 642-652.
- 554 60. van der Zanden, P. J. A.C., Denessen, E., Cillessen, A. H.N., & Meijer, P. C. (2018).
555 Domains and predictors of first-year student success: A systematic review. *Educational*
556 *Research Review*, 23, 57–77. <https://doi.org/10.1016/j.edurev.2018.01.001>.
- 557 61. U.S. Department of Education, National Center for Education Statistics. (2020 April). *The*
558 *condition of education*, https://nces.ed.gov/programs/coe/indicator_ctr.asp.
- 559 62. Bustamante, J. (2019, November 6). *College dropout rates*. [https://educationdata.org/college-](https://educationdata.org/college-dropout-rates/)
560 [dropout-rates/](https://educationdata.org/college-dropout-rates/).
- 561 63. Tison, G. H., Avram, R., Kuhar, P., Abreau, S., Marcus, G. M., Pletcher, M. J., & Olgin, J. E.
562 (2020). Worldwide effect of COVID-19 on physical activity: A descriptive study. *Annals of*
563 *Internal Medicine*, M20-2665. Advance online publication. [https://doi.org/10.7326/M20-](https://doi.org/10.7326/M20-2665)
564 2665.
- 565 64. Campbell, L. (2020, February 9). Chinese in UK report “shocking” levels of racism after
566 corona virus outbreak. *The Guardian*. [http://www.theguardian.com/uk-](http://www.theguardian.com/uk-news/2020/feb/09/Chinese-in-UK-report-shocking-levels-of-racism-after-coronavirus-outbreak)
567 [news/2020/feb/09/Chinese-in-UK-report-shocking-levels-of-racism-after-coronavirus-](http://www.theguardian.com/uk-news/2020/feb/09/Chinese-in-UK-report-shocking-levels-of-racism-after-coronavirus-outbreak)
568 [outbreak](http://www.theguardian.com/uk-news/2020/feb/09/Chinese-in-UK-report-shocking-levels-of-racism-after-coronavirus-outbreak).
- 569 65. Clissold, E., Nylander, D., Watson, C., & Ventriglio, A. (2020). Pandemics and
570 prejudice. *The International Journal of Social Psychiatry*, 66(5), 421–423.
571 <https://doi.org/10.1177/0020764020937873>.

- 572 66. Kambhampaty, A.P. (2020, June 25). Asian Americans share experiences of racism during
573 COVID-19. *Time Magazine*. <https://time.com/5858649/racism-coronavirus/>
- 574 67. Kao, D., Carvalho Gulati, A., & Lee, R. E. (2016). Physical Activity Among Asian American
575 Adults in Houston, Texas: Data from the Health of Houston Survey 2010. *Journal of*
576 *Immigrant and Minority Health*, 18(6), 1470–1481. [https://doi.org/10.1007/s10903-015-](https://doi.org/10.1007/s10903-015-0274-1)
577 [0274-1](https://doi.org/10.1007/s10903-015-0274-1).
- 578 68. Rajib Shaw, Yong-Kyun Kim, & Jinling Hua. (2020). Governance, technology and citizen
579 behavior in pandemic: Lessons from COVID-19 in East Asia. *Progress in Disaster Science*,
580 6. <https://doaj.org/article/23a004ad113f418389e18099d180c63d>.