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COVID-19 Vaccine Intent and Attitudes: results from a cross-sectional survey of university-based undergraduate and graduate students

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Master of Public Health

Epidemiology

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B.A., American University, 2016

Thesis Committee Chair: Allison T. Chamberlain, Ph.D.

An abstract of  
A thesis submitted to the Faculty of the  
Rollins School of Public Health of Emory University  
in partial fulfillment of the requirements for the degree of  
Master of Public Health  
in Epidemiology  
2021

## Abstract

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By Matthew Masiello

**Background.** Given high rates of COVID-19 transmission among students at institutes of higher education (IHE), there is a need to understand COVID-19 vaccine intent and attitudes among this population.

**Methods.** Using data collected from a 2021 cross-sectional survey, factors associated with vaccine intent and attitudes toward COVID-19 and risk mitigation activities were examined. Associations between intention to receive a COVID-19 vaccine, COVID-19-related attitudes and respondent educational level (undergraduate vs. graduate) were assessed using logistic regression.

**Results.** Of 15,451 students sent the survey, 3,610 (23%) responded. Among respondents, 3,362 (93%) reported an intention to get a COVID-19 vaccine or had already vaccinated. The most common reason for not wanting a vaccine was concern around long-term effects (74%). Most respondents (78%) reported still being concerned about COVID-19, but only 57% reported that their friend group expressed similar concern. This difference was greater among undergraduate students than graduate students (75% versus 53% compared to 81% versus 62%, respectively). The strongest predictor of not wanting a COVID-19 vaccine was not receiving a 2020-2021 influenza vaccine (aOR: 5.12, 95% CI: 3.69-7.12) and expressing no concern about COVID-19 (aOR: 2.19, 95% CI: 1.46-3.28).

**Conclusions.** Most IHE students that responded to the survey expressed intention to receive a COVID-19 vaccine. There was a notable difference between respondent attitudes toward COVID-19 and associated risk mitigation activities compared to what respondents believed their friend group's attitudes to be. IHE administrators should continue to stress the importance of risk mitigation activities while encouraging vaccine uptake among their student populations.

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## Background

Institutes of higher education (IHEs) have received unique attention by U.S. public health officials during the COVID-19 pandemic. While the number of weekly COVID-19 infections in the U.S. was generally decreasing during summer 2020, weekly incidence of COVID-19 cases among adults aged 18-22 rose by 55.1% during August-September 2020 (Leidner et al., 2021). Given that 45% of persons aged 18-22 were enrolled in IHEs in 2019, IHE campuses posed an environment for substantial transmission of SARS-CoV-2.

Barring any underlying health conditions or service as a caregiver for another high-risk individual, 18–22-year-olds were among the last demographic groups to have been prioritized for COVID-19 vaccine receipt (Dooling et al., 2021). While individuals in this age range are generally considered low-risk for severe COVID-19 disease and death (Kang & Jung, 2020), this college-aged demographic is particularly susceptible to COVID-19 infection and transmission given their active societal engagement and social mixing behaviors. Growing evidence indicates that currently available COVID-19 vaccines (e.g., mRNA- and adenovirus-based vaccines) offer protection against asymptomatic infection in addition to preventing severe illness (Thompson et al., 2021), such that vaccinating students, faculty, and staff at IHEs will be an important to controlling SARS-CoV-2 transmission in the U.S.

With little prior knowledge about coronavirus epidemiology among IHEs and no information on coronavirus vaccine willingness among college-aged individuals, examining research on influenza and influenza vaccination among IHEs is illustrative. While the influenza-attributable hospitalization rate of college students is low, the burden of disease is significant: students miss class, increase their antibiotic use, and use more healthcare services (Benjamin & Bahr, 2016). Seasonal influenza transmission is common on college campuses, yet influenza vaccination is notoriously low among IHE students, ranging between 12-30% coverage (Bednarczyk et al., 2015; Benjamin & Bahr, 2016; Poehling, Blocker, Ip, Peters, & Wolfson, 2012). IHE students report feelings of laziness and lack of motivation for seeking an influenza vaccine; however, once they are informed that vaccination protects vulnerable people around them, their willingness can increase (Bednarczyk et al., 2015). Commonly reported reasons for vaccine

hesitancy among IHE students include a belief that they will get influenza as a result of the vaccine, that vaccine side effects are dangerous, and that their perceived risk of contracting the vaccine is low (Benjamin & Bahr, 2016). Immunization facilitators include easy access to vaccines and health care providers (Bednarczyk et al., 2015), social encouragement (Rogers, Bahr, & Benjamin, 2018), being a first-year student (i.e., freshman), attending a private university, having a college-educated parent, and participating in student clubs (Poehling et al., 2012).

While IHEs consider COVID-19 vaccine mandates for their students, it is unclear how receptive IHE students are toward getting a COVID-19 vaccine voluntarily. Early evidence suggests that a majority of students intend to get a COVID-19 vaccine when it becomes available to them (Graupensperger, Abdallah, & Lee, 2021), however uptake should not be taken for granted. IHE administrators should be aware of vaccine willingness and hesitancy among their own student bodies. Understanding who is vaccine hesitant and for what reasons can inform vaccine uptake interventions. A useful stratification, when applicable, is level of education (undergraduate or graduate). These populations may differ in important characteristics for IHE risk mitigation planning, e.g., housing, social behaviors, and communication preferences. The primary aim of this study was to characterize vaccine receptiveness and hesitancy among IHE students at a private university in a southern state in the U.S. prior to broad COVID-19 vaccine availability. This manuscript describes those findings and assesses the association between level of higher education (undergraduate versus graduate) and willingness to receive a COVID-19 vaccine. This paper also presents differences between undergraduate and graduate students on their attitudes toward COVID-19 risk mitigation strategies and those perceived to be held by their friend groups.

## Methods

### *Data Collection*

An 18-question, anonymous, cross-sectional electronic survey was administered via email to all university students from March 8 - March 16, 2021 (Qualtrics, Provo, UT). The operational purposes of the survey



were to ascertain students' intentions to receive a COVID-19 vaccine and insights into areas of concern or hesitancy. At the time of survey administration in the state where this university is located, COVID-19 vaccines were restricted to healthcare workers, residents and staff of long-term care facilities, adults age 65 and older, and first responders; on March 25, 2021, vaccine was made available to all individuals aged 16 and older (GDPH, 2021). In addition to being sent to all students' university-sponsored email accounts, the survey was advertised in a weekly student newsletter and on the university student health center's Instagram account. Survey eligibility criteria included being a currently-enrolled student in at the university, able to read and understand English, and be at least 18 years old. The survey and research protocol were approved by the university's institutional IRB.

The survey included questions about demographics including age, race, ethnicity, current level of higher education (undergraduate or graduate student), undergraduate year, and graduate degree program. The primary outcome of interest was willingness to receive a COVID-19 vaccine when eligible (Yes/No/Maybe/I have already gotten a COVID-19 vaccine). Other data collected included receipt of 2020-2021 seasonal influenza vaccine (Yes/No), previous COVID-19 infection (Yes/No/Maybe), reasons for uncertainty toward receiving a COVID-19 vaccine (Speed of development/Side effects/Long-term effects/Uncertainty of the science/Whether it will work/Distrust toward the government), level of concern toward SARS-CoV-2 infection (extremely, very, moderately, or not concerned), reasons for concern (Underlying health conditions/Fear of severe illness/Fear of long-term effects/Fear of spreading it to others), personal attitudes toward COVID-19 disease and risk mitigation strategies as well as perceived friend group attitudes towards the same topics (Still concerned.../Somewhat concerned.../ Not concerned anymore.../Already had COVID-19, so no longer concerned).

### *Statistical Analysis*

Chi-square tests were used to assess differences in demographic variables between undergraduate and graduate students and to assess differences in students' intentions to receive a COVID-19 vaccine, level of concern toward COVID-19 infection, and personal and friend group attitudes toward COVID-19 and associated risk mitigation activities. Logistic regression models were used to assess the relationship

between unwillingness to receive a COVID-19 vaccine and level of higher education adjusting for age, sex, ethnicity, race, 2020-2021 influenza vaccine receipt, previous COVID-19 infection, and level of concern toward COVID-19. Students who already received a COVID-19 vaccine (e.g., those in the university’s medical and nursing schools) were categorized as vaccine-willing. Students who indicated being unsure were combined as those indicating unwillingness. Additionally, respondents that identified as American Indian/Alaskan Native or selected ‘other or prefer not to answer’ for the race variable were categorized into a single “other” race group for analysis. Statistical significance was defined a *P* value <.05. All analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

### Results

Of 15,451 enrolled students, 3,610 (23%) responded (Table 1). Among respondents, 1,821 were undergraduate students (50%) and 1,789 were graduate students (50%). The median age of all students was 23.9. More than half of the sample identified as white or Caucasian (58%), 25% identified as Asian or Asian American, 10% identified as Black or African American, and 4% identified as American Indian/Alaskan Native, “other” or preferred not to answer. Nearly 10% of students reported having already had COVID-19, with slightly more undergraduates than graduates reporting previous infection (11% versus 8%). Most students (86%) reported getting a 2020-2021 influenza vaccine.

**Table 1.** Characteristics of Survey Respondents

		<b>Total*</b> <b>(n = 3,610)</b>	<b>Undergraduate</b> <b>(n = 1,821)</b>	<b>Graduate</b> <b>(n = 1,789)</b>	<i>p</i> value
<b>Age</b>		23.9 (6.1)	20.1 (2.4)	27.7 (6.3)	
<b>Gender</b>					
	Female	2400 (66.5)	1,172 (64.4)	1,228 (68.6)	0.01
	Male	1,155 (32.0)	624 (34.3)	531 (29.7)	
	Non-Binary	38 (1.1)	20 (1.1)	18 (1.0)	
	Prefer not to answer	16 (0.4)	5 (0.3)	11 (0.6)	
<b>Ethnicity</b>					
	Hispanic	393 (10.9)	219 (12.0)	174 (9.7)	.04
	Non-Hispanic	3,159 (87.5)	1,3578 (86.7)	1,581 (88.4)	
<b>Race</b>					
	Asian/Asian American	897 (24.9)	555 (30.5)	342 (19.1)	<.0001

Black/African American	346 (9.6)	143 (7.9)	203 (11.4)	
White/Caucasian	2,076 (57.5)	981 (53.9)	1,095 (61.2)	
Other^	128 (3.6)	59 (3.2)	69 (3.9)	
<b>Undergraduate</b>	1,821 (50.4)			
Freshman	525 (14.5)	525 (28.8)	-	
Sophomore	437 (12.1)	437 (24.0)	-	
Junior	471 (13.1)	471 (25.9)	-	
Senior	375 (10.2)	375 (20.6)	-	
<b>Graduate Programs</b>	1,789 (49.6)			
Humanities and social sciences	546 (15.1)	-	546 (30.5)	
Public Health	392 (10.9)	-	392 (21.9)	
Business	204 (5.7)	-	204 (11.4)	
Law	227 (6.3)	-	227 (12.7)	
Medicine	181 (5.0)	-	181 (10.1)	
Nursing	135 (3.7)	-	135 (7.6)	
Religions studies	97 (2.7)	-	97 (5.4)	
<b>Receipt of 2020-2021 influenza vaccine</b>				
Yes	3,095 (85.7)	1,547 (85.0)	1,548 (86.5)	0.55
No	484 (13.4)	249 (13.7)	235 (13.1)	
<b>Previous COVID-19 Illness</b>				
Yes	349 (9.7)	200 (11.0)	149 (8.3)	0.008
No	3,074 (85.2)	1,525 (83.8)	1,549 (86.6)	
Maybe	149 (4.1)	66 (3.6)	83 (4.6)	

\*Values may not sum to column totals due to missing values.

^ Respondents that selected *American Indian/Alaskan Native*, *Prefer not to answer*, or *Not listed*, please specify were combined into *other*

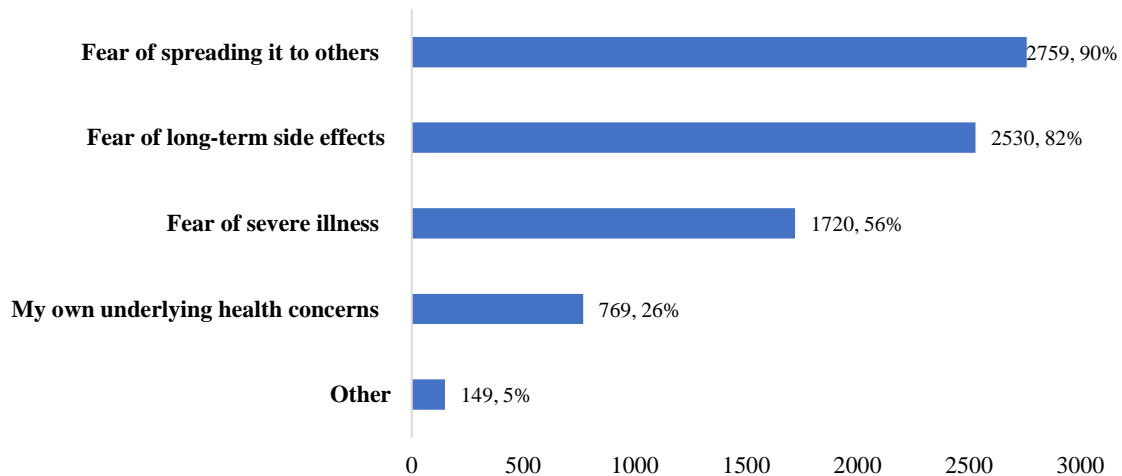
Regarding current concern towards contracting SARS-CoV-2, the majority (90%) of students reported at least some degree of concern, with only 10% reporting no concern. There was no statistically significant difference between undergraduate and graduate students on their level of concern toward contracting SARS-CoV-2 (Table 2).

**Table 2.** Level of Concern Toward Contracting SARS-CoV-2 by type of degree-seeking student

	Undergraduate students (n = 1,781)	Graduate Students (n = 1,773)	Total (n = 3,554)	p value
Extremely Concerned	457 (25.7)	420 (23.7)	877 (24.7)	0.09
Very Concerned	527 (29.6)	495 (27.9)	1,022 (28.8)	
Moderately concerned	614 (34.5)	637 (34.5)	1,251 (35.2)	
Not Concerned	183 (10.3)	221 (10.3)	404 (11.4)	

Among those reporting some degree of concern, fear of spreading SARS-CoV-2 to others was the most commonly reported reason cited for their concern towards the disease (90%), followed by fear of long-term side effects (82%) (Figure 1). Fear of severe illness was reported among 56% of students expressing some degree of concern.

**Figure 1.** Reasons for SARS-CoV-2 Concern (n = 3,072)



Note: respondents were able to select multiple choices

When asked about their personal attitudes toward COVID-19 and associated risk mitigation strategies, over three-quarters of respondents (78%) indicated that they were still personally concerned about COVID-19 (Table 3). Eighteen percent of students reporting being “somewhat mindful” of COVID-19. When asked what they perceived their friends' attitudes to be towards COVID-19, respondents perceived less concern about COVID-19 on behalf of their friend group; only 57% of respondents reported that their friend group was still concerned about COVID-19. Differences between personal attitudes and perceived friend group attitudes were greater among undergraduates than graduates; about half (53%) of undergraduate respondents said their friends were still concerned about COVID-19 compared to 62% of graduate student respondents.

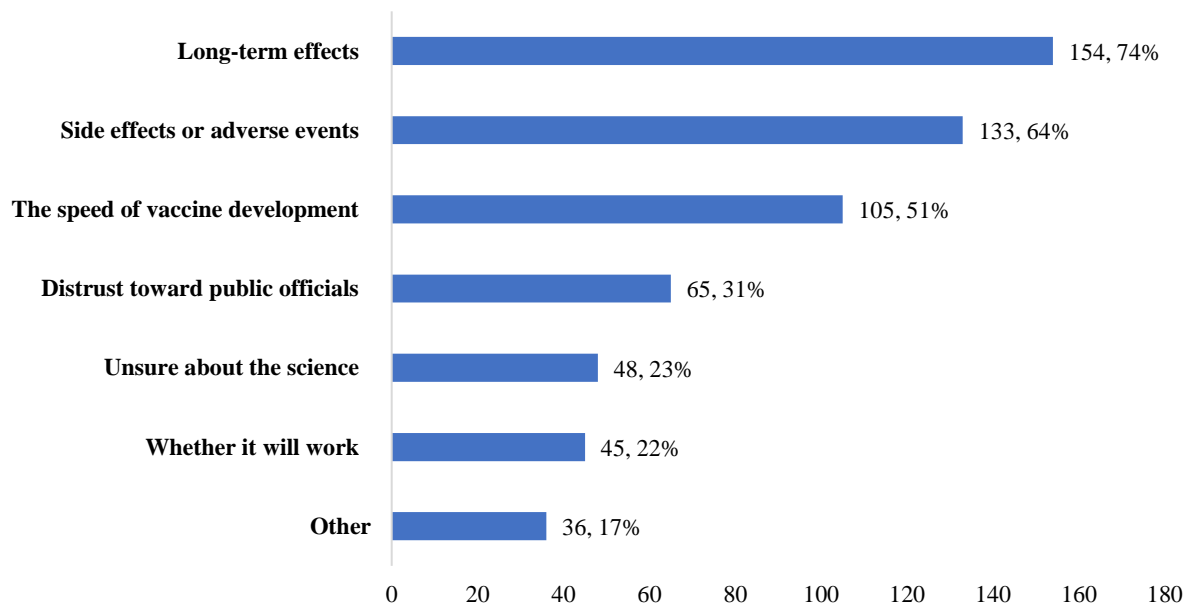
**Table 3. Attitudes toward COVID-19 and risk mitigation strategies by type of degree-seeking student**

	Undergraduate students (n=1,717)	Graduate Students (n=1,740)	Total (n=3,454)	<i>p</i> value
<b>Personal attitudes</b>				
Already had COVID-19, so not as concerned with masking and social distancing except when required	50 (2.9)	24 (1.4)	74 (2.1)	<0.0001
Not concerned anymore; if they get sick, likelihood of disease will be mild, so masking and distancing isn't a priority	41 (2.4)	44 (2.5)	85 (2.5)	
Somewhat mindful of COVID-19; will wear masks and distance sometimes	344 (20.1)	263 (15.1)	607 (17.6)	
Still concerned about COVID-19; pretty vigilant about wearing masks and distancing most of the time	1,280 (74.6)	1,408 (81.0)	2,288 (77.8)	
<b>Perceived friend group attitudes</b>				
Not concerned anymore since most of them have had COVID-19	57 (3.3)	17 (1.0)	74 (2.1)	<0.0001
Not concerned anymore; if they get sick, likelihood of disease will be mild, so masking and distancing isn't a priority	109 (6.4)	85 (4.9)	194 (5.6)	
Somewhat mindful of COVID-19; will wear masks and distance sometimes	648 (37.8)	566 (32.5)	1,214 (35.1)	
Still concerned about COVID-19; pretty vigilant about wearing masks and distancing most of the time	901 (52.6)	1,071 (61.6)	1,972 (57.1)	

When asked about intention to receive a COVID-19 vaccine, 75% said they would get the vaccine, 4% said “maybe,” and 1% said they would not. Eighteen percent reported already receiving the vaccine (35% of whom were affiliated with either the nursing or medical schools), bringing the total interested in receiving vaccine or already having received the vaccine to 93%. There was no meaningful difference between the proportion of undergraduate versus graduate students (6.4% vs. 5.4%;  $p=0.22$ ) who expressed uncertainty about or no intent to receive a COVID-19 vaccine.

Among the 207 students who reported at least some hesitation about receiving a COVID-19, the most common reasons cited for hesitancy were long-term effects (74%), side effects or adverse events (64%), and the speed of the vaccine development (51%) (Figure 2).

**Figure 2.** Reasons cited for not wanting the COVID-19 vaccine or being unsure (n = 207)



Note: respondents were able to select multiple choices

Multivariate logistic regression confirmed that level of education was not a statistically significant predictor of vaccine hesitancy after adjusting for age, sex, ethnicity, race, 2020-2021 influenza vaccine receipt, previous COVID-19 infection, and level of concern toward COVID-19 (adjusted OR [aOR] 1.33, 95% confidence interval [CI]: 0.89-2.01) (Table 4). The strongest predictor of vaccine hesitancy was not receiving a 2019-2020 influenza vaccination (aOR: 5.12, 95% CI: 3.69-7.12). Having reported a previous COVID-19 infection (aOR: 1.42, 95% CI: 1.08-1.86), expressing no concern about COVID-19 (aOR: 2.19, 95% CI: 1.46-3.28), and identifying as Black or African American (aOR: 2.99, 95% CI: 98-4.52) were also factors associated with vaccine hesitancy.

**Table 4.** Odds ratios for being unsure or not intending to receive a COVID-19 vaccine

	Crude OR	(95% CI)	Adjusted OR	(95% CI)
<b>Level of education</b>				
Undergraduate	1.31	(0.96-1.79)	1.33	(0.89-2.01)
Graduate	Ref		Ref	
<b>Sex</b>				
Female	1.16	(0.81-1.59)	1.16	(0.82-1.64)
Male	Ref		Ref	

<b>Flu shot</b>				
No Shot	5.54	(4.00-7.67)	5.12	(3.69-7.12)
Flu shot	Ref		Ref	
<b>Previous COVID infection</b>				
Yes	1.46	(1.13-1.90)	1.42	(1.08-1.86)
No	Ref		Ref	
<b>Race</b>				
Asian	1.06	(0.71-1.58)	0.84	(0.55-1.28)
Black	3.49	(2.37-5.16)	2.99	(1.98-4.52)
Other	2.84	(1.42-5.68)	2.85	(1.32-6.16)
White	Ref		Ref	
<b>Concern Level</b>				
No concern	2.07	(1.42-3.01)	2.19	(1.46-3.28)
Very concerned	0.30	(0.24-0.59)	0.36	(0.23-0.58)
Extremely concerned	0.29	(0.17-0.49)	0.26	(0.15-0.45)
Moderately concerned	Ref		Ref	

Abbreviations: CI, confidence intervals; OR, odds ratio; Ref, reference group  
Note: ORs adjusted for level of education, age, sex, ethnicity, race, 2019-2020 influenza vaccine receipt, previous COVID-19 infection, and level of concern toward COVID-19.

## Discussion

When surveyed only days prior to being eligible to receive a COVID-19 vaccine, the vast majority of IHE students that responded to our COVID-19 student vaccine survey indicated willingness to vaccinate. This overwhelmingly positive receptivity to the vaccine among the student respondents, without significant differences between undergraduate and graduate students, is reassuring towards making IHEs safe against COVID-19 disease. The minority of respondents that expressed vaccine hesitancy (who either reported uncertainty about getting the vaccine or no intention to get the vaccine) were more likely to not have gotten an influenza vaccine during the 2020-2021 influenza season, have had previous COVID-19 infection, or identified as Black or African American. While these findings align with previous research on this topic (Gatwood, McKnight, Fiscus, Hohmeier, & Chisholm-Burns, 2021; Savoia et al., 2021), they suggest a need for some tailored and culturally-sensitive vaccine promotion campaigns that broach a wide variety of hesitancy reasons and causes. They are also important to consider when debating student reactions to campus-wide COVID-19 vaccine mandates, which many colleges and universities have either enacted already or are considering (Nadworny, 2021). Furthermore, understanding

from previous research among this demographic that students can become more vaccine receptive after fully understanding that vaccination protect others in addition to themselves is a useful facilitator (Bednarczyk et al., 2015). With (90%) of our respondents indicating that spreading the virus to others was a major reason for remaining concerned about contracting COVID-19, messaging that continues to leverage this concept of social conscientiousness could be quite effective for vaccine promotion as well.

Students that were vaccine hesitant reported concern around side effects, adverse events, and purported long-term effects as primary reasons for uncertainty toward COVID-19 vaccines. Vaccine safety is a common concern for people that are vaccine hesitant, and this characteristic exists among IHE students (Benjamin & Bahr, 2016). This trend highlights the need to improve messaging on vaccine safety and the tradeoffs associated with not getting vaccinated. Adverse events that arise, such as the cases of cerebral venous sinus thrombosis associated with the Johnson & Johnson vaccine (CDC, 2021) , should be addressed promptly and communicated to students in lay terms that lead to continued confidence in vaccine safety, effectiveness, and evaluation.

Interestingly, there was a meaningful difference between respondents' personal concern toward COVID-19 and risk mitigation strategies and their perception of their friend group's concern toward the same topics. We found a much higher degree of personal concern for both COVID-19 disease and adherence to risk mitigation strategies than the concern they perceived their friend groups to have. While differences between individual behaviors and peer behaviors could indeed exist, we suspect the differences may not be this dramatic in reality; we hypothesize our finding may be a vestige of two types of bias: selection bias among those who opted to take this survey and social desirability bias. Due to our relatively low overall response rate (23%) and the fact over 90% of respondents were pro-vaccine, those who responded to the survey may be the more COVID-conscientious students compared to others that did not respond. On the whole, those who participated very well may be more concerned about COVID-19 and adherence to risk mitigation measures than their friends or peers that did not respond. They also may have been responding with answers they perceived would be the desired or responsible answers on behalf of themselves, perhaps feeling more comfortable answering honestly on behalf of their ambiguous "friend



group.” Either way, the differences we observed are interesting and worth exploring more. Moreover, most students still reported concern and continued vigilance around COVID-19 and risk mitigation, but it is possible that the dip in perceived friend group attitudes during a period of declining COVID-19 cases, hospitalizations and deaths could also be a result pandemic fatigue (MacIntyre et al., 2021).

The results of this survey analysis need to be considered within a few limitations. The study was based on a convenience sample of students that opted into taking the email-delivered survey resulting in a 23% response rate among the entire university student body. Given the topic of the survey, our results may be biased towards those interested in or eager for a COVID-19 vaccine. It may not be reflective of the entire student body. With that said, the response rate of our survey corresponds to rates achieved in similar surveys (Poehling et al., 2012; Rogers et al., 2018).

This research contributes to a body of scholarship on COVID-19 and vaccine attitudes among college-aged adults, highlighting important considerations for public health practitioners and IHEs. At the time of our survey administration, most respondents indicated positive attitudes toward COVID-19 vaccines. However, the nature of the pandemic is dynamic, always warranting sustained awareness of people's attitudes toward COVID-19 vaccine safety and effectiveness. This is especially true considering publicity around vaccine adverse events and the emergence of SARS-CoV-2 variants that do or theoretically may escape naturally- or vaccine-induced immunity (Edara et al., 2021; Garcia-Beltran et al., 2021). Maintaining a pulse on awareness of COVID-19 vaccine coverage and attitudes among those who may be reluctant is necessary to construct new and resonant public health messaging, especially among college-aged students.

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