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College Student Influenza and COVID-19 Vaccination Attitudes and Uptake Behavior: Prevalence, Correlates, and Promoting Improvement

Robert R. Wright *, Macey Bunnell, Given Chatelain, Eve McCulloch, Alexis L. Soelberg and Devon Marrott

Department of Psychology, Brigham Young University – Idaho, 210 West 4th South, Rexburg, ID 83460-2140, USA

* Correspondence: wrightro@byui.edu; Tel.: +1-208-496-4085

Abstract

Vaccination uptake is among the best public health behaviors to prevent infection, disease and death. However, public confidence in this behavior has waned in recent years alongside the twin respiratory threats of influenza and COVID-19. Moreover, certain populations, such as emerging adults, may be amenable to vaccination attitude and behavior change. The current investigation presents two studies that address influenza and COVID-19 vaccination uptake among emerging adults. First, among more than 2,000 emerging adults during the years of 2022-2024 we examine rates of vaccination uptake and attitudes, as well as relationships of vaccine rates with other concomitant health behaviors. Second, we explore the efficacy of a classroom-based vaccination promotion experience in altering both attitudes and behaviors regarding vaccination uptake among 275 emerging adults at college. Results highlight some health behaviors that are related to influenza uptake but not COVID-19 uptake. Moreover, results from Study 2 demonstrated that attitudes, but not behavior, seem to be most amenable to the classroom-based approach to encourage health behavior change, as a significant increase in positive attitudes toward both influenza and COVID-19 vaccines was observed. These findings are discussed further considering theoretical and practical applications.

Keywords: vaccine; influenza; classroom; intervention; health behavior; attitude

1. Introduction

Evidence supports vaccinations as an effective way to prevent many illnesses and diseases and is often credited as a major factor in preventing infant mortality and prolonging life [1]. Yet, vaccination attitudes and uptake have become increasingly variable in recent years, with observed declines across various populations [2,3]. According to data collected by the Centers for Disease Control and Prevention (CDC) for the year 2023, influenza was the 12th leading cause of death with 45,185 deaths [4] and COVID-19 was the 10th leading cause of death in the U.S. in 2023 with 49,932 recorded [5]. After only two years of dissemination, it was estimated that COVID-19 vaccinations have prevented as many as 3 million deaths, 16 million hospitalizations, and more than 100 million infections within the U.S. alone [6]. Despite this, vaccination rates for both diseases remain relatively low [4]. The current investigation presents two studies that address influenza and COVID-19 vaccination uptake and promotion among students attending college.

1.1. Influenza and COVID-19 Vaccination and Emerging Adults

Vaccine hesitancy is identified by World Health Organization (WHO) as one of the top ten threats to health [3] and is influenced by many factors including belief in conspiracies, high reactance, high amounts of disgust/repulsion towards needles and blood, and high hierarchical worldviews [7]. Across populations, vaccine hesitancy is further shaped by education, health literacy, and exposure

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to misinformation [2,3]. Furthermore, simply having medical accessibility alone is not sufficient to elicit uptake, as psychosocial and cognitive factors are associated with vaccine attitudes and behavior [8–10]. For instance, trust in vaccine safety and effectiveness is associated with COVID-19 and influenza uptake intention, particularly among college students [11,12].

Although factors such as education and socioeconomic status are generally higher compared to other groups, adults at university or college face unique circumstances for vaccination uptake. For instance, they report lower uptake than national targets, face high exposure risk, and are strongly influenced by social norms and perceived expectations [8,13,14]. Psychosocial and cognitive factors such as beliefs about safety, trust in information sources, and exposure to misinformation are associated with influenza and COVID-19 vaccine attitudes among this population [8–10]. College students are heavy consumers of social media, which can make them particularly susceptible to misinformation and peer influences [15,16]. Common myths and misconceptions of both the influenza and COVID-19 vaccinations can be easily viewed, misinterpreted and internalized as factual. Thus, the college student population is confronted with several challenges to vaccination uptake including attitude formation and perceived social norms.

1.2. Theory of Planned Behavior and Vaccination

As posited by the Theory of Planned Behavior (TPB) [17] attitudes are crucial to addressing vaccination uptake behavior. The TPB conceptualizes vaccine uptake as a volitional behavior driven by attitudes, subjective social norms, and perceived behavioral control [8,10,13,18,19]. Among college samples, attitudes emerge as the strongest predictor, while normative pressure from peers and instructors may also shape vaccine intentions [9,14]. Attitudes are known to be more amenable to change during emerging adulthood (18-29 years) [20] and emerging adults have relatively low vaccination rates [4,14], suggesting this population is one in which improvement can be made.

Moreover, positive attitudes towards vaccine safety and effectiveness predict uptake intention for COVID-19 and influenza, while doubts about the vaccine are common among the unvaccinated [11,12,14,21]. College students show patterns where attitudes and social norms predict vaccination intention more strongly than logistical barriers [8,13]. Moreover, pro-vaccine influences from healthcare providers, family and friends may lead to increased vaccination likelihood [11,12], and these subjective norms are strong predictors of intention among U.S. college students [14]. In fact, Mongeau and colleagues [13] found that attitudes and norms explained over 70% of the variance in influenza vaccine intention and Rahi [22] reported TPB constructs to explain 55% of variance in the intention to receive the COVID-19 vaccination. As such, the TPB constructs of attitude and social norms exert a strong influence on vaccination uptake behavior among college students.

1.3. Attitudes, Concomitant Health Behavior and the Classroom for Vaccination Promotion

Although many studies have been conducted on specific vaccine attitudes for influenza (e.g., [23]) and COVID-19 (e.g., [24]) among college or university students, little work has explored the comparison between the two. One notable exception is a study conducted in 2020 where researchers discovered that students held stronger attitudes and intentions to receive the COVID-19 vaccine than the influenza [25]. Even three years into the pandemic, Kuter and colleagues [26] found that student attitudes were still positive toward COVID-19 vaccination despite widespread information online containing polarizing viewpoints [15]. Moreover, some studies have found evidence to support the notion that the COVID-19 pandemic may have been a cue to action for adults across the nation and internationally to receive the influenza vaccine [27,28]. Conversely, other studies have identified a modest relationship suggesting that previous flu vaccination predicted COVID-19 vaccination among U.S. adults [29] and college students [30]. Therefore, it seems attitudes and behavior for both vaccines may gave bidirectional influences.

Other concomitant health behaviors (e.g., physical activity, healthy diet, sleep) may provide additional clues to vaccination uptake behavior. Indeed, studies among adults outside of the U.S. have shown those who are engaging in these health behaviors (e.g., regular exercise, balanced diet,

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adequate sleep) are more likely to receive their seasonal influenza or COVID-19 vaccinations [31–34]. One study among U.S. adults determined that COVID-19 vaccination status did not result in abandonment of protective health behaviors or the uptake of risk-increasing behaviors, suggesting that U.S. adults who receive their seasonal vaccinations may be engaging in these health behaviors [35]. Finally, in another study examining college students, Wright and colleagues [36] discovered increases in diet, sleep and exercise when only one of these specific behaviors was targeted for improvement. As such, it seems likely that vaccination uptake may be a health behavior that could demonstrate a similar pattern with these health behaviors, such that vaccination uptake likely occurs among those who are already engaging in health behaviors of diet, sleep, and physical activity. However, the relationship between these other health behaviors and vaccination attitudes and status has not been thoroughly explored among the college student population in the U.S. Moreover, exploration of concomitant health behaviors and the relationship to vaccination attitudes and status may aid in identifying certain circumstances in which vaccination uptake may be more likely to occur among college students.

Furthermore, educational settings may be well suited for improving vaccine attitudes. School-based health programs serve as effective contexts for shaping vaccine attitudes by increasing motivation, knowledge, and critical thinking [37]. Peer-based and autonomy-affirming campaigns can also improve vaccine safety perceptions without triggering reactance [18]. More specifically, the classroom has been identified as an effective medium for health promotion and improvement (e.g., [36,38]), which extends into vaccination attitudes and uptake behavior. For instance, [39] found that a course focused on immunizations and health practices led to improved knowledge, agreement, self-efficacy, and adherence. Similarly, more recent work demonstrated that targeted college classroom interventions can improve vaccine knowledge, attitudes, self-efficacy, and vaccination uptake [40]. Furthermore, Heo and Hyun [10] found that confidence improves when students receive autonomy-supportive information about how and where to obtain vaccines. As such, these findings support the TPB as an appropriate framework within a classroom setting for improving vaccine attitudes in college students.

1.4. Current Investigation

The current investigation comprises two studies wherein influenza and COVID-19 vaccination attitudes and status were explored relative to concomitant health behavior, and the classroom was examined as a setting for a program to improve vaccination attitudes and behavior. In these two studies, we examined six research questions built on the current literature regarding influenza and COVID-19 vaccination among college students in the U.S.

RQ1: Are college students more likely to get both vaccines (influenza, COVID-19) if they have received one?

RQ2: Are college student attitudes towards the COVID-19 vaccine different than the influenza vaccine?

RQ3: Is influenza vaccine status related to other health behaviors (i.e., diet, sleep, physical activity)?

RQ4: Is COVID-19 vaccine status related to other health behaviors (i.e., diet, sleep, physical activity)?

RQ5: Do attitudes for both influenza and COVID-19 vaccinations improve after classroom intervention experience, both compared over time (within comparisons) and between groups (treatment group, control group; between comparisons)?

RQ6: Does vaccination uptake behavior increase for both influenza and COVID-19 after a classroom intervention experience, both compared over time (within comparisons) and between groups (treatment group, control group; between comparisons)?

Ultimately, this research reveals a unique association of health behaviors with vaccine uptake and highlights the disconnect between vaccine attitudes and behavior, such that classroom-based

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promotion enhances favorable perceptions but may be insufficient on its own to increase vaccination uptake rates.

2. Study 1

2.1. Method

2.1.1. Participants and Procedure

Following IRB ethics approval from Brigham Young University – Idaho (#S22-02, on 17 May 2022), participants were solicited from on-campus General Psychology courses through email communication. Participation in a research study was a course requirement, but students selected between multiple studies and an alternative assignment was available. Student participants followed an electronic link, wherein they provided informed consent and then went through the questionnaire, completing it through Qualtrics. A total of 2,299 participants completed the survey, but responses from those who were not older than 18 years of age, did not provide permission for their data to be used for publication purposes, or did not complete the survey to their best ability (i.e., attention check) were excluded (n = 78). The final sample (n = 2,221), had an average age of 20.20 (SD = 2.70), was comprised of a female majority (60.9%), and was predominately White (85.4%), though Hispanic (6.7%), Black (2.1%), Asian (1.6%), Native Hawaiian (0.5%), and other/more than one (3.3%) were represented. Relationship status was mostly single (62.1%) with committed relationship (26.8%), married (6.9%), engaged to be married (3.8%), and divorced (0.3%) also observed. More than half of the sample were first semester students (50.9%) and unemployed (56.2%) with an average credit load of 12.67 (SD = 2.22). Participants came from families of relatively high socioeconomic status where average education was 3.44 (SD=1.27; 3 = Mother/Father received bachelor's degree, 4=Mother/Father received master's degree) and average income was 4.32 (SD=1.44; 4=$75,000-$100,000, 5=$100,000-$150,000).

2.2. Measures

2.2.1. Demographics

Demographic data including age, gender, relationship status, ethnicity, education level, credit enrollment, and employment status were collected. For the purposes of the current study, we investigated some additional variables. First, participants indicated their current status of major vaccinations with a dichotomous response item (*yes, no*), "*Are you current with your major vaccinations (e.g., Tetanus, Measles, Hepatitis)?*" As vaccine attitudes and uptake behavior can be influenced by media, we created a sum score across 4 items [16] representing minutes spent viewing a screen on a typical day during the past month, including smartphone (or other type of phone with a screen), tablet (or other small device with a screen), computer, and television.

2.2.2. Vaccine Uptake Behavior

Both influenza and COVID-19 uptake was assessed by asking participants if they had received the vaccine that current year with a dichotomous "yes" or "no" response choice.

2.2.3. Vaccine Attitudes

To capture attitudes regarding influenza and COVID-19 vaccines, we created six items each on a five-point agreement scale (1 = *strongly disagree*, 5 = *strongly agree*), where higher scores indicate a stronger positive attitude toward the vaccine. Sample items include, "*The influenza/COVID-19 vaccine does not cause the influenza/COVID-19*", "*More people should get the influenza/COVID vaccine to prevent the disease*", and "*It is safer for you to get the influenza/COVID-19 vaccine than to not*". Both influenza and COVID-19 measures demonstrated acceptable internal consistency (α = .88; α = .89, respectively).

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2.2.4. Physical Health

Subjective physical health was measured where participants rated their own physical health on a scale from 0 (worst physical health) to 100 (best physical health). Next, common physical health symptoms were measured using Spector & Jex's [41] 18-item Physical Symptom Inventory (e.g., headache, fatigue). Participants indicated the presence of any of these symptoms during the past 30 days. Because this is a checklist, no internal consistency estimates were calculated.

2.2.5. Health Behaviors

Consumption of sugary snacks (e.g., brownies, donuts), drinks with added sugar (e.g., regular soda, sports drinks, coffee, iced tea, lemonade, or fruit punch) and fast food over the previous month were examined using one item for each on a 10-point serving frequency scale (0 = *never* to 10 = *5 or more times a day*) [42]. Using the same scale, frequency of consumption of fruit and vegetables was also queried. We used the Stanford Patient Education Research Center's (SPERC) 6-item exercise measure to represent weekly minutes (e.g., walk/run, swim, bike) in the past 30 days by taking an average score of the five items devoted to aerobic activity [43]. Sleep quality was measured using a single item ("During the past month, how would you rate your sleep quality overall?") on a five-point scale (1 = *very bad*, 5 = *very good*). Sleep quantity was reported in average hours per night over the past month. Finally, we used a ten-item adapted version of the Sedentary Behavior Questionnaire (SBQ) from Rosenberg et al., [44] on a nine-point frequency scale (0 = *none*, 9 = *6 hours or more*) in which participants indicated how much time, in general, they spent in a week on a variety of activities that involve little to no physical exertion (e.g., watching television, playing video games, sitting listening to music, sitting while reading a book, riding in a car, and doing homework). It should be noted that SPERC and SBQ are behavior checklists rendering them inappropriate for internal consistency estimation (see [41]).

2.2.6. Data Analysis

First, we calculated and tabulated descriptive results regarding influenza and COVID-19 vaccination status to address RQ1. Then, to address RQ2, we conducted a t-test to examine the difference between the influenza and COVID-19 vaccine attitudes. Similarly, we used independent samples t-tests for statistical significance and reported Cohen's d main effects for comparisons between those who had received the influenza vaccine and those who had not (RQ3) regarding other health behaviors and wellbeing. Third, we followed the same analytic strategy for COVID-19 vaccinations (RQ4). Finally, other demographic variables were explored including age, socioeconomic status (family education, family income, personal education), and daily screen time.

2.3. Results

2.3.1. Vaccination Prevalence and Patterns (RQ1)

Descriptive statistics for study variables are presented in Table 1 [45]. Although vaccination attitudes for both influenza and COVID-19 were not related to any of the health behaviors included in our study, they were strongly interrelated. Of the total sample, 91.3% indicated they were current with all major vaccinations, 23.8% current with the influenza vaccination, and 76.9% current with the COVID-19 vaccination. Regarding gender differences, 25.6% of men reported being current with the influenza vaccine whereas women were at 22.7%. Similarly, for COVID-19 vaccine uptake, men were higher (82.9%) than women (73.1%).

Table 1. Study 1 Descriptive Statistics.

	M **(*SD*)**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**

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1. Influenza Vaccine Attitude	3.31(0.80)	.88											
2. COVID-19 Vaccine Attitude	3.16(0.88)	.75**	.89										
3. Age	20.20(2.70)	.00	.00	--									
4. Subjective Health	79.38(14.59)	-.03	-.04	.00	--								
5. Physical Symptoms	5.53(3.71)	-.04	-.02	-.13**	-.31**	--							
6. Sugary Snack Consumption	0.73(.87)	-.01	.00	-.04	-.07**	.10**	--						
7. Sugary Drink Consumption	0.49(.74)	.01	.00	-.01	-.07**	.12**	.34**	--					
8. Fruit Consumption	0.99(1.00)	-.01	.03	.01	.07**	-.02	.04	.01	--				
9. Vegetable Consumption	0.96(.99)	-.02	.04	.09**	.06*	-.02	.01	-.01	.71**	--			
10. Sleep Quality	3.80(.73)	-.01	-.02	-.01	.21**	-.28**	-.03	-.12**	.03	.01	--		
11. Sleep Quantity	6.76(1.01)	.00	-.01	.04	.05	-.15**	-.04	-.12**	.02	.01	.40**	--	
12. Physical Activity	37.98(27.74)	-.03	-.01	-.03	.08**	.00	-.04	.00	.24**	.23**	-.03	-.06*	--
13. Sedentary Behavior	119.90(54.33)	-.03	.02	-.01	-.05*	.16**	.07**	.16**	.02	.04	-.11**	-.10**	.09** --

Note: * $p < .05$, ** $p < .01$; Internal consistency estimates (Cronbach's α) are listed on the diagonal where appropriate. Sugary snack and drink, as well as fruit and vegetable consumption are reported in servings per day. Physical activity and sedentary behavior are in minutes per day.

Results showing the relationship between vaccination status for the influenza and COVID-19 (RQ1) are displayed in Table 2 [46]. The most frequent occurrence was those who received the COVID-19 vaccine but not the influenza vaccine (55.4%) and the least frequent was for those who received the influenza vaccine but not the COVID-19 vaccine (2.4%). Moreover, most of those who received the influenza vaccine received the COVID-19 vaccine (89.7%), but few of those who received the COVID-19 vaccine also received the influenza vaccine (27.7%). This suggests a complicated interplay, such that if people receive the influenza vaccine, they are more likely to get the COVID-19 vaccine but not vice versa.

Table 2. Study 1 Probability Table of Influenza and COVID-19 Vaccination Occurrence.

		Influenza Vaccination		**Totals**
		Yes	**No**	
COVID-19 Vaccination	Yes	402 (21.2%)	1,048 (55.4%)	1,450 (76.6%)
	No	46 (2.4%)	397 (21.0%)	443 (23.4%)
		448 (23.7%)	1,445 (76.3%)	1,893(100%)

Note: Values represent frequency of occurrence of vaccination, so that each individual is only counted once.

2.3.2. Attitude Comparisons and Health Correlates (RQ2-RQ4)

To investigate differences in student attitudes toward the influenza and COVID-19 vaccines (RQ2), we computed a t-test to compare mean scores. The means were relatively positive for both the influenza ($M = 3.31$, $SD = .80$) and COVID-19 ($M = 3.16$, $SD = .88$) vaccines. Moreover, the difference between the two attitudes was not large (.15), but the t-test resulted in a statistically significant difference so that attitudes were more positive toward the influenza shot ($t[3794] = 5.69$, $p < .001$, $d = .18$).

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Independent samples t-tests revealed several differences between those who had received the influenza vaccine and those who had not (RQ3). As shown in Table 3 [47], influenza attitude was significantly higher for those who received the influenza vaccine (d = .82). Furthermore, those who received the influenza vaccine were also significantly higher in fruit consumption and physical activity. However, those with the influenza vaccine also indicated higher sugary drink consumption and sedentary activity, providing contradicting results. All other behavior variables were not significantly different.

Table 3. Study 1 Influenza Vaccination Comparisons.

Variable	Yes *M*(*SD*)	No *M*(*SD*)	Diff	*t*(*df*), *p*	*d*
Influenza Attitude	3.78(.63)	3.16(.79)	.62	17.20(1895), <.001***	.82
Subjective Health	78.74(15.77)	79.57(14.20)	-.83	1.00(1898), .319	.06
Physical Symptoms	5.28(3.89)	5.61(3.66)	-.33	1.65(1898), .099	.09
Sugary Snack	0.76(.94)	0.72(.84)	.04	.79(1898), .431	.04
Sugary Drink	0.55(.84)	0.46(.70)	.09	2.01(1898), .045*	.12
Fruit Consumption	1.07(1.08)	0.96(.97)	.11	2.01(1898), .045*	.11
Vegetable Consumption	1.03(1.04)	0.94(.98)	.09	1.78(1898), .075	.10
Sleep Quality	3.77(.74)	3.81(.73)	-.04	1.04(1898), .299	.06
Sleep Quantity	6.71(1.06)	6.77(1.00)	-.06	1.05(1970), .296	.05
Physical Activity	41.95(28.49)	36.74(27.40)	5.21	3.50(1898), <.001**	.19
Sedentary Behavior	124.71(56.28)	118.32(53.64)	6.39	2.19(1898), .029*	.12

Note: *p < .05, ** p < .01, *** p < .001; Diff category refers to the difference between Yes and No groups. Yes and No refer to vaccine uptake status. Sugary snack and drink, as well as fruit and vegetable consumption are reported in servings per day. Physical activity and sedentary behavior are in minutes per day.

Next, further independent samples t-tests uncovered two differences between those who had the COVID-19 vaccine and those who did not (RQ4; see [48]). First, COVID-19 attitudes were much higher for those who received the vaccine than those who did not (d = 1.21). Second, those who received the vaccine reported significantly fewer physical health complaints. All other behavior variables were not significantly different.

Table 4. Study 1 COVID-19 Vaccination Comparisons.

Variable	Yes *M*(*SD*)	No *M*(*SD*)	Diff	*t*(*df*), *p*	*d*
COVID-19 Attitude	3.37(.77)	2.43(.81)	.94	21.60(1891), <.001***	1.21
Subjective Health	79.63(14.32)	78.55(15.48)	1.08	1.35(1891), .176	.07
Physical Symptoms	5.41(3.72)	5.93(3.69)	-.52	2.57(1891), .010*	.14
Sugary Snack	0.71(.84)	0.78(.94)	-.07	1.50(1891), .135	.09
Sugary Drink	0.47(.71)	0.53(.83)	-.06	1.44(1891), .152	.09
Fruit Consumption	0.99(1.00)	0.99(1.02)	.00	0.07(1891), .942	.01
Vegetable Consumption	0.97(.99)	0.94(1.01)	.03	0.43(1891), .670	.02
Sleep Quality	3.80(.74)	3.81(.72)	-.01	0.30(1891), .764	.02
Sleep Quantity	6.73(1.03)	6.82(.98)	-.09	1.60(1962), .110	.02
Physical Activity	38.12(27.37)	37.57(28.96)	.55	0.37(1891), .714	.02
Sedentary Behavior	120.45(54.10)	117.70(55.15)	2.75	0.93(1891), .354	.05

Note: *p < .05, ** p < .01, *** p < .001; Diff category refers to the difference between Yes and No groups. Yes and No refer to vaccine uptake status. Sugary snack and drink, as well as fruit and vegetable consumption are reported in servings per day. Physical activity and sedentary behavior are in minutes per day.

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2.3.3. Demographic Factors and Vaccination Status

Finally, we explored some additional demographic factors. First, we investigated differences among those who received the influenza vaccine and those who did not (see [49]). While there were no differences in age, family education, family income, and personal education, daily screen time was significantly higher for those who had received the vaccine than those who had not (+17.63 minutes per day, p = .007). Second, we explored differences among those who had received the COVID-19 vaccine (see [49]). Age, family education, and family income were all significantly (p's < .05) higher for those who had received the vaccine than those who had not. Personal education and daily screen time, however, were not significant.

Table 5. Study 1 Vaccine Demographic Variable Comparisons.

Variable	Yes *M*(*SD*)	No *M*(*SD*)	Diff	*t*(*df*), *p*	*d*
Influenza Vaccine Comparisons					
Age	20.03(3.17)	20.25(2.53)	-.22	1.53(1898), .128	.08
SESEduc	3.46(1.25)	3.43(1.27)	.03	.46(1898), .643	.03
SESIncome	6.33(1.65)	6.18(1.73)	.15	1.36(1316), .173	.09
Education	1.50(.78)	1.57(.82)	-.07	1.63(1898), .104	.09
Daily Screen time	195.69(124.82)	178.05(121.04)	17.63	2.69(1898), .007**	.15
COVID-19 Vaccine Comparisons					
Age	20.32(2.74)	19.82(2.53)	.50	3.42(1891), <.001***	.19
SESEduc	3.49(1.25)	3.28(1.30)	.21	3.09(1891), .002**	.17
SESIncome	6.27(1.72)	6.04(1.70)	.23	1.98(1314), .048*	.13
Education	1.56(.82)	1.53(.81)	.03	0.60(1891), .549	.03
Daily Screen Time	181.70(119.76)	182.47(129.08)	-.77	0.12(1891), .907	.01

Note: *p < .05, ** p < .01, *** p < .001; Daily Screen Time is in minutes per day.

2.4. Discussion

Using a large convenience sample within a cross-sectional research design, Study 1 addressed Research Questions 1-4, uncovering some interesting patterns among college students regarding influenza and COVID-19 vaccination. First, most participants indicated they had received the COVID-19 vaccination but not the influenza vaccination, likely reflecting vaccination mandates for the COVID-19 vaccination were still influential for many even following the pandemic restrictions. Second, attitudes were more positive for the influenza vaccine than the COVID-19 vaccine among our emerging adult sample, which is contrary to other findings among college students [26]. Moreover, COVID-19 vaccination status was related to fewer physical health complaints, suggesting that the vaccine may have been effective at reducing health symptoms or that those who were healthier were being vaccinated.

Interestingly, screen time was associated with influenza but not COVID-19 vaccine uptake. Moreover, several health behaviors were related to influenza vaccine uptake, but were contradictory, providing mixed results. While COVID-19 vaccine uptake was not related to any health behaviors, it was associated with increased age and socioeconomic status. These findings present complicated relationships between these vaccine uptake behaviors, attitudes, other health behaviors, and demographic characteristics within college students. The cross-sectional nature of this study precludes any ability to draw clear causal inferences, though some basic relationships can be observed. Building on these initial findings, Study 2 provides further exploration of a means to increase positive attitudes toward vaccinations and promote vaccine uptake for both influenza and COVID-19 to address Research Questions 5 and 6 using a pre/post study design.

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3. Study 2

3.1. Method

3.1.1. Participants

Data from student participants who did not provide consent for their data to be included in research publications ($n = 2$) or indicated they did not provide accurate responses (i.e., failed attention check; $n = 1$) were excluded in analyses. The sample ($n = 275$) was an average of 23.46 ($SD = 4.82$) years of age and comprised of mostly women (56.7%). Ethnicity was primarily White (83.6%) with Hispanic (9.5%), Black (1.8%), Asian (1.1%), and Native Hawaiian represented. More than 80% were Seniors (43.6%) or Juniors (37.5%) with many being single (42.9%) or married (36.0%). Overall, student participants were enrolled in an average of 12.57 ($SD = 2.83$) credits and 63.6% were employed, most of those (83.9%) part-time. Participants came from families of relatively high socioeconomic status where average education was 3.48 (SD=1.31; 3 = Mother/Father received bachelor's degree, 4=Mother/Father received master's degree) and average income was 4.15 (SD=1.52; 4=$75,000-$100,000, 5=$100,000-$150,000). Our intervention group ($n = 190$) was similar to our control group ($n = 85$) at the pre assessment on all study demographics. A total of 42 completed the first questionnaire and did not complete the second (15.3% attrition) for a final sample of 233.

3.1.2. Procedure

Following ethics approval from the IRB at Brigham Young University – Idaho (#W24-23, on 3 April 2024), participants were solicited from on-campus upper-division psychology courses through email invitation. Students were required to participate for course credit but were allowed to complete an alternative assignment. Prospective participants followed an online link to complete a questionnaire pertaining to their course experience at the beginning of the semester for the pre-course survey (Week 1). Once the course was completed, students followed a similar procedure to complete the post-questionnaire (Week 14). Both questionnaires were identical and took a median of 33.42 minutes to complete. Data were collected across multiple semesters (multiple, separate groups of student participants) spanning the years 2024 to 2025.

We followed a pre/post-controlled research design where we collected data simultaneously from our treatment and control groups at the beginning and at the end of semester, which was 12 weeks apart. Two specific upper-division psychology courses were used for the treatment (Health Psychology) and control (Industrial/Organizational Psychology) groups. Following the Theory of Planned Behavior [17], our intervention group received a classroom experience that involved positive attitude formation, subjective norm establishment, and increased perceived behavioral control relative to vaccination uptake. Student participants attended class three times a week (classes were 60 minutes long) and received material from the same instructor during the 14-week semester course.

Mirroring previous literature [37], positive attitudes were encouraged as student participants were exposed to information that highlighted the benefits of vaccination uptake and dispelled common myths and misconceptions. Student participants met in small groups of 3-5 members throughout the semester to participate in semi-structured meetings that focused on health behavior change goals, mutual encouragement and accountability, problem-solving, and fostered a sense of health behavior social norms. These weekly meetings were held during the first 15 minutes of class, once a week, and students were required to attend at least four of the five meetings (80%). Fostering further perceived behavioral control, treatment group participants were also provided with information regarding vaccination availability on campus. We followed standard control group procedure where no treatment material was shared with the control group to prevent contamination [39]. Both treatment and control groups were assessed by completing the same questionnaire, following the same timeline.

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3.1.3. Measures

The questionnaire included measures of demographics (e.g., age, gender, relationship status), subjective physical health, vaccination attitudes (influenza, COVID-19), and vaccine uptake behavior (influenza, COVID-19). All these measures were identical with Study 1 measures at both data collection points.

3.1.4. Data Analysis

First, to investigate change in attitude toward the influenza and COVID-19 vaccines (RQ5), we used paired samples *t* tests for statistical significance ($p < .05$) and reported Cohen's *d* main effects for both the treatment and control groups. Second, using similar statistical approaches, we compared vaccine uptake behavior for both the influenza and COVID-19 to investigate potential increases (RQ6). To better compare the two groups, we also computed a modified Cohen's *d* effect size where the difference in the time points for the treatment group was subtracted from the difference in the control group and divided by the pre pooled standard deviation. Then, we computed an independent samples t test on the change scores between the treatment and control groups for both RQ5 and RQ6.

3.2. Results

Among the entire sample at pre assessment, subjective health was 72.69 ($SD = 16.22$), which is out of a scale to 100, suggesting the sample was generally healthy. In further support of this, subjective health estimates were similar at post assessment ($M = 75.45$, $SD = 15.64$), which was also not significantly different ($t[159] = 1.17$, $p = .243$, $d = .09$). Similar to Study 1, we observed a difference in attitude strength between the influenza and COVID-19 vaccinations. Specifically, the attitude for the influenza vaccination at pre ($M = 3.63$, $SD = .79$) was significantly higher than the attitude for the COVID-19 vaccination at pre ($M = 3.36$, $SD = 3.36$; $t[312]=2.76$, $p = .006$, $d = .31$). This was also observed at the post assessment, as attitudes for influenza vaccination ($M = 3.94$, SD .78) was significantly higher than COVID-19 vaccination ($M = 3.74$, $SD = .88$; $t[316] = 2.14$, $p = .033$, $d = .24$).

3.2.1. Intervention Effects on Attitudes and Behavior (RQ5-RQ6)

We addressed RQ5 regarding attitude change for both the influenza and COVID-19 vaccinations (see [50]). Attitudes for the influenza vaccination increased significantly ($p < .001$) from pre to post assessment. Next, we examined COVID-19 vaccination attitudes and discovered a significant increase in these attitudes as well ($p < .001$). Conversely, among the control group, attitudes for both the influenza and COVID-19 vaccines did not change during the study period ($p = .665$, and .577, respectively). When compared together, changes among the intervention group were significantly ($p = .002$ and $p < .001$, respectively) greater than those among the control group for attitudes for both the influenza ($d = .47$) and COVID-19 ($d = .71$) vaccines. Collectively, these results suggest that the classroom experience enhanced positive attitudes toward both vaccines.

Table 6. Study 2 Vaccination Attitude Differences.

Variable	Pre *M*(*SD*)	Post *M*(*SD*)	Diff	*t*(*df*), *p*	*d*
Intervention Group					
Influenza Attitude	3.63(.79)	3.94(.78)	+.31	5.95(157), <.001***	.39
COVID Attitude	3.36(.94)	3.74(.88)	+.38	8.28(159), <.001***	.42
Control Group					
Influenza Attitude	3.40(.88)	3.42(.88)	+.02	0.44(72), .665	.05
COVID Attitude	3.17(.90)	3.13(.96)	-.04	0.56(72), .577	.07
Comparing Intervention and Control Groups					
Variable	**Treatment *M*(*SD*)**	**Control *M*(*SD*)**	**Diff**	***t*(*df*), *p***	***d***
Influenza Attitude	+0.31 (.64)	+0.02 (.54)	+.29	3.20(229), .002**	.47
COVID Attitude	+0.38 (.58)	-0.04 (.63)	+.42	5.00(231), <.001***	.71

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Note: ** $p < .01$, *** $p < .001$; Diff category refers to the difference between Pre and Post or the Treatment and Control groups. Values presented for the Treatment and Control categories are difference scores from Pre to Post.

Second, we examined RQ6 for change in vaccination uptake behavior (see [51]). At pre, a total of 54 student participants indicated they had received their annual influenza vaccine (33.3%) and at post, an additional six reported vaccine uptake for a nearly four percent increase (37.0%). This increase, however, was not statistically significant (p = .253). Regarding COVID-19 vaccine uptake behavior, we observed a total of 89 student participants with the vaccine at pre (54.9%) and an increase of 3 to 92 at post (56.8%), which was also not statistically significant (p = .579). Among the control group, 18 indicated they had received the influenza vaccine at the pre-assessment and no participants indicated they had received the influenza vaccine during the study period. COVID-19 vaccination, however, did increase by two, from 61 to 63. However, when compared, the change scores between the intervention and control groups for both the influenza and COVID-19 vaccine uptake behavior were approaching but not statistically significant (p = .090 and p = .102, respectively). Collectively, these results suggest the classroom experience was not sufficient to change vaccine uptake behavior for influenza or COVID-19.

Table 7. Study 2 Vaccination Behavior Differences.

Variable	Pre *M*(*SD*)	Post *M*(*SD*)	Diff	*t*(*df*), *p*	*d*
Intervention Group					
Influenza Vaccine	1.66(.48)	1.69(.47)	.03	1.15(171), .253	.06
COVID Vaccine	1.50(.50)	1.52(.50)	.02	0.56(183), .579	.04
Control Group					
Influenza Vaccine	1.80 (.41)	1.80(.41)	.00	0.00 (80), .999	.00
COVID Vaccine	1.28(.45)	1.26(.50)	.02	1.00 (80), .320	.11
Comparing Intervention and Control Groups					
Variable	**Treatment *M*(*SD*)**	**Control *M*(*SD*)**	**Diff**	***t*(*df*), *p***	***d***
Influenza Vaccine	+0.04 (.31)	0.00 (.00)	+.04	1.70(173), .090	.15
COVID Vaccine	+0.01 (.18)	+0.02 (.16)	-.01	0.60(261), .102	.08

Note: ** $p < .01$, *** $p < .001$; Diff category refers to the difference between Pre and Post or the Treatment and Control groups. Values presented for the Treatment and Control categories are difference scores from Pre to Post.

4. General Discussion

The current investigation included two studies examining influenza and COVID-19 vaccine attitudes and behavior among college students. In Study 1, we compared attitudes and uptake behavior for each vaccine, discovering a stronger favorable attitude for the influenza vaccine, yet less uptake behavior compared to COVID-19. We also examined the relationship of attitudes and behavior with other concomitant health behaviors, uncovering a unique pattern of results. Both attitudes were strongly associated with each other, but those who received the influenza vaccine indicated both improvements and digressions in health behavior while COVID-19 vaccine receivers did not. This suggests a poignant difference in associated health profiles between those who receive the influenza and COVID-19 vaccines that could have implications for future efforts for vaccination promotion. Finally, Study 2 demonstrated that a classroom vaccination promotion experience can improve vaccination attitudes, though vaccine uptake behavior was less amenable to change.

Based on our results in Study 1, college student vaccination attitudes seem to be more positive for influenza than for COVID-19. This is contrary to other findings [25] and may be reflective of shifting attitudes based on when these data were collected. Indeed, the current study's data were collected among students at a later point from the onset of the pandemic restrictions (March 2020), which may have influenced a shift in these attitudes. It is possible that high exposure to social media

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and the increased use of other technologies following the onset of the pandemic [15,16] may have produced less favorable attitudes for COVID-19, as these sources likely contain conflicting and mistaken information regarding this new vaccine. Kuter and colleagues [26], however, reported positive student attitudes for COVID-19 vaccination even three years into the pandemic, suggesting this possible dampening effect of social media may not be strong. It is important to note that this study did not directly compare vaccination attitude strength between COVID-19 and influenza. Thus, the interpretation of shifting attitudes over time is still likely, such that influenza attitudes have likely shifted little and COVID-19 attitudes have declined over time among college students.

Moreover, the behavioral inconsistency coinciding with these attitudes may elicit cognitive dissonance for college students. Indeed, despite attitudes being higher for influenza, vaccination rates were much lower, and the lower COVID-19 attitudes were similarly mismatched with much higher rates of vaccination uptake. As an aversive mental state, the cognitive dissonance that may develop under these circumstances could explain difficulties in vaccination uptake across the nation as well as the persistent and strong negative reactions to vaccinations despite valid scientific findings supporting the efficacy of vaccination [24,52]. Relatedly, Study 1 results suggest that college students are more likely to get the influenza vaccination if they have also received the COVID-19 vaccine. This is consistent with other studies that have noted that adults were more likely to receive the influenza vaccine if COVID-19 vaccine uptake had already occurred [27,28]. As such, it may be inferred that the vaccination mandate for COVID-19 at the onset of the pandemic likely influenced college students to receive the influenza vaccination. Although there has been some resistance to mandated vaccinations, this is consistent with other findings that suggest required vaccinations may have positive influences on attitudes and uptake for other vaccinations as well [53].

Concomitant health behaviors were also related to vaccine status, though deferentially by vaccine type. For instance, influenza vaccination was related to both dietary and physical activity behaviors whereas those with COVID-19 vaccination indicated fewer physical health complaints. Moreover, family socioeconomic status (SES) was positively associated with COVID-19 vaccination status but not influenza and daily screen time was related to influenza vaccination but not COVID-19. The observations of both the presence and lack of protective health behaviors occurring for those with influenza vaccination provide support for the transfer and redundancy effects. Whereas some may engage in other health behavior alongside vaccination uptake due to their similar goals of health protection (transfer effect), others may consider vaccination not essential, since the health behavior already provides some protection (redundancy effect, [54]). However, COVID-19 vaccinations did not demonstrate support for either of these effects, only offering some modest support that COVID-19 vaccination is associated with less physical ailments. However, it may not be that straightforward.

Ecological Systems Theory offers additional insight [55,56]. For instance, COVID-19 is relatively new and politically charged, exerting a strong macro influence that subsumes smaller, micro influences [55]. Thus, with strong influences of vaccination mandates and family SES, smaller influences such as personality may dissipate in strength. Indeed, personality characteristics that may be otherwise related to vaccine uptake behavior and other health behaviors may seem to not have any influence on associations between COVID-19 vaccination status and other health behavior. In the case of influenza vaccination, however, there is no such strong macro influence, allowing the micro influences of personality (e.g., conscientiousness) to have effect. This would explain the contradictory findings of how health behaviors and daily screen time were related to influenza, as those who are more conscientious are likely vaccinated and more aware of their health behaviors and time spent on devices. So, they may not necessarily be healthier, but more cognizant of their behavior due to higher self-awareness. However, more conscientious individuals may choose to be vaccinated for COVID-19, monitor healthy behaviors and time spent on devices, but the strong macro forces of mandates and family may obfuscate this relationship.

Consistent with other classroom-based health promotion studies [10,36,40], our results from Study 2 suggest that vaccination promotion efforts can be effectively delivered to students in the classroom setting. Positive attitude formation, particularly for the influenza and COVID-19 vaccines,

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are particularly important for university students in uptake behavior [9,11,12,14,21]. These findings suggest that educational formats can help dispel common misconceptions and misunderstandings regarding these vaccinations, foster more positive impressions, and begin to address vaccine hesitancy, which is a major threat to public health [3]. This could be formatted for a wide array of settings such as university health-oriented classes (e.g., public health, premed prerequisites, anatomy and physiology) and first-year required courses (e.g., college success, physical education), as well as workshops or trainings provided through student health or wellness programs.

Finally, our results demonstrated little support for vaccination behavior change following participating in the vaccination promotion classroom experience. This observation is consistent with the Theory of Planned Behavior [17] and literature suggesting that actual change in vaccination uptake behavior is more difficult than attitude improvement alone [52,57]. Our results further suggest that influenza vaccine uptake behavior may be more amenable to change using the classroom vaccination promotion experience compared to COVID-19 vaccination. It is possible that students have more trust in the influenza vaccine due to the longer duration of availability than the COVID-19 vaccine [11,12]. It is also possible, merging results from Study 1, that efforts made over technology to dispel concerns regarding influenza vaccination are more effective for influenza, as students who received the influenza vaccine reported spending more daily time on screens. However, even more likely, it seems simple attitude improvement alone, as elicited by the classroom vaccination promotion experience, is not enough to significantly increase vaccine uptake behavior for either vaccination among college students. As such, college students would likely need additional input including social norm adjustments [8,13,14] and removal of additional barriers (e.g., needle/blood aversion, expense, inconvenience) to promote control.

5. Potential Limitations and Future Research

Despite the strengths of this investigation, certain potential limitations are present. First, our data were cross-sectional, rendering any causal inferences difficult, if not impossible. We are unable to affirm that any changes were clearly due to our classroom vaccination promotion experience. However, the use of two study designs in the present investigation does ameliorate this concern. Second, all data collected were retrospective self-report and unable to be triangulated with other data (e.g., third party reports, objective records). Third, other research design characteristics may have introduced methodological limitations. For instance, despite our efforts to use well-validated measures, we did not use all the same measures in both studies and did not measure all Theory of Planned Behavior constructs. Furthermore, we did not include any measures of personality (e.g., Big Five), which would have allowed for refinement of study findings. Finally, our college student sample and cohort characteristics may limit generalizability, as our students came from a private university and reported being predominantly White with a family background of relatively high socioeconomic status.

Future research can build on the results of this investigation. Vaccination attitude differences between influenza and COVID-19 should be further explored in both college student and other populations. Moreover, ways in which both vaccinations can be promoted concurrently should be investigated, including other health behavior cues. This would allow identification of ways to maximize efforts to promote vaccination and perhaps dispel misconceptions and misunderstandings. Other studies should consider building vaccination promotion efforts, especially in the classroom, that can further explicate effective methods for changing vaccination uptake behavior. Future examinations should consider additional vaccines (e.g., HPV) and more objective measures (e.g., doctor records, vaccination uptake behavior) to verify self-reports.

In conclusion, this investigation employed two studies to examine attitudes and uptake behavior for influenza and COVID-19 vaccination. In Study 1, college students reported a stronger positive attitude for influenza than COVID-19 vaccination and those who had the COVID-19 vaccination were more likely to report having the influenza vaccination as well. Moreover, those who received the influenza vaccine indicated associations with health behaviors and higher daily screen time where

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those who received the COVID-19 vaccine indicated associations with fewer physical health complaints and higher family socioeconomic status. In Study 2, our classroom vaccination promotion experience was associated with improved attitudes for both vaccines, but the small improvements in vaccine uptake behavior for both vaccines was modest and not statistically significant. As such, it seems vaccination attitudes and uptake behavior are related to important health behavior and, while attitudes were more amenable to change, classroom-based health promotion efforts offer promise in addressing vaccine hesitancy among college students.

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47. Table 3: Study 1 Influenza Vaccination Comparisons
48. Table 4: Study 1 COVID-19 Vaccination Comparisons
49. Table 5: Study 1 Vaccine Demographic Variable Comparisons
50. Table 6: Study 2 Vaccination Attitude Differences
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