Predicting Intention to Take a COVID-19 Vaccine in the United States: Application and Extension of Theory of Planned Behavior

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Abstract

Purpose: This study aims to apply and extend the theory of planned behavior (TPB) to predict intention to take a COVID-19 vaccine.

Design: Cross-sectional.

Setting: Online.

Sample: Adult US residents recruited from Amazon Mechanical Turk (n = 172).

Measures: Intention to take a COVID-19 vaccine (outcome variable), demographic variables (predictors), standard TPB variables (perceived behavioral control, attitude, and subjective norm; predictors), and non-TPB variables (anticipated regret, health locus of control, and perceived community benefit; predictors).

Analysis: Hierarchical linear regression predicting intention to take a COVID-19 vaccine, with demographic, standard TPB, and non-TPB variables entered in regression models 1, 2, and 3, respectively.

Results: The extended TPB model accounted for 72.5% of the variance in vaccination intention (p < .001), with perceived behavioral control (β = .29, p < .001), attitude (β = .23, p = .043), and perceived community benefit (β = .23, p = .020) being significant unique predictors.

Conclusion: Despite the relatively small and non-representative sample, this study, conducted after COVID-19 vaccines were widely available in the USA, demonstrated that perceived behavioral control was the most robust predictor of intention to take a COVID-19 vaccine, suggesting that the TPB is a useful theoretical framework that can inform effective strategies to promote vaccine acceptance.

In 2020, more than 375,000 individuals in the USA died from COVID-19 complications.[1] Although the main mechanism for combatting COVID-19 is vaccinating a large proportion of the population, a survey conducted in April 2021 in the USA found that 15% of the participants would "wait and see," 6% would take a COVID-19 vaccine "only if required," and 13% would "definitely not" take a COVID-19 vaccine.[2] A USA census-matched survey in June 2020 found several demographic variables correlated with intention to take a COVID-19 vaccine, but did not assess theoretically based psychological variables.[3]

We believe utilizing established theories, such as the theory of planned behavior (TPB),[4] is essential to develop effective interventions. Despite its potential usefulness, however, only a small number of studies examined the utility of the TPB in predicting intention to take a COVID-19 vaccine. One such USA-based study in September 2020 found attitudes and subjective norms toward taking a COVID-19 vaccine, but not perceived behavioral control (PBC) over taking the vaccine, predicted intention to take a COVID-19 vaccine.[5] The authors argued that the non-significant association between PBC and vaccination intention may be because PBC over taking a

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COVID-19 vaccine was not fully developed without actual vaccine availability.

To better understand the decision to take a COVID-19 vaccine when vaccines are actually available, this study re-examined the association between TPB variables and vaccination intention. This study also examined whether three non-TPB variables, anticipated regret, health locus of control, and perceived community benefits, which have been shown to be significant predictors of vaccination intention against influenza[6] or COVID-19,[5,7] can predict intention to take a COVID-19 vaccine over and above standard TPB variables.

Methods

One hundred seventy-two USA residents with a 95% or higher hit approval rate were recruited from Amazon Mechanical Turk between March 30 and April 8, 2021. Participants who provided written informed consent online completed a Qualtrics survey and received a code to enter in Amazon Mechanical Turk to receive $1.00. Ten participants who failed an attention check were excluded. Table 1 shows demographic information of the remaining 162 participants. The institutional review board at the first author's university deemed the study exempt.

TPB items assessing intention to take a COVID-19 vaccine were developed from Gerend and Shepherd.[8] Items assessing PBC, attitudes, and subjective norm, and of taking a COVID-19 vaccine were adopted from Chu and Liu[5] with some modifications. Items assessing anticipated regret were developed from Chapman and Coups[6] and Ravert et al.[9] The items assessing health locus of control against COVID-19 were developed from Olagoke et al.[7] Items assessing perceived community benefits from COVID-19 vaccination were adopted from Chu and Liu.[5]

For hierarchical linear regression predicting intention to take a COVID-19 vaccine as the outcome variable, demographic variables, standard TPB variables, and non-TPB variables were entered as predictor variables in Models 1, 2, and 3, respectively. All statistical analyses were performed with SPSS Version 27, and the statistical significance level was set at $p < .05$.

Results

Table 2 shows results of the hierarchical linear regression. The first model with demographic variables accounted for 8.0% of the variance, $F(10, 151) = 1.31$, $p = .232$. No variable was a significant unique predictor of intention. The second model including the standard TPB variables accounted for an additional 62.6% of the variance, $\Delta F(3, 148) = 104.66$, $p < .001$. In this model, PBC, attitude, and subjective norm were significant unique predictors of intention. The third model including three non-TPB variables accounted for an additional 1.9% of the variance, $\Delta F(3, 145) = 3.41$, $p = .019$. In this model, PBC, attitude, and perceived community benefits were

Table 1. Demographic Information of the Sample.

Variable	Category	n (%)
Age group	18-29	48 (29.6)
	30-49	89 (54.9)
	50+	25 (15.4)
Gender	Female	49 (30.2)
	Male	113 (69.8)
Race/ethnicity	White	115 (71.0)
	Other	47 (29.0)
Education	No bachelor's	22 (13.6)
	Bachelor's or higher	140 (86.4)
Annual income	< $30,000	28 (17.3)
	$30,000-$49,999	43 (26.5)
	$50,000-$74,999	54 (33.3)
	≥ $75,000	37 (22.8)
Political ideology	Liberal	99 (61.1)
	Moderate	13 (8.0)
	Conservative	50 (30.9)

significant unique predictors of intention. Overall, this model accounted for 72.5% of the variance in vaccination intention, $F(16, 145) = 23.84$, $p < .001$, adjusted $R^2 = .69$.

Discussion

Unlike a similar previous study conducted in September 2020[5] when COVID-19 vaccines were still under development, this study demonstrated that PBC was the most robust predictor in March and April 2021 when three COVID-19 vaccines were widely available in the USA. Vaccination is not fully under one's own control in that one has to receive the vaccine from a provider.[10] Therefore, decreasing perceived barriers to receive a COVID-19 vaccine are essential. The present findings suggest that strategies to enhance PBC over taking a COVID-19 vaccine are promising, which should be composed of logistical and financial strategies removing any barriers to take a COVID-19 vaccine, along with psychological and educational strategies fostering perception of the ease of taking a COVID-19 vaccine.

In addition, this study demonstrated that attitudes toward taking a COVID-19 vaccine and community benefits from COVID-19 vaccines were significant predictors of vaccination intention. The attitudes reflect people's confidence in the vaccine in terms of efficacy, safety, and trustworthiness,[10] and they can be a potential target in public health campaigns. The community benefits can also be targeted given a previous study with a hypothetical scenario demonstrating explicitly communicating the social benefits of herd immunity increased participants' intention to get vaccinated.[11] Because younger individuals are less likely to be vaccinated than other adults,[12] informing this group of the potential community benefits may be particularly promising.[5]

Table 2. Hierarchal Linear Regression Predicting Intention to Get Vaccinated.

Variables	Categories	Model 1		Model 2		Model 3	
		β	t	β	t	β	t
Age group	18-29 (ref)						
	30-49	.14	1.51	.04	.71	.01	.26
	≥ 50	.15	1.60	.04	.65	.03	.51
Gender	Female (ref)						
	Male	.08	.98	.05	.98	.06	1.32
Race/Ethnicity	White (ref)						
	Non-white	.09	1.08	.00	.09	−.01	−.20
Education	No bachelor's (ref)						
	Bachelor's or higher	.10	1.23	.04	.85	.07	1.53
Annual income	< $30,000 (ref)						
	$30,000-$49,999	.05	.42	−.02	−.36	−.04	−.57
	$50,000-$74,999	.04	.36	−.02	−.36	−.03	−.48
	≥ $75,000	.05	.48	−.07	−1.10	−.10	−1.53
Political ideology	Moderate (ref)						
	Liberal	.23	1.55	−.03	−.38	−.05	−.53
	Conservative	.02	.14	−.06	−.73	−.06	−.75
PBC				.31	4.50***	.29	4.10***
Attitude				.41	4.15***	.23	2.04*
Subjective norm				.18	2.08*	.15	1.64
Anticipated regret						.04	.55
Locus of control						−.05	−.94
Community benefit						.23	2.36*

Note. *p < .05. ***p < .001. ref = reference, PBC = perceived behavioral control.

The present study has limitations. First, due to practical reasons, the sample, recruited from Amazon Mechanical Turk, was not a representative national sample in the USA, and sample size was relatively small. In addition, we did not collect sample residential information. Although the effect sizes of the extended model were large (Cohen's f^2 = 2.63), future research should evaluate the generalizability of the present findings with a larger and more representative sample while collecting residential information. Second, the cross-sectional design does not permit causal inferences. Future research employing experimental or longitudinal approaches and actual behavioral measures is warranted to better understand causality.

So What?

What is already known on this topic?. Attitudes and subjective norms toward taking a COVID-19 vaccine significantly predicted vaccination intention when vaccines were not available.

What does this article add?. After COVID-19 vaccines became widely available, perceived behavioral control emerged as the most robust predictor of vaccination intention, with attitudes and community benefits also being significant unique predictors.

What are the implications for health promotion practice or research?. Public health campaigns to promote COVID-19 vaccination should target perceived behavioral control, attitudes, and community benefits to increase intention to take a COVID-19 vaccine.

Author Contributions

Yusuke Hayashi: conceptualization, methodology, validation, formal analysis, investigation, writing—original draft, writing—review and editing, visualization, and funding acquisition. Paul Romanowich: methodology, writing—original draft, and writing—review and editing. Donald Hantula: methodology, writing—original draft, and writing—review and editing.

Declaration of Conflicting Interests

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Ethical Approval

The institutional review board at the Pennsylvania State University reviewed the study protocol and deemed the study exempt (Study ID: 17411).

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