Alignment of the Health Belief Model to Examine the Seasonal Influenza Vaccination Rate Among Undergraduate College Students

Matthew S. Caputo
Reap College of Professional Studies, Marywood University
https://orcid.org/0009-0002-4586-6599

Deborah A. Hokien
College of Liberal Arts and Sciences, Kutztown University
https://orcid.org/0000-0001-5452-692X

Correspondence concerning this article should be addressed to Matthew S. Caputo, 825 Lakeview Drive, Mountain Top, PA 18707. Email: caputo3292@gmail.com

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Abstract

Background: College students who do not get vaccinated annually for influenza or other respiratory illnesses can spread disease to others. Objective: This quantitative cross-sectional study, using the Health Belief Model (HBM) as a framework, aimed to determine if college students between the ages of 18–23 and their knowledge of influenza, perceived risk of the disease, and perceived benefit from receipt of the vaccine, influenced their rate of influenza vaccination uptake. Methods: Students from two different private universities in Scranton, Pennsylvania were asked to participate in an online survey developed by the researchers. Results: A total of 647 undergraduate students participated in this study with a self-report influenza vaccine uptake rate of 36.0%. Logistic regression found perceived benefit to be a significant predictor ($p < .001$) of vaccination. Conclusion: Results of this study suggest a need for campus-wide pro-immunization campaigns to highlight benefits and reduce barriers to promote seasonal influenza vaccination for students.

Keywords: influenza vaccine uptake rate, predictors of behavior, health belief model, campus immunization policy, influenza vaccine compliance.

INTRODUCTION

Benefits of vaccination and finding ways to increase immunization rates have been thrust into the spotlight in the wake of the coronavirus (COVID-19) pandemic. Despite the COVID-19 pandemic uprooting life, educational systems, and the economy worldwide, vaccination mandates on college campuses are inconsistent and not a focal point when compared to the K-12 educational system (Haeder, 2020). Yasmin et al. (2021) reported that the lowest COVID-19 vaccine acceptance rates were among pregnant women, tobacco/marijuana users, and college students. The impact of influenza outbreaks and other respiratory illnesses on college campuses can be severe, leading to a disruption in the academic performance of students and resulting in increased truancy in curricular and co-curricular activities (Gandhi & Bozer, 2020).

It has been opined that "The two most important contributions to public health in the past 100 years have been sanitation and vaccination, which together have dramatically reduced deaths from infectious disease" (Murphy et al., p. 687, 2008). According to the U.S. 2020-21 influenza season report published by the Center for Disease Control [CDC], the influenza vaccine acceptance rate among adults 18 years of age and older was nearly half the population (49.4%), however these numbers are trending downward, and recent research shows that the vaccine acceptance rate among undergraduate students is well below this level with self-reported uptake rates between 28% and 43% (Bednarczyk et al., 2015; Gandhi & Bozer, 2020; Kreiger et al., 2021; Ratnapradipa et al., 2017; Rogers et al. 2018). The data fall short of the 70% compliance goal for Healthy People 2030 set by the United States Department of Health and Human Services [USDHHS]. Increasing the uptake rate of seasonal influenza vaccination among college students can contribute to the 70%

compliance goal of the USDHHS and protect this target population from a preventable illness. Vaccinations have substantially reduced human disease, permanent injuries, and deaths worldwide. Vaccines do not only protect those who get them, but also their community through herd immunity. In addition to its various health benefits, vaccination also has many societal benefits, such as: healthcare savings, increased life expectancy, enhanced ability for society members to travel with protection from vaccine preventable diseases, and continued stimulus to the economy (Andre et al., 2008).

The incidence of influenza and Influenza-like illnesses in US college campuses ranges from 9 – 48% among students (Guh et al., 2011; Iuliano et al., 2009; Nichol et al., 2005; Poehling et al., 2012; Zivich et al., 2020). Kreiger et al. (2021) notes that even healthy college students can be susceptible to severe complications associated with seasonal influenza and cause disruptions to their day-to-day activities. Although hospitalization of adults with influenza is low among healthy individuals ages 5 to 49 years, the disease is still a great burden for outpatient care, and it requires campus stakeholders to promote student immunization with the seasonal influenza vaccine (Poehling et al., 2012).

The Health Belief Model (HBM) was chosen as the theoretical framework for this study as it is designed to determine the likelihood of a student's action to prevent, screen for, or to control illness using the concepts of susceptibility, seriousness, benefits and barriers to one's behavior, cues to action, and self-efficacy (Champion & Skinner, 2008). Using the HBM, if a student regards themselves as: (1) susceptible to contracting influenza, (2) contracting influenza would have potentially serious health consequences, (3) receiving the vaccine would reduce their susceptibility to or severity of influenza, and (4) receiving the vaccine would outweigh the barriers to (or cost of) missing classroom time, then a student is more likely to get vaccinated to reduce their health risks. Coupling severity with perceived susceptibility is a strength of the HBM, however, the relationship between risk and severity in forming a threat is not always clear. A heightened state of severity (hospitalization) is required before perceived susceptibility becomes a powerful predictor. Perceived benefits and barriers are stronger predictors of behavior change when perceived threat is high. Cues to action or their relative impact as a construct of the HBM have not been clearly identified in the literature. Additionally, the HBM does not consider the emotional component of behavior as a predictor.

Ratnapradipa et al. (2017) used the HBM to link research and theoretical understanding of influenza immunization practices among college freshmen during a non-pandemic influenza season. In this study, college freshmen were the target population because they would most likely be making a vaccine decision without direct familial influence, and they were most likely living in dormitory-style housing among a new peer group resulting in an increased risk of influenza transmission. Survey results showed that many participants had already received the influenza vaccine and reported that they were more likely to continue receiving an annual influenza vaccine based on their previous behavior. The data also showed that family influence had the largest co-founding effect. Past vaccination history, race, and peer intention were also found to be significant cofounders of the HBM constructs in this research study. The perceived benefits of receiving the vaccine outweighed the perceived susceptibility or severity of contracting the disease. The greatest barriers to vaccination reported by the students were potential vaccine side effects, pain, becoming sicker with the vaccine, and finding the time to get the vaccine.

In a study by Ryan et al. (2019), undergraduates and graduates in health-related disciplines had a higher influenza vaccine uptake rate compared to students enrolled in non-healthcare programs. All participants in this study reported that they preferred to receive influenza vaccine information from their own healthcare provider instead of other sources, such as social media or campus clinic events. The results of this study concluded that a "one size fits all" campaign approach to increasing influenza vaccine uptake on a college campus is unlikely, and that a hybrid messaging approach targeting college students would be most effective (Ryan et al., 2019).

Research related to the seasonal influenza vaccination uptake rate, and the HBM predictors of influenza immunization among college students aged 18 to 23 years is limited. In previously published studies on vaccine compliance among college-age students the overarching characteristics of participants were female, enrolled in a healthcare discipline, practiced previous vaccine compliance (influenza or other, such as the human papillomavirus), sought physician input, had experience with contracting influenza, had confidence in the vaccine, and were non-smokers (Kreiger et al. 2021, Ratnapradipa et al., 2017, Schmid et al., 2017).

In this paper, we aimed to investigate the HBM factors that influence the uptake rate of the seasonal influenza vaccine among college-aged students of all undergraduate majors at two different universities located in Scranton, Pennsylvania. Using the HBM as a framework, this research determined the predictors of the seasonal influenza vaccination uptake rate among students related to their: knowledge about the influenza vaccine and disease, perceived risks of contracting influenza disease, and perceived benefits of the influenza vaccine. The results of this study aligned with previously reported common perceived vaccine barriers of college-aged students. The overall goals of this study were to provide new research information that may lead to new or updated university and college campus vaccine policies, and to suggest ideas for supporting on-campus pro-immunization programs and effective messaging platforms to increase the seasonal influenza vaccine uptake rate among undergraduate students.

METHODS

A 26-question internet-based survey was developed and administered via a university-wide student email distribution list at the beginning of the fall semester after the study proposal was reviewed and approved independently by each university's Institutional Review Board (IRB). Ethical approval for this study was obtained by the Marywood University Exempt Review Committee (MU ERC# 2014-E077), and the Director of Research and Sponsored Programs at the University of Scranton (IRB Protocol #4-15A). A standardized statement of informed consent from Marywood University was used. Participants were asked to read the consent form and ask the researcher questions about the study before agreeing to complete the survey. Background information on the study, procedures, risks and benefits of the study, confidentiality, and a statement of voluntary participation were provided to students prior to starting the survey. A student agreed to the consent form if they clicked on the hyperlink to begin the survey. Students could withdraw from the survey at any time. However, because the survey was anonymous, the survey could not be withdrawn once it was submitted.

Prior to the study, a focus group was conducted using undergraduate students enrolled at Marywood University to assess the readability and comprehension of the survey instrument. The

focus group did reveal a few items regarding the wording of certain survey questions, which were modified based on student feedback. No substantial changes were made to add or remove survey questions, however, and the overall survey design was not impacted. In addition to the focus group, the survey was independently reviewed and certified by an expert in vaccine immunology with expertise in influenza to further contribute to instrument reliability.

The instrument captured student demographic information regarding age, gender, the university they attended, how many credits they were enrolled in, their area of program study, their class rank, their living situation, the education level of their parent(s), and their ethnicity. Additionally, participants were asked if they had received prior information about the influenza vaccine or if they had been encouraged to receive the influenza vaccine in the past year from one of several sources: medical professional, parents, student health center, social media, advertisements, or peers. Participants were also asked if there was any medical reason, such as an allergy to the vaccine, that would prohibit their compliance.

In addition to collecting participant demographic information, the survey was designed to assess the central concepts of the HBM by assessing participants' perceived risk, perceived benefit, and knowledge of seasonal influenza and the vaccine. Respondents were asked to evaluate a series of statements regarding their perceived risk of contracting influenza disease using a four-point Likert scale response from strongly disagree (1) to strongly agree (4). To assess perceived benefit, questions were asked to assess students' compliance to the annual immunization, perception of vaccine usefulness, and perception of vaccine effectiveness in preventing illness. Evaluation of participants' general knowledge regarding the influenza disease and vaccine, included whether they believed that "influenza was a respiratory virus" as well as their understanding of whether a list of symptoms was considered common for influenza. For participants that did receive the vaccine, information was gathered regarding the type of vaccine administered (injection or nasal spray), the site location where the vaccine was administered (pharmacy, physician's office, etc.), and if the participants specifically went to the administration site for the vaccine or requested it while there. For participants who were not immunized, a series of statements regarding perceived barriers, e.g., vaccine cost being too high, time constraints, and / or risk to self if vaccine was administered, were assessed using the same Likert scale.

All responses were examined for inclusion unless a respondent exited the survey early, in which case, the incomplete survey was withdrawn from the study and was not included in the data analyses. Descriptive statistics were used for reporting the student demographics. T-test analysis was used for comparison of individual scores, and the logistic regression analysis was used for the prediction of group membership (vaccinated vs. unvaccinated). Survey questions related to the students' knowledge, risk, and benefit of influenza vaccination were combined to produce scores for each of these independent variables and standardized for data analysis. Correct responses for each knowledge question (yes/no and T/F statements) were scored a point for a score range of zero to 20 for each participant. Risk of disease was scored by summing the responses to the three Likert statements with a response of strongly agree being scored as four points, agree as three points, disagree as two points, and strongly disagree as one point. The higher the total points (12 points at the most) the higher perception of risk. Benefit of vaccination was scored by evaluating the responses to several questions regarding a student's annual compliance, whether they perceived it as useful, and their belief in the effectiveness of the vaccine providing a range of zero to five with

zero representing the highest perceived benefit of influenza vaccination. Scores were standardized for comparison in statistical analysis due to the varying scales observed.

Descriptive statistics were used for reporting the demographics of participants, a t-test was used for score comparison of individual scores, and logistic regression analysis was used for prediction of group membership (vaccinated vs unvaccinated). Knowledge, risk, and benefit questions were combined to produce scores for each attribute and standardized for comparison during analysis. Differences in reported knowledge questions were examined using Chi-Square. All analyses were done using IBM SPSS v 29.0 at a predetermined a priori of 0.05.

RESULTS

At the time of the study, the undergraduate population of full-time students was 1,896 (30.3% male and 69.7% female) at Marywood University and 3,693 (45.1% male and 54.9% female) at the University of Scranton, providing a combined potential participant pool of 5,589 (40.0% male and 60.0% female). Our final sample of 647 participants was equally distributed from these two universities ($\chi^2 = 0.237$, $p = 0.626$) and represented an overall response rate of 11.6%. Our sample included individuals 19.23 ± 0.04? years of age who were overwhelmingly Caucasian (85.9%) and female (77.3%), so results may not be generalizable to a more ethnically diverse and/or predominantly male undergraduate student body.

Table 1

Sample Demographics and Influenza Vaccination Rates (N = 647)

		Distributions			Vaccine Uptake Rate
		Overall	Un-vaccinated	Vaccinated	
Total Sample Size		647[†]	414 (64.0)	233 (36.0)	233 (36.0)
Age (Years ± S.E.)		19.23 ± 0.04	19.26 ± 0.06	19.18 ± 0.07	
Gender					
	Female	500 (77.3)	312 (75.4)	188 (80.7)	188 (37.6)
	Male	147 (22.7)	102 (24.6)	45 (19.3)	45 (30.6)
College					
	Marywood University	225 (34.8)	157 (37.9)	68 (29.2)	68 (30.2)
	University of Scranton	422 (65.2)	257 (62.1)	165 (70.8)	165 (39.1)
Major					
	Business	117 (18.1)	86 (20.8)	31 (13.3)	31 (26.5)
	Education	37 (5.7)	25 (6)	12 (5.2)	12 (32.4)
	Health Care	214 (33.1)	118 (28.5)	96 (41.2)	96 (44.9)
	Humanities	80 (12.4)	56 (13.5)	24 (10.3)	24 (30)
	Psychology	59 (9.1)	41 (9.9)	18 (7.7)	18 (30.5)
	Science	140 (21.6)	88 (21.3)	52 (22.3)	52 (37.1)
Ethnicity					
	African American	5 (0.8)	5 (1.2)	0 (0)	0 (0)
	Asian	27 (4.2)	19 (4.6)	8 (3.4)	8 (29.6)

	Caucasian	556 (85.9)	353 (85.3)	203 (87.1)	203 (36.5)
	Hispanic	24 (3.7)	16 (3.9)	8 (3.4)	8 (33.3)
	Mixed Ethnicity	18 (2.8)	9 (2.2)	9 (3.9)	9 (50)
	Prefer not to answer	17 (2.6)	12 (2.9)	5 (2.1)	5 (29.4)
Enrollment Status					
	Full-time	643 (99.4)	410 (99)	233 (100)	233 (36.2)
	Part-time	4 (0.6)	4 (1)	0 (0)	0 (0)
Parental Education					
	Never graduated high school	2 (0.3)	2 (0.5)	0 (0)	0 (0)
	High School	97 (15)	70 (16.9)	27 (11.6)	27 (27.8)
	Attended college	62 (9.6)	40 (9.7)	22 (9.4)	22 (35.5)
	Associate's / Technical degree	72 (11.1)	53 (12.8)	19 (8.2)	19 (26.4)
	Bachelor's degree	217 (33.5)	134 (32.4)	83 (35.6)	83 (38.2)
	Graduate degree	158 (24.4)	90 (21.7)	68 (29.2)	68 (43)
	Professional / terminal degree	39 (6)	25 (6)	14 (6)	14 (35.9)
Class Year					
	Freshman	55 (8.5)	38 (9.2)	17 (7.3)	17 (30.9)
	Sophomore	150 (23.2)	101 (24.4)	49 (21)	49 (32.7)
	Junior	217 (33.5)	138 (33.3)	79 (33.9)	79 (36.4)
	Senior	225 (34.8)	137 (33.1)	88 (37.8)	88 (39.1)
Reported Living Status					
	On Campus	381 (58.9)	229 (55.3)	152 (65.2)	152 (39.9)
	Off Campus	157 (24.3)	105 (25.4)	52 (22.3)	52 (33.1)
	With Parents	109 (16.8)	80 (19.3)	29 (12.4)	29 (26.6)
Information Source (% based on Total, Vac, and Unvac N)					
	Medical Professional	390 (60.3)	202 (48.8)	188 (80.7)	188 (48.2)
	Parents	346 (53.5)	155 (37.4)	191 (82)	191 (55.2)
	College Health Center	300 (46.4)	178 (43)	122 (52.4)	122 (40.7)
	Media	436 (67.4)	290 (70)	146 (62.7)	146 (33.5)
	Peers	192 (29.7)	118 (28.5)	74 (31.8)	74 (38.5)

[†]12 Reported Exemption to Vaccine

Vaccination Uptake

The self-reported overall vaccination uptake rate in our study was 36.0% and aligns with previous research (Bednarczyk et al., 2015; Gandhi & Bozer, 2020; Kreiger et al., 2021; Ratnapradipa et al., 2017; Rogers et al., 2018). Students who reported having received advice from their parents had the highest rate of vaccination (55.2%) followed by those who received advice from medical professionals/healthcare providers (48.2%). The lowest rate of vaccination (33.5%) was among those students who reported receiving advice from the media, which included television, billboards, and online social media platforms. This result indicates that social media plays less of a role when compared to parental influence on vaccine acceptance rate among this group of participants and aligns with the other studies (Kreiger et al. 2021, Ratnapradipa et al., 2017, Rogers et al., 2018).

Table 2

Study Findings Comparison Matrix

	This Study	Bednarczyk et al[6]	Gandhi & Bozer[3]	Kreiger et al[7]	Ratnapradipa et al[8]	Ryan et al[18]	Rogers et al[9]
Population							
Vaccine Uptake Rate (%)	36.0	28.0	31.0	38.0	31.5	62.8	43.0
Sample Size (*N*)	647	600	365	1,021	184	1,122	158
University Setting (State in USA)	Private (PA)	Public (NY)	Public (TX)	Public (CT)	Private (MO)	Public (FL)	Public (CA)
Predictors of Vaccination							
Convenience (4)		✓	✓		✓		✓
Perceived Benefit (2)	✓				✓		
Knowledge of Risks (2)		✓				✓	
Age or Gender (2)			✓	✓			
Mandated for Major of Study (2)				✓		✓	
Previous Vaccine Compliance (2)				✓	✓		
Influence (Family or Friends) (2)					✓		✓
Healthy Lifestyle (1)				✓			
Barriers to Vaccination							
Lack of Knowledge (7)	✓	✓	✓	✓	✓	✓	✓
Inconvenience (7)	✓	✓	✓	✓	✓	✓	✓
Concern for Self / Vaccine Safety (7)	✓			✓			✓
Recommendation(s)							
General Education Campaigns (7)	✓	✓	✓	✓	✓	✓	
Targeted Education Campaigns (2)			✓				✓
Increasing Convenience (2)	✓	✓					

Among those vaccinated in our sample, 89.7% reported they received the intramuscular immunization and 72.5% of these vaccinations were received at either a physician's office or pharmacy. The majority of those immunized reported having sought out the vaccination specifically (78.1%), while less than one sixth of immunizations were performed on-site by the university's health clinic.

Table 3

Vaccinated Sample Follow-up Data Obtained (N = 233)

		N Study Respondents (%)
Type		
	Injectable	209 (89.7)
	Spray, Drop, or Mist in the Nose	21 (9.0)
	I Don't Know	3 (1.3)
Location		
	Doctor's Office	109 (46.8)
	Pharmacy	60 (25.8)
	University Health Clinic	38 (16.3)
	City Clinic or Health Center (Not Affiliated with University)	9 (3.9)
	Hospital	8 (3.4)
	Work	7 (3.0)
	Unknown / Not reported	2 (0.9)
Reason for medical visit		
	Get influenza vaccine	182 (78.1)
	Offered while there for another reason	34 (14.6)
	Asked for the vaccine while there for another reason	10 (4.3)
	Not reported	7 (3.0)

Ryan et al. (2019) points out that lack of knowledge around formulations of vaccines for students with an aversion to needles can be a barrier to immunization. In our sample, the overwhelming majority received the intramuscular form with less than 10% receiving the nasal spray, a non-injectable version, suggesting many might not be aware of options beyond the injectable type. Like our study, most research finds that convenience, or lack of thereof, is a barrier to vaccination (Bednarczyk et al, 2015; Gandhi & Bozer, 2020; Kreiger et al., 2021; Ratnapradipa et al., 2017; Rogers et al., 2018). Providing students with easy access to receive the vaccine on campus may reduce barriers to vaccination and should be part of a campus action plan.

Knowledge, Perceived Risk, and Perceived Benefit for Vaccinated and Unvaccinated Respondents

Forward logistic regression was conducted to determine whether perceived risk, perceived benefit, and knowledge of the influenza vaccine are successful predictors of immunization. Data screening led to the elimination of six outliers (< 1%) and multicollinearity was not an issue as all tolerance variables exceed 0.10. Regression results indicated that the overall model fit of only one predictor (perceived benefit) was questionable (-2 Log likelihood = 521.787) but was statistically reliable in distinguishing between the vaccinated and unvaccinated groups ($\chi 2$ (0) = 304.554, $p < .001$). The

model correctly classified 79.1% of cases and indicated that a student is more likely to be immunized when there is a perceived benefit to doing so (OR = 2.97, 95% CI [2.51 – 3.51], p < 0.001). Independent samples t-tests were used to compare the standard scores of knowledge, risk, and benefit between the vaccinated and unvaccinated respondents as reported in Table 4.

Table 4

Independent Samples t-test Comparing Standardized Scores of the Unvaccinated vs Vaccinated Respondents (N = 647)

		n	*Mean*	SD	*t*	*df*	*sig.*
Risk Score							
	Vaccinated	233	.320	.968	**-6.350**‡	645	<0.001
	Unvaccinated	414	-.180	.957			
Benefit Score†							
	Vaccinated	233	.826	.579	**-22.710**‡	624.8	<0.001
	Unvaccinated	414	-.465	.861			
Knowledge Score							
	Vaccinated	233	.131	.964	**-2.521**‡	645	<0.05
	Unvaccinated	414	-.074	.999			

†Levene's test for equality of variance failed ($p < 0.001$)
‡Significance found at *a priori* of 0.05

In all cases, the unvaccinated population had lower perceived risk, lower perceived benefit, and lower perceived knowledge scores compared to the vaccinated group. Assessment of the knowledge scoring questions revealed that both groups answered most of the questions with a similar amount of accuracy based on Chi-square analysis as shown in Table 5.

Table 5

Knowledge Assessment – Correct Responses (Overall, Unvaccinated, and Vaccinated)

	Correct Answer	**Overall**	**Unvaccinated**	**Vaccinated**	**% Diff**	**CHISQ p-value**
		647†	414	233		
Is Influenza virus a respiratory virus?	Yes	302 (46.7)	181 (43.7)	121 (51.9)	**8.2**‡	0.044
The flu may cause fever	T	624 (96.4)	393 (94.9)	231 (99.1)	4.2	0.199
The flu may cause dry skin	F	494 (76.4)	317 (76.6)	177 (76)	0.6	0.398
The flu may cause nausea	T	512 (79.1)	329 (79.5)	183 (78.5)	1.0	0.311
The flu may cause nasal congestion	T	599 (92.6)	376 (90.8)	223 (95.7)	4.9	0.253
The flu may cause swollen hands and feet	F	442 (68.3)	282 (68.1)	160 (68.7)	0.6	0.696

The flu may cause headache	T	593 (91.7)	375 (90.6)	218 (93.6)	3.0	0.892
The flu may cause diarrhea	T	352 (54.4)	228 (55.1)	124 (53.2)	1.9	0.393
The flu may cause sore throat	T	568 (87.8)	353 (85.3)	215 (92.3)	7.0	0.078
The flu may cause excessive tiredness	T	608 (94)	384 (92.8)	224 (96.1)	3.3	0.711
The flu may cause muscle aches	T	599 (92.6)	374 (90.3)	225 (96.6)	6.3	0.064
The flu vaccine may cause disease	F	529 (81.8)	332 (80.2)	197 (84.5)	4.3	0.523
The flu vaccine protects against all known flu strains	F	490 (75.7)	303 (73.2)	187 (80.3)	7.1	0.158
The flu vaccine can cause an allergic reaction	F	599 (92.6)	380 (91.8)	219 (94)	2.2	0.778
It is better to get the flu than the flu vaccine	F	582 (90)	360 (87)	222 (95.3)	**8.3**‡	0.012
It is better to get the flu vaccine late in the season to protect longer	F	578 (89.3)	368 (88.9)	210 (90.1)	1.2	0.548
There is no point in getting the flu vaccine after Thanksgiving	F	599 (92.6)	374 (90.3)	225 (96.6)	6.3	0.064
You do not need to get the flu vaccine annually	F	528 (81.6)	316 (76.3)	212 (91)	**14.7****	<0.001
You need special permission to get the flu vaccine if pregnant	F	110 (17)	64 (15.5)	46 (19.7)	4.2	0.22
The flu vaccine protects against stomach flu	F	539 (83.3)	339 (81.9)	200 (85.8)	3.9	0.609

†12 Reported Exemption to Vaccine
‡Significance found at *a priori* of 0.05
**Significance found at <0.001

However, three question responses stood out as statistically significant. Students who were not vaccinated were more likely to report unawareness that influenza virus is a respiratory virus, belief that the vaccine was a greater health risk than the disease, and unawareness that the vaccine was needed annually, even though the overall knowledge score was not found to be a predictor in the regression model.

Reported Barriers to Vaccination by the Unvaccinated Group

The unvaccinated group was asked to answer additional survey questions regarding their decision to not be immunized, which have been summarized in Table 6.

Table 6

Frequency of Barriers Reported for Not Getting the Influenza Vaccine (N = 377 of 414)

Barrier statement	*N* Reporting Agree / Strongly Agree (%)
I believe that vaccines may have dangerous side effects	154 (40.8)
I do not have time to get a flu vaccination	133 (35.3)
I believe that as a result of the flu shot I may actually get the flu	132 (35.0)
I do not believe I am in danger of contracting the flu	127 (33.7)
I do not believe the flu vaccine works to prevent the flu	83 (22.0)
Vaccines are too expensive for me right now	70 (18.6)
I do not know where to receive a flu vaccination	54 (14.3)
I was not informed that flu vaccines might be important	50 (13.3)
I believe that vaccines may have dangerous side effects	154 (40.8)

While more than half of all those who responded did not report feeling any of the included statements were barriers for them, the barriers reported most often as either "Agree" or "Strongly Agree" included the worry regarding the vaccine causing dangerous side effects (40.8%), time constraint (35.3%), concern that vaccine may cause illness (35.0%), and the lack of concern for self that the flu would be an issue (33.7%). The barriers to seasonal influenza vaccination amongst undergraduate college students found in this study validates what has been found in other studies. A common theme among the research community is that college students who report not receiving the vaccine often cite inconvenience or lack of time, concern that the vaccine will cause them to become sick or have other harmful side-effects, and belief that the flu is not a serious health concern (Bednarczyk et al, 2015; Gandhi & Bozer, 2020; Kreiger et al., 2021; Ratnapradipa et al., 2017; Rogers et al., 2018; Ryan et al., 2019).

DISCUSSION

This cross-sectional quantitative study based on the HBM hypothesized that a college student will seek out health care action (immunization) if the perceived benefit (staying healthy) is greater than the perceived risk (getting the flu/missing time in class or co-curricular activities). Results of this study suggest that only perceived benefit of the vaccine (staying healthy) was statistically reliable ($p < .001$) in distinguishing between vaccinated and unvaccinated participants, while misconceptions regarding safety of the vaccine or need for annual protection was associated with noncompliance. Our results align with others (Ratnapradipa et al., 2017) in finding that the only significant construct with the HBM for those vaccinated and those who intended to be vaccinated was the health benefit one gets from receiving the vaccine.

Although the findings of this study did not support our hypothesis that students' overall knowledge about influenza disease and vaccination predicted vaccination status, the answers to the knowledge survey questions did show that students had several misconceptions about the influenza virus and the spread of the disease. Our results showed that students were not aware that the influenza virus was a respiratory virus. They also believed that getting the vaccine was a greater health risk than getting the disease itself, and they did not realize the vaccine was needed annually. Supplemental analysis showed that these misconceptions were statistically significant predictors of vaccination

($p < .05$, .05, and .001). Individuals with these misconceptions were less likely to get immunized, even though the overall knowledge score was not a predictor. Additional research on specific misconceptions related to vaccination uptake rate would be a valuable addition to the overall research body on factors of immunization compliance.

Unvaccinated students of this study population did not cite a financial limitation to getting vaccinated, but rather a lack of time. This observation was similar to the findings of the 2010 study by Merill and colleagues, who found respondents to have an agreement level of neutral (2.99) when asked if the vaccine was too expensive. These researchers concluded that eliminating the cost of the influenza vaccine would not substantially increase immunization rates and that the participants in their study were motivated to become immunized based on perceived severity of disease, and communication of disease severity was the key to increasing vaccination rates among college students (Merill et al., 2010).

Eighty-two percent of students from our study sought out the vaccine and/or requested it while at their doctor's office or pharmacy. Only 18% of participants received the vaccine from their university clinic. Universities should find ways to make the vaccine more convenient to students on campus such as: targeted informational sessions, educating students about the benefits of receiving the influenza vaccine, setting up vaccination clinics that are visible on campus, and offering student incentives for vaccination. Some students reported an aversion to receiving an injection and are not often made aware that a nasal spray option is available to them. Offering an alternative vaccine delivery method could further increase the uptake of the influenza vaccine on college campuses to enhance herd immunity. Younger generations, like those in college, are used to the convenience provided by modern technology, and healthcare should be no different. A recent New York Times article noted that for the first time in United States history, an at-home nasal spray influenza vaccine will be made available to the population. Although this will still require a prescription, this is an important step to increasing accessibility, ease of vaccine administration, and overcoming barriers for students.21 In general, implementing these changes on college campuses will positively contribute toward meeting the USDHHS Healthy People 2030 national goal of 70% vaccine compliance, reduce classroom truancy, and minimize spreading of the disease on college campuses.

Our study echoes the findings of other researchers and supports the position that there is a need for focused pro-immunization campaigns on college campuses, combined with a reduction of specific barriers to help increase the uptake rates among students (Bednarczyk et al., 2015; Gandhi & Bozer, 2020; Kreiger et al., 2021; Ratnapradipa et al., 2017; Ryan et al., 2019; and Rogers et al., 2018). Our results suggest that disseminating information on the benefits of vaccination to students while also providing collocated immunization clinics can give students a convenient pathway toward immunization on campus. This is particularly true with influenza vaccination as college students are less likely to see this vaccination as important compared to others, like the COVID-19 vaccine (Graupensperger et al., 2021). Overall, students need to understand that the annual immunization is beneficial and useful to them particularly on a college campus where transmission can be high due to small indoor classes spaces, frequent community gatherings, and crowded dormitory settings (Zivich et al., 2020). Interestingly, only one study examined recommends reducing barriers to convenience despite all studies finding students citing lack of time or convenience to getting the vaccine as a barrier (Bednarczyk et al., 2015).

Limitations of Study

This study sample consisted of undergraduate students, the majority of whom were Caucasian (85.9%) and female (77.3%), which may not be generalizable to a more ethnically diverse population so a repeat of this study at a more diverse institution would be warranted. Self-reported data was another potential limitation. In this type of data collection, the researchers were unable to independently verify the participants' responses. The study results were analyzed under the assumption that all respondents answered independently, honestly, and accurately. Although the survey instrument was not pilot tested prior to data collection, a focus group for comprehension of the survey questions was completed in conjunction with an independent outside review and certification of the survey by a vaccine expert working in the field. A pilot study would have further supported the reliability and validity of the instrument used for this study. Finally, this study was cross-sectional in design, so a longitudinal format or qualitative follow-up to examine why students are hesitant to become vaccinated could add to the extant literature.

CONCLUSION

Previous studies have shown that traditional college aged students are unlikely to determine their risk level for contracting influenza and typically do not seek immunization on their own (Ramsey & Marczinski, 2011). As reported by Shropshire and team, college campus mass media campaigns were shown to increase student participation by up to 30%, which may be another way to promote immunization and increase the uptake rate among undergraduates (Shropshire et al., 2013). However, in our study, we did not find that social media or public advertisements increased vaccination uptake.

Overall, students need to understand that the annual immunization is beneficial and useful to them particularly on a college campus. Advertising against certain misconceptions, such as the perception that the vaccine has common and severe side effects or that young adults are not susceptible to the flu, may help reduce barriers reported by the unvaccinated students.

Providing students with information about the seasonal influenza vaccine risk implications should alleviate the misconception about the vaccination's side effects. A pro-immunization on-campus campaign should emphasize that even healthy young college students are susceptible to the flu and they should take action to be immunized each year. Also, the misconception that the seasonal influenza vaccine can inadvertently cause a person to get the flu should be addressed and corrected. Finally, college campuses should organize annual flu clinics to provide students ample opportunities to get vaccinated while on campus and provide additional formats of the vaccine, such as the nasal spray.

It is the responsibility of the university or college to ensure the safety and well-being of all campus stakeholders. More effective higher education policies and using varying means of messaging to promote seasonal influenza vaccination among college-aged students are needed on campuses. College administrators would benefit from the development and implementation of annual pro-immunization campaigns geared toward undergraduate students coupled with conveniently located campus immunization clinics to bolster the immunization uptake rate, help protect them from contracting the flu, decrease classroom and co-curricular tardiness, and further prevent the spread

of the virus among the community. Finding innovative ways to educate students about the benefits of getting the vaccine at a universal setting for students, such as a freshman seminar or senior capstone class, could provide a uniform opportunity to reduce barriers for all students. It would be beneficial for school stakeholders to use their platform to specifically dispel influenza vaccine misinformation, convey the message that influenza vaccine is needed annually, and communicate that the flu can be dangerous to one's health, and being unvaccinated would put students and others at risk of a serious illness.

About the Authors

Matthew S. Caputo, Reap College of Professional Studies, Marywood University

Dr. Matthew Caputo is an Associate Director within the Clinical Medical and Regulatory Affairs department at Novo Nordisk, Inc. working as the Digital Enablement Partner for the Strategic Operations group. Prior to this, he led the PMO for a North American professional services group within a top global life science software company, Dassault Systèmes, implementing regulated computerized systems used within all areas of a pharmaceutical organization from early development through manufacturing for many of the top S&P 500 pharmaceutical companies.

With over 20 years of experience in the biopharmaceutical industry, Dr. Caputo began his career working to develop, qualify, and validate protein binding immunoassays used for clinical serology testing of vaccine candidates at Sanofi Pasteur. Dr. Caputo is also a part-time lecturer within the Reap College of Professional Studies teaching two levels of advance statistics at Marywood University in Scranton, PA.

Dr. Caputo has progressed in his career to become a trusted expert with the pharmaceutical industry where he leverages his expertise to help optimize processes and realize value through digital transformation efficiencies. Matthew holds a Ph.D. in Human Development with a specialization in Health Promotion and a Master of Science in Biotechnology from Marywood University in Scranton, PA. He received his Bachelor of Science in Biology from the University of Scranton in Scranton, PA. Outside of his professional career, Matthew enjoys traveling with his wife to their home away from home, Lake Keuka, NY, as well as spending free time in nature as an avid outdoorsman hunting, hiking, and camping.

Deborah A. Hokien, College of Liberal Arts and Sciences, Kutztown University

Dr. Deborah Hokien is the Associate Dean of the College of Liberal Arts & Sciences at Kutztown University in Kutztown, PA. With nearly 30 years of experience in higher education, Deborah has been instrumental in the development of innovative academic programs, writing grant proposals, research collaboration, establishing assessment best practices, and fostering student excellence. She holds a Ph.D. in Analytical Chemistry with a specialization in polymer surface chemistry/materials science from Lehigh University in Bethlehem, PA. Dr. Hokien has received numerous awards for her contributions to the field including patents, publications, and conference presentations. Outside of work, Deborah enjoys reading, hiking, golf, and traveling abroad.

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