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College students' influenza vaccine hesitation: a reasoned action investigation with quantitative and qualitative data

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Abstract This two-wave longitudinal study (performed pre-COVID), using both quantitative and qualitative data, investigated college students' influenza vaccine hesitancy and confidence using the theory of planned behavior (TPB). At Time 1, college students ($n = 277$) completed TPB measures and reported past influenza vaccine behavior. At Time 2 (30 days later), participants indicated whether they received the influenza vaccine since Time 1. At Time 2, participants who indicated that they had not received the influenza vaccine since Time 1 also described their most important reasons for not doing so. The TPB model fit the quantitative data well; direct paths from attitude and norms to intention, and from intention to future behavior, were strong and significant. The TPB model explained 71% of the variance in intention and 28% of the variance in future behavior. Neither perceived behavioral control nor past behavior improved the model's ability to predict intentions or future behavior. From the qualitative data, participants' reasons for not getting vaccinated focused on perceived behavioral control (e.g., time cost) and attitudes (e.g., unimportance and low susceptibility). Theoretical implications for message development are discussed.

Keywords College students · Flu shot · Influenza vaccine · Theory of planned behavior · Vaccine hesitancy

Introduction

Vaccine hesitancy, or "the reluctance to receive recommended vaccination because of concerns and doubts about vaccines" (Dubé et al., 2021, p. 176), has existed since vaccines were first developed and represents an important public health issue (World Health Organization [WHO], 2014). Moreover, specific concerns vary across vaccines, locations, populations, and times (Dubé et al., 2021). Although COVID-19 is the most recent and pressing source of vaccine hesitancy there are other examples, such as human papillomavirus; measles, mumps, and rubella; and our specific focus, influenza vaccinations (i.e., the flu shot) among U.S. college students (National Foundation for Infectious Diseases [NFID], 2016, 2017).

Motivating college students to get the influenza vaccine is challenging (Cornally et al., 2013; NFID, 2017). Although healthy college-age students typically perceive themselves as being at low risk (Czyz et al., 2019), influenza (or simply, the flu) is serious and highly contagious. The influenza virus spreads quickly in the close quarters common on college campuses. Flu symptoms can last up to eight days, cause students to miss class and/or work, and may lead to serious health complications (Nichol et al., 2010). Flu vaccination rates among college students are typically low and, therefore, the NFID called for "research to better understand and quantify…student motivators and influencers" (2017, p. 5). Answering this call, our primary goal is to investigate university students' flu vaccination hesitancy using quantitative and qualitative data. Specifically, we use the theory of planned behavior (i.e., TPB) as a lens as it focuses on both individual and social determinants (Ajzen, 1985, 1991; Fishbein & Ajzen, 2010).

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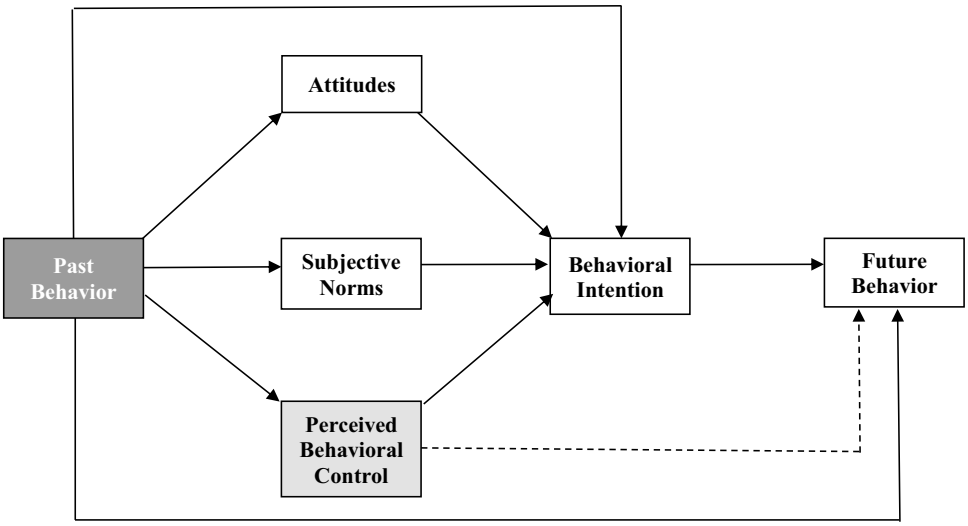

Fig. 1 Path Model representation of the theory of reasoned action and the theory of planned behavior variables on flu shot intention and behavior. *Note* Unshaded boxes represent TRA variables (Ajzen, 1991; Ajzen & Fishbein, 1980). The lightly-shaded box, perceived behavioral control, was added in the TPB. Past behavior (the dark gray box) was suggested by Albarracin et al. (2001). For simplicity's sake, paths among attitude, subjective norms, and perceived behavioral control are omitted from this diagram (Ajzen & Fishbein, 2005; Fishbein & Ajzen, 2010)

Influenza and the influenza vaccine

The flu is a serious, contagious, illness caused by the influenza virus (Centers for Disease Control and Prevention [CDC], 2019). The CDC estimated that between October 1, 2018 and March 9, 2019, nearly 30 million people in the U.S. became ill due to, and up to 35,500 people died from, the flu. Despite the flu vaccine's efficacy, college-aged students typically do not comply with health recommendations (NFID, 2017).

The flu is an important case from which to study vaccine hesitancy using the reasoned action approach (i.e., RAA). First, although college students underestimate the threat of the flu (Czyz et al., 2019; NFID, 2016), they are likely in close proximity with hundreds, if not thousands, of people daily in shared housing, classrooms, and face-to-face social interactions (e.g., study groups to sporting events). Second, seemingly healthy people can infect others one day before, and up to 5 to 7 days after, demonstrating flu symptoms (CDC, 2019). Third, the flu virus mutates constantly, necessitating annual vaccinations. Fourth, young-adult college students may be unfamiliar with independently making health decisions and, as a consequence, may not have taken control of health decisions (James et al., 2020). Finally, college students may perceive a lack of resources (e.g., time, money, and health insurance) to get the flu vaccine (NFID, 2016; Schmid et al., 2017).

Reasoned action approach

Considerable research focused on vaccinations in general (e.g., Brewer et al., 2017; Xiao & Wong, 2020) and flu vaccination in particular (e.g., Schmid et al., 2017). Although research utilized a variety of theories (Brewer et al., 2017), one popular framework is the RAA, which focuses on behavior, performed in a particular place and time, based on the information a person has at the time (Ajzen & Fishbein, 1980, 2005; Fishbein & Ajzen, 2010). The RAA encompasses both the theory of reasoned action and the TPB. Our investigation focuses on the latter, however, to fully understand it, a discussion of the former is necessary.

Theory of reasoned action

In its day, the theory of reasoned action (TRA: Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) was groundbreaking because it claimed that the sole determinant of *behavior* (i.e., actions in a particular situation) was not attitude, but *behavioral intention* (i.e., a person's readiness to perform a behavior in the future). Considerable research across behavioral domains and audiences indicated that intentions are a strong, though imperfect, predictor of behavior (Fishbein & Ajzen, 2010). Behavioral intention, in turn, is determined by a person's *attitude toward the behavior* (i.e., favorable or unfavorable behavioral evaluations) and *subjective* (or *injunctive*) *norms* (i.e., how important others *as a whole* evaluate behavioral performance; Fishbein & Ajzen, 1975; see the unshaded boxes in Fig. 1).

In the TRA, both attitude and subjective norms have two predictors. Attitude is determined by *behavioral beliefs* (i.e., perceived consequences of behavior performance) and *outcome evaluation* (i.e., the positive or negative evaluation of each consequence). Subjective norms are based on *normative beliefs* (i.e., perceptions of what important individuals or groups expects him or her to do) and *motivation to comply* with each important individual or group. Therefore, beliefs—right or wrong—impact attitudes and norms (and ultimately intention and behavior) that are ripe targets for health communication interventions.

Table 1 Meta-analytic results on the influence of TPB variables on intentions and behavior

Effect	Genera meta-analyses	Vaccination meta-analysis
Attitude → intention	.41–.57	.64
Subjective norms → intention	.28–.40	.61
Perceived behavioral control → intention	.41–.54	.42
Perceived behavioral control → behavior	.24–.37	–
Intention → behavior	.41–.54	–
Variance explained in intention	33%–44%	51.9%
Variance explained in behavior	9%–27%	–

Notes Meta-analytic range = the range of average weighted correlations from past TRA/TPB meta-analyses (i.e., Albarracin et al., 2001; Armitage & Conner, 2001; Downs & Hausenblas, 2005; McEachan, et al., 2011; Rich et al., 2015). Vaccination meta-analysis: average weighted correlation coefficients from the Xiao and Wong (2020) meta-analysis of TRA/TPB studies specifically on vaccinations

Theory of planned behavior

The TPB (Ajzen, 1985, 1991) extended TRA by adding a third predictor of intentions, i.e., *perceived behavioral control* (i.e., the extent to which a person believes that he or she is capable of, or has control over, behavioral performance; Fishbein & Ajzen, 2010; the lightly-shaded box in Fig. 1). Perceived behavioral control is "virtually identical" to self-efficacy (Fishbein & Ajzen, 2010, p. 161). In the present context, high perceived behavioral control likely represents vaccine confidence. Perceived behavioral control is a proxy for, and is easier to measure than, actual control and is influenced by two factors: *control beliefs*, (i.e., factors thought to influence behavioral performance or control) and the *power of each control belief* (i.e., how strongly each control belief might facilitate or impede behavioral performance or control). In sum, the TPB adds perceived behavioral control as a predictor of both behavior and intentions and adds two determinants for perceived control.

Meta-analytic results and past behavior

Several meta-analyses assessed TRA/TPB variables' ability to predict an array of health-related behaviors and intentions among a plethora of audiences (e.g., Albarracin et al., 2001; Armitage & Conner, 2001; Downs & Hausenblas, 2005; McEachan, et al., 2011; Rich et al., 2015). Moreover, Xiao and Wong (2020) meta-analyzed TRA/TPB studies that focused on vaccination intentions. Together, results from these six TRA/TPB meta-analyses (five general and one on vaccinations) provide three important insights that can help frame our results.

First, the six meta-analyses provide effect size benchmarks that provide useful comparisons for our data. Table 1 presents the range of effect size (i.e., mean weighted correlations) for all TPB relationships for the five general TRA/TPB meta-analyses and, separately, from Xiao and Wong's (2020) vaccination meta-analysis. For the five general TRA/TPB meta-analyses, ranges for all effects fell into Cohen's (1988) medium-to-large range. In the Xiao and Wong (2020) vaccination meta-analysis, mean weighted correlations between both attitudes and subjective norms and intentions were larger than those reported in the general TRA/TPB meta-analyses. The mean weighted correlation between perceived behavioral control and intentions in the vaccination meta-analysis, however, was at the lower end of the range in the general TRA/TPB meta-analyses.

Second, meta-analyses provide benchmarks for variance explained in intentions and future behaviors (see Table 1). Specifically, in the Xiao and Wong (2020) vaccination meta-analysis, TPB predictors (attitude, subjective norms, and perceived behavioral control) explained more variation (52%) in intention than did the five general TRA/TPB meta-analyses (33–44%). With the addition of intentions, the general TRA/TPB meta-analyses were able to explain between 9 and 27% of variation in future behavior. The Xiao and Wong (2020) vaccination meta-analysis could not consider behavior because so few studies measured future behavior.

Third, McEachan et al. (2011) note that *past* behavior (the dark gray box in Fig. 1) may inform attitude, subjective norms, perceived behavioral control, intentions, and *future* behavior (see also Albarracin et al., 2001). The weighted-mean correlations between past behavior and attitudes ($\bar{r}$ = 0.32), subjective norms ($\bar{r}$ = 0.22), perceived behavioral control ($\bar{r}$ = 0.33), intention ($\bar{r}$ = 0.47), and future behavior ($\bar{r}$ = 0.50) were, for the most part, in the moderate-to-strong range (Cohen, 1988). McEachan et al. added past behavior as an exogenous variable in a TPB model (see Fig. 1). Including past behavior in the meta-analytic TPB model increased the proportion of variance explained in both intentions (5%) and future behavior (11%), but attenuated relationships between all predictors and both intention and future behavior.

Reasons for non-vaccination

According to WHO (2014), vaccine hesitancy stems from a complex interplay of factors that influence the decision to accept none, a few, or all vaccines. The RAA asserts that the most important factor in (in)action is an individual's beliefs about the behavior in question (i.e., getting the flu vaccine) as they compose attitudes toward the behavior, subjective norms, and perceived behavioral control. These beliefs are often identified as barriers to flu vaccination (Schmid et al., 2017). This investigation's second goal, then, is to understand college students' beliefs related to vaccine hesitancy by investigating their reasons for not getting the flu vaccine.

The 3C's model (confidence, complacency, and convenience; WHO, 2014) represents a simple typology for describing people's reasons for not getting vaccinated. Confidence focuses on trust (or lack of the same) in the vaccine, the health-care system, and policy makers. Complacency focuses on risks associated with the disease in question and the necessity of vaccination. Finally, convenience centers upon accessibility, affordability, and understandability of vaccination services. Schmid et al. (2017) report that each of these broad categories are identified as barriers to vaccination uptake among at-risk groups. Considering reasons for not being vaccinated from the TPB perspective and the 3C's model should generate a clearer understanding of college students' thinking that can help focus persuasive messaging.

Research questions and hypotheses

The primary goal of this longitudinal study is to investigate vaccination hesitancy by assessing TPB variables' ability to predict and explain college students' flu vaccine intentions and future behavior. A second goal is to assess college students' most important reasons for *not* getting the flu vaccine. Thus, we advance the following hypothesis and research questions:

H_1: TPB variables (unshaded or lightly-shaded boxes in Fig. 1) will predict college students' flu vaccine intentions and future behavior.

RQ_1: Does past behavior increase the predictive power of TPB variables on college students' flu vaccine intentions and future behavior?

RQ_2: What are college students' reasons for *not* getting the flu vaccine?

Method

Participants

Time 1

Undergraduate students ($n = 565$), enrolled in three lower-division classes at a large southwestern US university,[1] volunteered to participate for a small amount of course credit during late September 2018 (i.e., pre-COVID-19). Participants ($n = 83$) who had already received the flu vaccine were directed to an unrelated study. Thus, 482 participants completed the Time 1 survey (52.0% male, 47.6% female, and 0.4% other/non-binary; mean age = 19.04, $SD = 1.59$). Participants were 69% white, 13.5% Asian, 5.5% African American, 1.0% native Hawaiian or other Pacific Islander, 0.8% American Indian, and 9.9% other. Additionally, 20.7% identified as Hispanic or Latino/a.

Time 2

Thirty days later[2] (i.e., early November, 2018), the 482 students in the same three classes were invited to complete the Time 2 survey for additional course credit. Over half of eligible participants ($n = 277$; 57.5%) participated at Time 2.

Non-response analysis of continuous measures revealed no significant differences: attitude ($t = -0.21$, $df = 481$, $p > 0.05$), subjective norms ($t = -0.55$, $df = 481$, $p > 0.05$), perceived behavioral control ($t = 0.37$, $df = 481$, $p > 0.05$), intention ($t = 0.70$, $df = 481$, $p > 0.05$), or age ($t = -0.30$, $df = 481$, $p > 0.05$). Similarly, chi-square tests revealed no differences for categorical variables: gender ($\chi^2 = 3.49$, $df = 2$, $p > 0.05$), race ($\chi^2 = 8.05$, $df = 6$, $p > 0.05$), or ethnicity ($\chi^2 = 0.01$, $df = 1$, $p > 0.05$). Participants who completed both Time 1 and Time 2 surveys were slightly less likely to have ever received a flu shot than those who completed only the Time 1 survey ($\chi^2 = 3.92$, $df = 1$, $p = 0.048$).

[1] Vaccinations were available from all of the university's Student Health Services locations (and multiple vaccination events around campus) during the flu season (including the data-collection period). Student Health Services repeatedly communicated flu vaccination availability, using multiple media, during that time.

[2] A 30-day data-collection period was chosen for several reasons. First, multiple meta-analyses report significantly larger intention-behavior associations when studies utilize time frames of four weeks or less (Downs & Hausenblas, 2005; McEachan et al., 2011; Topa & Moriano, 2010). Second, the period provided participants a chance to decide whether (or not) to get a flu shot at the beginning of the flu season (as recommended by Student Health Services). Third, it allowed us to complete the study in time to return extra credit information to instructors before the end of the semester.

Table 2 Reliability, descriptive statistics, and zero-order correlations for model variables

	α	*M*	*SD*	1	2	3	4	5
1. Past behavior (1 item)	NA	0.77	.42	–				
2. Attitude (5 items)	.95	3.60	1.08	.50*	–			
3. Subjective norms (4 items)	.86	2.92	1.00	.44*	.63*	–		
4. Perceived behavioral control (5 items)	.75	4.22	.69	.20*	.41*	.31*	–	
5. Intention (4 items)	.97	2.74	1.33	.39*	.74*	.70*	.36*	–
6. Future Behavior (1 item)	NA	0.19	.39	.18*	.32*	.24*	.17*	.35*

Notes Past behavior, attitude, subjective norms, perceived behavioral control, and intention were measured at Time 1; future behavior at Time 2. All variables, except past and future behavior (coded as 0 = No, 1 = Yes), were measured with five-point scales. Sample sizes for correlations containing past behavior are $n = 246$; correlations between all other variables are $n = 277$

*$p < .001$

Instrumentation

Time 1 survey

All TPB measures were adapted from Ajzen and Fishbein (1980) and Fishbein and Ajzen (2010). *Attitude* was assessed using five, five-point, semantic differential items (e.g., "To me, getting the flu shot is: harmful-beneficial"). All other continuous variables were measured with Likert-type scales (i.e., 1 = "strongly disagree" to 5 = "strongly agree"): *subjective norms* (four items; e.g., "My close friends think that I should get the flu shot"); *perceived behavioral control* (five items; e.g., "Getting the flu shot is completely up to me"), and *intention* (four items; e.g., "I intend to get the flu shot in the next 30 days"). *Past behavior* was assessed with one item (i.e., "Have you ever received a flu shot?") with response options of "yes," no," and "I do not remember." Finally, both Time 1 and Time 2 surveys included demographic items and two linking items (day of the month of their birth and the last two digits of their phone number) that facilitated pairing participants' Time 1 and Time 2 responses.

Time 2 Survey

The Time 2 survey was administered 30 days after the Time 1 survey. *Future behavior* (i.e., using Time 1 as a reference) was measured using a single item: "Have you received a flu shot in the past 30 days (i.e., since completing Part 1 of this study)?" Response options were yes and no. Participants who answered no also provided responses to an open-ended item that read, in part: "In the space below, please indicate the most important reasons why you did not get a flu shot in this time frame." The Time 2 survey also included demographic and linking items. Table 2 contains descriptive statistics, reliabilities, and correlations among all RAA variables.

Procedures

These data were part of a larger investigation of college students' flu vaccination behavior (Roberto et al., 2019). Procedures were approved by the relevant institutional review board. Participants completed two surveys: The Time 1 survey included theoretical variables and the Time 2 (30 days later) survey included flu vaccination behavior since Time 1. Participants who had not received a flu vaccine at Time 2 also described their reasons for not having done so.

Data analytic plan

Hypothesis 1 (i.e., testing the TPB causal model; see Fig. 1) was tested with the path analyses option in *Mplus* 8.3, a structural equation modeling package (Muthén & Muthén, 2019). First, analyses tested the extent to which the model (without past behavior) fit the data. Second, path analysis tested the extent to which past behavior improved model fit. Participants ($n = 31$) who responded "don't remember" to the Time 1 past behavior item were removed from TPB model tests of past behavior. Using a mean- and variance-adjusted weighted least squares estimator (WLSMV, the default option in *Mplus* for a dichotomous dependent variable; Kline, 2016; Muthén & Muthén, 2017), chi-square, comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) assessed model fit. A nonsignificant chi-square test, both RMSEA and SRMR ≤ 0.08, and CFI > 0.95 suggest strong fit (Hu & Bentler, 1999; Kline, 2016). R^2 assessed the models' predictive power for intentions and future behavior.

To answer Research Question 2, one author generated TPB-based categories after reviewing participants' reasons for not receiving a flu shot during the previous 30 days. To pilot-test initial codes, two authors independently analyzed 10% of the 213 qualitative responses, compared coding decisions, and resolved discrepancies through discussion to

Table 3 Correlations and path coefficients with and without past behavior included in the model

Effect	Correlation	Standardized path coefficients	
		Without past behavior	With past behavior
Attitude → intention	.74	.60*	.53*
Subjective norms → intention	.70	.31*	.37*
Perceived behavioral control → intention	.36	.02	.05
Perceived behavioral control→ future behavior	.17	.12	.09
Intention → future behavior	.35	.47*	.46*
Past behavior → attitude			.50*
Past behavior → subjective norms			.44*
Past behavior → perc. beh. control			.20*
Past behavior → intention			− .04
Past behavior → future behavior			.11
R^2 for intention		.71	.68
R^2 for future behavior		.28	.31

*$p < .001$

consensus. The same two authors then refined the codebook by modifying existing, and adding new, categories. Both authors independently analyzed all remaining responses and discussed discrepancies to consensus. This iterative process generated 15 categories based on TPB and past behavior (see Table 4). When participants provided multiple reasons, all responses were placed into the categories.

Results

On average, participants reported mildly positive attitudes toward the flu vaccine, neutral subjective norms, positive perceived behavioral control, and neutral behavioral intentions (see Table 2). Moreover, 19% of the Time 2 sample indicated that they received a flu vaccination during the previous 30 days. Consistent with the TPB, attitudes, subjective norms, and perceived behavioral control were positively and significantly related to behavioral intentions. Both behavioral intentions and perceived behavioral control were significantly and positively correlated with future behavior.

Testing the TPB model

Hypothesis 1 predicted that TPB variables (measured at Time 1) will predict college students' flu vaccine behavior (i.e., future behavior, measured at Time 2). Fit between the model and the data was strong, χ^2 (2) = 6.09, $p = 0.048$, RMSEA = 0.09, CFI = 0.98, SRMR = 0.03; for regression coefficients, see Table 3. Attitude and subjective norms significantly predicted behavioral intention which, in turn, strongly predicted future behavior. Perceived behavioral control did not significantly predict either behavioral intention or future behavior. Predictors accounted for considerably more variance in intentions ($R^2 = 0.71$) than behavior ($R^2 = 0.28$). Overall, H1 was supported.

Past behavior and the TPB

Research Question 1, whether adding past behavior to the TPB model would increase predictive power, was investigated with a second path analysis. Paths between past behavior and all TPB variables were added (see Fig. 1) and results are presented in Table 3. Fit between the model and the data was also strong, χ^2 (2) = 5.94, $p = 0.051$, RMSEA = 0.09, CFI = 0.99, SRMR = 0.02. Past behavior significantly predicted attitudes toward the behavior, subjective norms, and perceived behavioral control, but neither intention nor future behavior. Again, predictors accounted for more variance in intentions ($R^2 = 0.68\%$) than future behavior ($R^2 = 0.31\%$). In short, past behavior did not improve the predictive power of the TPB model.

College students' reasons for not receiving the influenza vaccine

Research Question 2 focused on participants' reasons for not getting a flu shot and how those reasons related to TPB constructs. Participants ($n = 224$) provided 323 reason(s) for not getting a flu vaccine ($M = 1.44$ reasons per participant). All provided reasons were placed into one of 15 main categories (see Table 4; excluding *other* and *no response* categories). Over half of all responses fell into nine categories that were relevant to TPB's attitudes toward the behavior. Four categories fell within perceived behavioral control (approximately one-third of all responses), while a single category (3% of all

Table 4 Reasons participants did not get a flu shot

Reason	Definition	Example	Frequency (%)
Attitude-based reasons			
Unimportance	The flu shot wasn't of value, necessary, or beneficial to participants	I don't believe I need it	45 (13.9)
Low susceptibility	Participants believe they are healthy, or they won't get sick/get the flu without a flu shot	I have not had the flu in years and am pretty healthy	34 (10.5)
Lack of priority	Participants mentioned that they prioritized other commitments, or considered getting a flu shot but forgot	It's the last thing to do on my list	25 (7.7)
Side effects	Individual side effects stop participants from getting a flu shot or they believe the flu shot will make them sick	It hurts my arm for a few days	23 (7.1)
Low salience	Participants do not think about getting the flu shot or were not motivated to get the flu shot	The thought was not on my mind	20 (6.2)
Ineffectiveness	Participants do not believe or are hesitant that a flu shot is effective at protecting them from the flu	The flu shot doesn't stop me from getting the flu	11 (3.4)
Fear of needles	Participants have a fear of needles or shots	Truthfully, I just have an irrational fear of needles. I get scared just thinking about needles	8 (2.5)
Alternative recommendations	Participants think they can avoid the flu through other strategies (e.g., washing hands)	I do not believe in getting shots for sicknesses that can be avoided simply by washing your hands	6 (1.9)
Global vaccine concerns	Participants are against vaccines in general, or have never had any vaccinations	I am against all vaccinations in general, I think they are just putting in a bunch of harmful chemicals into your body and injecting the sickness	3 (0.9)
Subjective norms-based reasons			
Family influence	Parents or family members influenced participants' decision not to get a flu shot	My parents don't believe in flu shots	11 (3.4)
Perceived behavioral control-based reasons			
Time cost	Participants "did not have time" or it would be inconvenient/take too much time to get a flu shot	I didn't have time to go out and get it	69 (21.4)
Monetary cost	Participants did not have money for a flu shot or did not want to pay for a flu shot	I've been super broke over the past month. I can't afford the $40 it normally takes at the moment	10 (3.1)
Lack of knowledge	Participants did not have enough knowledge about the flu shot	I'm not sure if my insurance will cover it	9 (2.8)
Contraindications	Participants believe that an allergy prevents them from getting a flu shot	I am allergic to eggs, which makes it not possible for me to get the flu shot as I would have a severe allergic reaction	2 (0.6)
Past behavior	Previous experiences or past behaviors are used as justification as to why participants have not gotten the flu shot this year	I never have and never really got the flu, so why should I?	20 (6.2)

responses) fell within subjective norms. Finally, past behavior was used as a rationale for not getting a flu vaccine by 6% of participants.

Five categories encompassed over 60% of responses. The most common reason was *time cost* (not having the time to get a flu vaccine; 21.4%). Second, *unimportance* indicated that participants did not consider the flu vaccine as urgent, important, or necessary (13.9%). Third, in *low susceptibility* responses, participants described themselves as healthy and having a strong immune system (10.5%). Fourth,

participants expressed concerns about the flu vaccine's *side effects* (7.1%). Finally, participants referred to their *past behavior* (e.g., never or rarely having received a flu vaccine) as a reason for not having received a vaccination within the past 30 days.

Discussion

Vaccine hesitancy represents an important public health issue that varies across vaccines and populations (WHO, 2014). Consequently, considerable research, from a number of theoretical frames (for a review, see Brewer et al., 2017), focused on bolstering intention and vaccination uptake (e.g., Capasso et al., 2021; Conner et al., 2017). The present longitudinal study, focused on flu vaccine confidence and hesitancy among U.S. college students, was driven by two goals. Our first goal was to quantitatively assess vaccine hesitancy and confidence using the TPB (Ajzen, 1985, 1991; Fishbein & Ajzen, 2010). In the TPB, attitudes toward the behavior, subjective norms, and perceived behavioral control are predicted to influence behavioral intentions. Intentions and perceived behavior control, in turn, are predicted to influence future behavior. We also investigated past behavior as a predictor of all TPB variables (Albarracin et al., 2001; McEachan et al., 2011; see Fig. 1).

This study's second goal was to identify college students' reasons for not receiving a flu vaccine. These qualitative data speak to specific elements underlying flu vaccine hesitancy. We discuss results as they relate to our goals before considering implications for health messaging directed toward college students as well as the study's strengths and limitations.

Theory of planned behavior

From the RAA perspective (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2010), our results are curiously mixed. On the positive side, consistent with Hypothesis 1, the TPB model closely fit the data and explained considerable variation in intentions and future behaviors (see Table 3). Both attitudes toward the behavior and subjective norms strongly and positively predicted behavioral intentions, which, in turn, strongly predicted future behaviors. Consistent with both the TRA and TPB, participants with positive attitudes and close friends and family who support flu vaccination had strong intentions to get a flu shot.

Although the TPB model fit our data well, neither perceived behavioral control nor past behavior significantly predicted behavioral intentions or future behavior. The perceived behavioral control result is curious not only because it was inconsistent with TPB, but mean values of perceived behavioral control were highest of all measured variables (i.e., 4.22 on a five-point scale). Furthermore, past behaviors significantly predicted participants' attitudes, subjective norms, and perceived behavioral control, but neither intentions nor future behaviors. Although past and future behavior are significantly correlated in the present data, their relationship is weak when compared with the McEachan et al. (2011) meta-analysis.

College students' betwixt and between status in dealing with their own health may explain, in part, why neither perceived behavioral control nor past behavior predicted behavioral intention or future behavior. Before coming to college, students' health care interactions (e.g., appointments, tests, and vaccinations) were likely orchestrated by parents or guardians (Curtis, 2015). Once arriving at college, students act more independently, however, they remain tethered to family patterns and influences (Curtis, 2015; James et al., 2020). As a consequence, students' independent experiences with health care are likely limited. So, even though a college student might have received the flu vaccine in the past, it may not have been *their* decision. This explanation likely speaks to the difference between perceived and actual behavioral control. New students might feel that getting a flu vaccine is up to them, however, they may lack the experience interacting with the health-care system to be able to do so effectively.

Reasons for not getting a flu shot

Coding identified 15 categories that described participants' most important reasons for not getting the flu vaccine within the past 30 days (see Table 4), which have multiple implications for vaccine hesitancy and health-intervention messaging. The four largest response categories (i.e., time cost, unimportance, low susceptibility, and lack of priority) clearly indicate that college students' flu-related risk assessments do not generate a sense of urgency (NFID, 2016, 2017; Schmid et al., 2017). Given that time is a precious commodity, there is little space for what are seen as superfluous activities. Given other responsibilities (e.g., school, work, and relationships), taking the time to get the flu vaccine is not seen as worth the effort, especially for healthy participants who consider their immune system to be robust.

Second, from the TPB perspective, a vast majority of responses reflected individual (i.e., attitudes toward the behavior and perceived behavioral control), rather than social, considerations. Put another way, participants rarely mentioned other people in their reasons for not getting the flu vaccine. Family members (especially parents) were the only specific individuals mentioned. Thus, subjective norms were represented solely by family influence. The few cases that mentioned peers typically described a friend's past experience with the flu, rather than beliefs about the flu vaccine. The absence of others' influence beyond parents

seems inconsistent with the quantitative results indicating that subjective norms influenced intentions.

Third, reasons for not getting the flu vaccine are clearly consistent with the 3C's Model (WHO, 2014; see also Schmid et al., 2017). Confidence concerns are evident in the side effects, ineffectiveness, and global vaccine concern categories. There is little evidence of a lack of confidence in health infrastructures. Complacency concerns are reflected in unimportance, low salience, and low susceptibility reasons. Finally, convenience is represented in the time cost, monetary cost, and lack of knowledge categories.

The lack of knowledge category is particularly interesting and sheds further light on college students betwixt and between status in terms of their own health. Participants' open-ended responses shed light why neither perceived behavioral control and past behavior were unrelated to both intentions and behaviors in the SEM results. For example, some participants (particularly out-of-state students) were unsure whether their parents' health insurance would cover vaccination cost or how to complete the requisite paperwork (James et al., 2020; Schmid et al., 2017). Other categories indicated that some participants lacked resources (e.g., money[3] or knowledge) necessary to get the flu vaccine, or that it was inconvenient to do so.

That all of the major components of the 3C's model appear in our qualitative findings reflects the complexity of college students' vaccine hesitancy (Schmid et al., 2017; WHO, 2014). Specifically, given the scarcity of students' time and resources, getting a flu vaccine appears to be an unnecessary luxury, or even a health hazard.

Finally, responses reflecting the confidence component indicate that flu vaccine hesitancy applies specifically to the flu vaccine (e.g., side effects, ineffectiveness, and contraindication), rather than global vaccination concerns (e.g., anti-vaccination beliefs; Dubé et al., 2021). Interestingly, some participants' reasons related to side effects reflected misinformation (e.g., the flu shot, or the chemicals in it, can give you the flu).

Implications for health communication campaigns

Our results provide multiple suggestions for messages designed to persuade college students to get their annual flu vaccine. Most importantly, messages should attempt to increase students' flu vaccination intentions by creating a sense of urgency. Messages should emphasize the importance of getting the flu vaccine by highlighting students' susceptibility (e.g., environmental factors). Brewer et al. (2017) note that few studies have utilized fear appeals to motivate vaccination uptake. Such messages could also emphasize both response efficacy (e.g., vaccines reduce the threat of getting the flu) and self-efficacy (e.g., the individual's ability to get the flu vaccine) by including information on the availability of vaccinations and how students can use their own (or their parents') health insurance (Curtis, 2015; James et al., 2020).

Second, given very limited global anti-vaccination sentiment, messages can attempt to increase flu vaccine confidence by directly addressing reasons for college students' hesitancy. For example, messages should highlight the extent to which, and how, the flu vaccine provides protection. What is more, messages should attempt to combat misinformation (e.g., flu shots, or chemicals in them, do not cause the flu; flu shots take two weeks to provide protection).

Finally, many participants provided multiple reasons for not getting the flu vaccine. This indicates that college students' hesitancy suggests a complicated decision-making process (Dubé et al., 2021; WHO, 2014). Health campaign designers should consider utilizing arguments that combat multiple reasons (rather than a single determinant) to enhance message effectiveness.

Strengths and limitations

This investigation adds to existing literatures given four key strengths. First, this study is based on, and extends, the RAA to an important but understudied topic and audience (i.e. college students and the flu vaccine). Xiao and Wong's (2020) meta-analysis of TRA/TPB vaccination studies included only three studies on the flu vaccine.

Second, this study's longitudinal design assessed actual behavior 30 days after other TPB variables. This design allows for the prediction of *future* behavior, something of a rarity, as most TRA/TPB vaccination studies either measured all variables at the same time or do not measure behavior at all (Xiao & Wong, 2021). This is important because multiple meta-analyses indicate that intentions correlate much less strongly with *future* behavior than *past* behavior. In the present study, however, past behavior predicted neither intentions nor future behavior.

Confidence in our data and analyses also stems from three sources. First, we used established instruments (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 2010) with high reliabilities (i.e., alphas = 0.75–0.95). Second, our final sample size ($n = 277$) provides ample power for moderate-to-large effects reported in TRA/TPB meta-analyses (e.g., Xiao & Wong, 2020). Third, both qualitative and qualitative data adds depth to our interpretations. For example, inconsistency between quantitative (i.e., reflecting high perceived behavior control) and qualitative data (i.e., reflecting less

[3] The university provided free flu shots for students with proof of health insurance and charged $20 for students without such proof. During the data-collection period, off-campus businesses (e.g., drug and grocery stores) charged $20-$50 for the same service.

control) may highlight the difference between *actual* and *perceived* control.

This study's final strength is generalizability to other vaccine-preventable diseases faced by college students (e.g., human papillomavirus and meningitis B; Xiao & Wong, 2020). Our results suggest that college students' lack of experience in independently managing their health care might also interfere with vaccinations beyond influenza.[4]

One potential limitation to this study is Time 1 to Time 2 attrition. Only 277 of the original 482 participants (57.5%) completed the Time 2 survey 30 days later. While not ideal, dropouts are nearly inevitable and nonresponse analyses indicated that the only significant difference was that individuals completing the Time 2 survey were slightly less likely to have ever received the flu vaccine.[5] Participants may have thought that they could not receive extra credit twice for the same study (a typical policy) or might not have needed, or benefited from, the small amount of extra credit promised one month later in the semester.

Directions for future research

Future research on persuading college students to get the flu vaccine should utilize the most recent iteration of the RAA the integrative model of behavioral prediction (IM; Fishbein, 2000, 2008; Fishbein & Ajzen, 2010; Institute of Medicine, 2002). The integrative model adds two factors that influence *actual* control over a behavior: (1) knowledge and skills and (2) environmental constraints. *Knowledge and skills* are individual factors that affect an ability to perform the behavior (e.g., understanding how, or having the expertise, to perform the behavior). For example, messages for new students should explain how health insurance can be used. *Environmental factors*, on the other hand, are external factors that facilitate or inhibit behavior. Examples include relationships (e.g., social ties), community (e.g., the physical environment), and societal factors (e.g., public policy) that influence behavior. Flu-shot campaigns should also make it as easy and inexpensive as possible to perform the behavior.

Further, like perceived behavior control, both knowledge and skills and environment factors influence the strength of the relationship between intention and behavior. Open-ended responses indicate that some students see the flu shot as something they should do, but just do not have the resources to make it happen. Making it easy for students to get the flu vaccine will help reduce slippage between intentions and behaviors.

Finally, future research should investigate college students' reasons for not getting, *and for getting*, the flu shot. Open-ended responses highlighted barriers college students face when considering the flu vaccine (Schmid et al., 2017). Asking why students *did* get a flu vaccine would likely be equally insightful (e.g., underscoring parental influence in health decisions). Such data would broaden our understanding of factors that influence this important behavior.

Conclusion

The goals of this study were (1) to quantitatively assess the TPB's ability to predict college students' annual flu vaccination behavior and (2) to qualitatively identify their primary reasons for not getting the flu vaccine. In tandem, results suggest that TPB provides important insights regarding this topic and audience, and also identifies over a dozen specific concerns that need to be addressed when developing messages and interventions. Finally, many of our findings should generalize to other vaccine-preventable diseases for this population.

Author contributions PM was involved in study design, and was primarily responsible for writing the final drafts of the manuscript as well as facilitating revisions. YL was involved in study design, data analysis, assisted in writing the original manuscript and participated in revisions. EH was involved in study design, qualitative analyses, and commented on the completed, and revised, manuscript. AJR was involved in study design; writing early drafts of the theory, method, and discussion sections; and edited and commented on revisions.

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Data availability Data and materials are available upon request.

Code availability Not applicable.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Human and animal rights and Informed consent This study was ethically approved by the Institutional Review Board at Arizona State University (USA) and performed in accordance with the criteria defined by the rules of the committee.

[4] Our study, performed during Fall Semester 2018, preceded COVID-19 emergence, which facilitates understanding of college students' vaccine decisions without concerns about COVID-19 as a confounding factor.

[5] Given the small difference, a probability level of .048, and the number of statistical tests performed in nonresponse analyses, this effect could represent a Type 1 error.

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