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Extended theory of planned behavior in explaining the intention to COVID-19 vaccination uptake among mainland Chinese university students: an online survey study

Chia-Wei Fan[a], I-Hua Chen [b,c,d], Nai-Ying Ko [e], Cheng-Fang Yen[f], Chung-Ying Lin [g,h,i], Mark D. Griffiths [j], and Amir H. Pakpour [k]

[a]Department of Occupational Therapy, AdventHealth University, Orlando, FL, USA; [b]School of Education Science, Minnan Normal University, Zhangzhou, China; [c]Fujian Key Laboratory of Applied Cognition & Personality, Fujian, China; [d]International College, Krirk University, Bangkok, Thailand; [e]Department of Nursing, College of Medicine, National Cheng Kung University, Tainan, Taiwan; [f]Department of Psychiatry, Kaohsiung Medical University Hospital & School of Medicine College of Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan; [g]Institute of Allied Health Sciences, College of Medicine, National Cheng Kung University, Tainan, Taiwan; [h]Department of Public Health, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan; [i]Department of Occupational Therapy, College of Medicine, National Cheng Kung University, Tainan, Taiwan; [j]International Gaming Research Unit, Psychology Department, Nottingham Trent University, Nottingham, UK; [k]Department of Nursing, School of Health and Welfare, Jönköping University, Jönköping, Sweden

ABSTRACT

Objective: The Theory of Planned Behavior (TPB) is one of the most robust models in explaining health-related behavior. In this study, we tested the extended TPB to predict university students' intentions to uptake COVID-19 vaccination.

Methods: An online cross-sectional survey was developed to investigate students' intention to uptake the COVID-19 vaccine based on the components of the TPB (i.e., attitude, subjective norms, and perceived behavioral control) and extended components (i.e., knowledge about COVID-19, risk perception of COVID-19, and past influenza vaccination behavior). Non-probability sampling was used to collect data from 3145 students from 43 universities in mainland China in January 2021. Structural equation modeling (SEM) was applied to examine the proposed model. Enrolled students were relatively young (mean age = 20.80 years; SD = 2.09), half of them are female (50.2%), and most of them were studying in undergraduate programs (n = 3026; 96.2%).

Results: The results showed that students' knowledge of the COVID-19 vaccine and risk perception of COVID-19 positively influenced their attitude toward the uptake of a COVID-19 vaccine. Also, students' attitude toward COVID-19 vaccination uptake and their past influenza vaccination uptake behaviors were positively associated with the intention to uptake COVID-19 vaccination. Subjective norm and perceived behavioral control were not significant predictors for the intention to uptake COVID-19 vaccination (R^2 = 0.49).

Conclusions: The present study demonstrated that the extended TPB appears to be an efficient model with the focus on attitude, knowledge, risk perception, and past influenza vaccination uptake behaviors in explaining students' intention for COVID-19 vaccination.

The coronavirus disease 2019 (COVID-19) pandemic has deeply impacted multiple aspects of human lives since the end of 2019, including physical and mental health, social interactions, economy, education, and occupations.[1-6] Vaccination against the virus has become the most important measure in tackling COVID-19 as most countries worldwide continue to struggle to control the spread of the virus. The development of COVID-19 vaccines worldwide has been accelerated in response to the urgent need to control the spread of the virus, and more than 60 candidate vaccines are under clinical evaluation.[7] However, research has demonstrated that significant minority of individuals worldwide are still hesitant about the COVID-19 vaccine injection.[8-15] Consequently, hesitancy and resistance to uptake vaccination may hamper the effectiveness of controlling the spread of the virus.[16] Therefore,

it is important to understand the factors predicting individuals' intention to uptake COVID-19 vaccination.

Applying theory to real life practical situations is beneficial because theories provide a comprehensive consideration of behavior changes concerning critical factors.[17] For example, the Theory of Planned Behavior (TPB)[22] can be used as a practical framework to understand important factors for intention to uptake COVID-19 vaccination. Research has applied the TPB to analyze individuals' attitudes toward (and uptake of) vaccination such as influenza[18,19] and human papillomavirus (HPV).[20] Therefore, the TPB may also work for COVID-19 vaccination uptake. Indeed, a meta-analysis of TPB studies showed that attitudes, subjective norms, and perceived behavioral control accounted for 39% variance in intentions to uptake vaccination in a previous study.[21] According to the TPB[22], three core components, comprising of attitude, subjective norms, and perceived behavioral control, together shape an individual's intentions to uptake vaccination. Individuals' attitudes toward a behavior refers to the degree to which an individual has a favorable or unfavorable evaluation toward a specific behavior.[23] Perceived subjective norms regarding behavior refers to individuals' perceptions of judgement from significant others (e.g., friends, family, and society members more generally) in engaging in a specific behavior.[24] Perceived behavioral control refers to the confidence toward the likelihood of successfully engaging in a specific behavior. [24]

Based on the efficiency in explaining vaccination uptake for influenza and HIV, the TPB has been successfully used for predicting intentions to uptake COVID-19 vaccination.[25] A recent study demonstrated that individuals who had a more positive attitude toward vaccination uptake, scored higher on subjective norms and self-efficacy had higher willingness to uptake vaccination against COVID-19.[26] Another study showed that parents' positive attitudes, perceived family members' supporting COVID-19 vaccination for children, and perceived behavioral control of having the children uptake COVID-19

vaccination were associated with higher parental acceptability of COVID-19 vaccination for children.[27] However, more evidence is needed to better understand how the TPB can be used to inform the intention to uptake COVID-19 vaccination based on the following reasons.

First, COVID-19, a novel infectious disease, can cause death within a relatively short period among individuals in high-risk groups. Therefore, compared to all previous human vaccines, the COVID-19 vaccines were developed in much faster and shorter time periods. Consequently, individuals worldwide are being encouraged to have a COVID-19 vaccination based on much less scientific evidence compared to other vaccines. Second, since the beginning of the COVID-19 pandemic, there has been much misinformation and many conspiracy theories that may increase individuals' hesitance and resistance to uptake COVID-19 vaccination.[28] Third, in addition to the original three core components of the TPB, further components (e.g., knowledge on COVID-19 vaccines, risk perception COVID-19, and past behaviors of vaccination uptake) that can amplify the efficacy of the TPB should be tested to construct an extended TPB to better predict behavioral intentions regarding the uptake of COVID-19 vaccination.

Knowledge about vaccines and risk perception of risk due to disease are two possible components that warrant examining in relation to the intention to uptake vaccination. These two important factors are also applicable to COVID-19 (i.e., knowledge about COVID-19 vaccines and risk perception of COVID-19 are important factors in relation to the intention to uptake COVID-19 vaccination). Knowledge concerning the benefits of COVID-19 vaccination have been positively associated with COVID-19 vaccination uptake intentions.[26] Moreover, risk perception is associated with individuals' health-related attitudes,[29] and perceived high risk of contracting COVID-19 also increases the likelihood of preventive behaviors such as wearing a mask, washing hands, and keeping social distance.[26,30] However, the role of knowledge concerning COVID-19 vaccines and risk of COVID-19 may contribute

individuals' favorable attitude toward COVID-19 vaccines and therefore increase intention to uptake.

Past influenza vaccine uptake is another component that warrants inclusion in the extended TPB explaining the intentions to uptake COVID-19 vaccination. A systematic review of influenza vaccination intention and behaviors identified past vaccination behaviors as one of factors predicting current intentions to influenza vaccination.[18] However, whether past influenza vaccination behaviors predict the intentions to uptake COVID-19 vaccination is unknown. Therefore, the present study incorporated knowledge concerning COVID-19 vaccination, risk perception of COVID-19, and past influenza vaccination uptake with the TPB's key factors (i.e., attitude, subjective norms, and perceived behavioral control) to predict the intentions to uptake COVID-19 vaccination among university students in China. University students are generally considered as low-risk groups and are not among the priority groups in getting vaccinated. Consequently, university students might not pay full attention to the vaccine information and may not be fully aware of the importance of vaccination. However, when fighting against COVID-19, vaccinating everyone is paramount. Therefore, it is extremely important to include university students and understand their intentions concerning vaccination. The following hypotheses were proposed:

H1: Knowledge concerning COVID-19 vaccination will be positively associated with attitude toward COVID-19 vaccination uptake.

H2: Risk perception of COVID-19 will be positively associated with attitude toward COVID-19 vaccination uptake.

H3: Attitude toward COVID-19 vaccination will be positively associated with the intentions toward COVID-19 vaccination uptake.

H4: Subjective norms will be positively associated with the intentions toward COVID-19 vaccination uptake.

H5: Perceived behavioral control will be positively associated with the intentions toward COVID-19 vaccination uptake.

H6: Past influenza vaccination uptake will be positively associated with the intentions toward COVID-19 vaccination uptake.

Methods

Participants and recruitment procedure

The Institutional Review Board of the Jianxi Psychological Consultant Association (IRB ref: JXSXL-2020-DE22) approved the study protocol. The study comprised an online survey utilizing non-probability sampling. The data were collected between January 5 and 16, 2021, a period in which mainland China had begun COVID-19 vaccination uptake. University students were not the priority population in getting COVID-19 vaccination. Therefore, authorities did not promote vaccination uptake for university students. However, the students can get vaccinated if they themselves go to a hospital.

To recruit the sample, college counselors in different universities were first approached by the research team to help launch the online survey and disseminate the study information to the target population (i.e., university students) via their respective online social communities. The present study recruited 3145 mainland Chinese students who were voluntarily willing to participate in the survey. All the students were clearly informed of their rights in participation, including the confidentiality and the anonymity of their data, on the first page of the online survey. All participants provided informed consent and completed all the survey items given that the survey platform did not allow missing answers. Therefore, no missing data were observed in the present study. Moreover, there were only two inclusion criteria for participants. These were that they were (i) students studying in an undergraduate or a postgraduate university program in mainland China, and (ii) aged over 18 years.

Measures

Theory of Planned Behavior (TPB) measures. Attitudes in the TPB were assessed using six items rated on a seven-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The scale had excellent internal reliability (0.93), average variance extracted (0.69), and composite reliability (0.93). A sample item is "Vaccination is a very effective way to protect myself against COVID-19". A higher score indicates a more positive attitude toward COVID-19 vaccination uptake.

Subjective norms in the TPB were assessed using two items rated on a four-point scale from 1 (*not important at all*) to 4 (*very important*). The items had very good internal reliability (0.86), average variance extracted (0.76), and composite reliability (0.86). A sample item is "Is your family an important factor for you to get vaccinated against COVID-19?". A higher score indicates a higher level of subjective norms.

Perceived behavioral control in the TPB was assessed using a single item ("I can choose whether to get a COVID-19 vaccination or not") rated on a seven-point scale. A higher score indicates a higher level of self-efficacy in getting vaccinated against COVID-19.

The intention to get vaccinated against COVID-19 in the TPB was assessed using two items. One item ("When a COVID-19 vaccine becomes available, will you get vaccinated?") was rated on a four-point scale from 1 (*definitely unwilling*) to 4 (*definitely willing*). The second item ("Please rate your current level of willingness to receive a COVID-19 vaccine") was rated from 1 (*very low*) to 10 (*very high*) on a visual analogue scale. The internal reliability (0.72), average variance extracted (0.56), and composite reliability (0.72) of the two intention items were acceptable. A higher score indicates more willingness to get COVID-19 vaccinated.

Knowledge measure. Knowledge concerning COVID-19 vaccination was assessed using two

items rated on a seven-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The two

items had very good internal reliability (0.84), average variance extracted (0.72), and

composite reliability (0.84). A sample item is "I know very well how vaccination protects me

from COVID-19". A higher score indicates a better level of knowledge concerning COVID-

19 vaccination.

Risk perception measure. Risk perception of COVID-19 infection was assessed using four

items rated on a seven-point scale from 1 (*not at all*) to 7 (*certain*). The scale had acceptable

internal reliability (0.75), average variance extracted (0.45), and composite reliability (0.75).

A sample item is "What do you think are your chances of getting COVID-19 over the next

one month compared to others outside your family?". A higher score indicates a higher level

of perceived COVID-19 infection.

Past influenza vaccine behavior measure. Past influenza vaccine behavior was assessed using

a single item ("Did you receive an influenza vaccination in the past few years?"). The item

was rated on a four-point scale from 1 (*never*) to 4 (*always*). A higher score indicates a higher

level of adherence to getting vaccinated against influenza.

Background information measures. Several demographic questions (i.e., age, gender, major

study in the university, and level of education [undergraduate *vs.* postgraduate]) were also

asked in the survey.

Data analysis

Descriptive statistics were analyzed using the standard procedure such as means and

frequencies to illustrate the participants' characteristics, including their demographics and

mean scores of the measures used in the proposed model (Figure 1; please see below for

detailed information). Pearson correlation coefficients were calculated to understand the zero-

order associations between the studied variables. Finally, the proposed model was examined

using the structural equation modeling (SEM) method with the maximum likelihood

estimator and bootstrapping method. More specifically, the proposed model is outlined in

Figure 1, where knowledge and risk perception are the explanatory factors underlying

attitude; attitude in turn is the explanatory factor underlying intention to have a COVID-19

vaccine; subjective norms, perceived behavioral control, and past behavior concerning

influenza vaccination uptake are also the explanatory factors underlying intention to have a

COVID-19 vaccination. All the explanatory factors were constructed latently, except for

those variables assessed only using one item (i.e., perceived behavioral control and past

behavior). Moreover, two indirect effects were examined in the model: (i) the path between

knowledge and intention toward COVID-19 vaccination uptake via attitude and (ii) the path

between risk perception and intention toward COVID-19 vaccination uptake via attitude. For

the two indirect effects, bootstrapping method with 5000 bootstrapping samples was used to

examine whether the indirect effects were significant. A significant indirect effect is

supported when its 95% confidence interval (i.e., the range between upper limit confidence

interval [ULCI] and lower limit confidence interval [LLCI]) does not contain 0.[31]

(Insert Figure 1 here)

Results

The participants came from 30 provinces in mainland China (covering 88% of the

mainland China's provinces). The participants' characteristics are presented in Table 1. A

relatively balanced gender distribution was found among the recruited participants (1578

females; 50.2%) and the participants were relatively young (mean age = 20.80 years; SD =

2.09) with most of them were studying on undergraduate programs (n = 3026; 96.2%). Less

than 10% of the participants were studying a program related to health (n = 241; 7.7%).

When comparing the demographics of the present sample and the mainland Chinese

university students, no significant differences were found in gender distribution ($\chi^2 = 0.08$; p

= 0.77), education level ($\chi^2 = 1.42$; $p = 0.23$), and the program studied at the university ($\chi^2 =$

0.31; $p = 0.58$). However, the present sample (mean age 20.8 years) was slightly older than the mainland Chinese university students, whose mean age was 20.0 years ($t = 19.12$; $p < 0.001$). Moreover, the participants' scores in the measures that were used in the proposed model are presented in Table 1.

(Insert Table 1 here)

Table 2 shows the correlations between the studied variables used in the proposed model. The proposed model was supported by most of the SEM fit indices (RMSEA = 0.061, SRMR = 0.055, TLI = 0.974, and CFI = 0.980) and only the significant χ^2 test ($\chi^2 = 1544.648$, $df = 120$; $p < 0.001$) did not support the data-model fit (Figure 2). Moreover, all the tested paths were significant, except for the path between subjective norms and intention toward COVID-19 vaccination uptake ($p = 0.052$) and that between perceived behavioral control and intention toward COVID-19 vaccination uptake ($p = 0.778$). More specifically, the standardized coefficients were 0.98 between knowledge and attitude ($p < 0.001$); 0.08 between risk perception and attitude ($p < 0.001$); 0.70 between attitude and intention toward COVID-19 vaccination uptake ($p < 0.001$); and 0.10 between past influenza vaccination uptake and intention toward COVID-19 vaccination uptake ($p < 0.001$) (Figure 2).

(Insert Table 2 and Figure 2 here)

The indirect effects proposed in the model were both supported by the SEM results. More specifically, the unstandardized coefficient in the path between knowledge and intention toward COVID-19 vaccination uptake via attitude was 0.389 (bootstrap SE = 0.020; ULCI = 0.429; LLCI = 0.350); and the path between risk perception and intention toward COVID-19 vaccination uptake via attitude was 0.011 (bootstrap SE = 0.005; ULCI = 0.023; LLCI = 0.0002) (Table 3).

(Insert Table 3 here)

Discussion

To the best of the authors' knowledge, the present study is the first study with a sample size larger than 2000 to examine university students' intention toward getting a COVID-19 vaccine, and comprised of 43 universities and 3145 participants across mainland China. The study used the key components in the theory of planned behavior (TPB; i.e., attitude, subjective norms, and perceived behavioral control), and other relevant components (i.e., knowledge, risk perception, and the past vaccination behavior) to augment the efficacy of TPB in explaining intention toward COVID-19 vaccination uptake.

The results supported the hypotheses that students' knowledge concerning COVID-19 vaccine (H1) and risk perception of COVID-19 (H2) would positively influence their attitude toward COVID-19 vaccination uptake. Additionally, students' attitude (H3) toward COVID-19 vaccination as well as their past influenza vaccination uptake behavior (H6) were positively associated with the intentions toward COVID-19 vaccination uptake. On the other hand, two hypotheses were not supported. More specifically, subjective norms (H4) and perceived behavioral control (H5) were not significant predictors for the intentions toward COVID-19 vaccination uptake. Nevertheless, in general, the present study's findings support the premise that the TPB can be used to understand university students' intention towards COVID-19 uptake and explain health-related behavior[21], as well as extended TPB appearing to augment the efficacy of original TPB.[32]

Original TPB components in explaining intention to uptake COVID-19 vaccination

In the present study, Chinese university students were positive about the COVID-19 vaccine (an average score of 5.82 on a seven-point Likert scale), which is in line another Chinese study reporting that only 16.4% would definitely or probably decline getting the COVID-19 vaccine.[33] Moreover, the finding that students' attitude toward the COVID-19 vaccine was strongly associated with their vaccination intention is consistent with recent previous studies,[34,35] including the one that found positive attitude toward the vaccine is a

significant predictor of COVID-19 vaccine uptake intentions.[26]

However, subjective norm was not a significant predictor for COVID-19 vaccine intention. In other words, students' perception of judgement from others was not a significant predictor for their own behavior and intention. This was in line with a previous study in which subjective norms did not predict physical activity behavior of patients on haemodialysis.[36] However, the finding contradicts other studies. For example, Guidry et al.[26] found that individuals who had a more positive attitude toward vaccination, scored higher on subjective norms and had higher COVID-19 vaccine uptake intention. Also, Lin et al.[33] found in their study that knowing the vaccine has been taken by many individuals from the general public may serve as a cue in uptake of COVID-19 vaccination. One of the possible explanations is that both previous studies were conducted during the relatively early period of the COVID-19 pandemic. Guidry et al.[26] completed their survey in July 2020, and Lin et al.[33] completed their survey in May 2020. During that period, the information concerning COVID-19 was still unclear with arguments and debates on a variety of topics concerning COVID-19 coming from public officials, scientists, and stakeholders across various media platforms.[37] It is possible that participants would lean more toward their family members or important others, which resulted in the subjective norms being much more important to their vaccination intention when the pandemic started. Instead, the present study completed data collection in January 2021, in which more open discussion and evidence were available and individuals were generally more clear concerning COVID-19 information. Therefore, participants in the present study may have already made up their own mind in relation to their personal intention toward COVID-19 vaccination uptake.

Perceived behavioral control was also not a significant predictor toward intention for COVID-19 vaccination uptake. This finding also contradicts with previous studies. For example, Zhang et al.[27] found that perceived behavioral control of having children uptake

COVID-19 vaccination was associated with higher parental acceptability of COVID-19 vaccination for children. Additionally, Guidry et al.[26] found that high perceived behavioral control was a significant predictor of willingness to take a COVID-19 vaccine. Moreover, Xiao et al.[25] found that perceived behavioral control was a significant predictor of vaccination intentions among 5149 participants from five databases. The difference in findings is likely explained by Chinese society's expectation of who should receive a COVID-19 vaccination first. More specifically, frontline healthcare workers who have a higher risk of exposure to COVID-19 and those aged 65 years have the highest priority in receiving a COVID-19 vaccination.[38] In contrast, the present study's participants were university students, a population that has a lower priority in COVID-19 vaccination uptake. Being low priority may have influenced the students' confidence in COVID-19 vaccination uptake and further influenced the association between perceived control and intention toward COVID-19 vaccination uptake.

Other components in the extended TPB

The finding that knowledge concerning the COVID-19 vaccine was directly associated with attitude and indirectly with intention is consistent with previous studies.[9,39-41] Concerns about vaccine safety is a commonly cited reason for being unsure about whether to get a vaccination.[42] Therefore, when individuals have the safety knowledge concerning COVID-19 vaccination, their intention toward COVID-19 vaccination uptake is increased. Indeed, Fisher et al.[9] indicated that their study participants wanted more information about the vaccine, such as its compatibility with personal health conditions and whether it is recommended by doctors or official organizations. Moreover, Grech and Gauci[43] conducted an online survey with 852 participants from Health Sciences, Dentistry and Medicine departments and found that participants were most concerned about the potential long-term side effects of the COVID-19 vaccine.

Apart from knowledge, students' risk perception of the COVID-19 vaccine was another significant factor directly associated with their attitude and was indirectly associated with intention. This result concurs with other studies.[26,34,35,44] For example, a study of 1062 US college students[34] found that perceived severity and fear of COVID-19 were positively associated with their attitude of vaccine acceptance. Moreover, similar findings have been reported in other populations, such as those in France and Israel.[42,44,45] Therefore, the importance of risk perception in explaining an individual's attitude toward vaccination uptake should not be ignored.

Past vaccination uptake behaviors were directly and strongly associated with intention toward COVID-19 vaccination uptake. This result is also consistent with other relevant studies. For instance, individuals who have received the seasonal influenza vaccine in the previous year report higher intention to get the COVID-19 vaccine across the world compared to those that have not.[9,35,40,43,46] Similarly, a cross-sectional study from 32,361 UK adults found that individuals who had not received a past vaccine were twice as uncertain about the COVID-19 vaccine and 3.4 times more likely to refuse the COVID-19 vaccine than those who had previously received vaccines.[40]

Limitations

A few limitations should be noted when interpreting the present study's results. First, although the study had a large sample size across 43 universities from China, the students comprised a convenience sample and voluntarily participated in the study. Therefore, the generalizability of the present findings is restricted. Additionally, the students who chose to take a part in this survey might share different characteristics than those who chose not to participate, which may have resulted in biased information. Second, this study used a cross-sectional design and had no long-term follow up. Given that information related to COVID-19 vaccines is released in a daily basis, students' knowledge, risk perception, attitude, and

subjective norms toward COVID-19 vaccination may potentially change over time. However, the cross-sectional design prevents the capturing of such changes. Additionally, recall bias commonly exists in cross-sectional studies and should be taken into consideration when interpreting the results. Some questions asked students to recall their past behaviors (e.g., "Did you receive an influenza vaccination in the past few years?"). Therefore, recall bias cannot be excluded. Third, students' knowledge concerning COVID-19 vaccination was evaluated by their subjective perceptions, which cannot be used to represent the objective knowledge level. Therefore, the interpretation of the results should be treated with caution when taking subjective perspectives into consideration. Finally, the survey did not include quality control items to ensure the validity for every answer (e.g., asking what 1+1 is after item answers to ensure that the participants were paying attention to the survey items). Therefore, future studies are needed to consider using this type of quality control to ensure survey validity.

Conclusions

The present study used the extended TPB to provide useful guidance for tailored students' perceptions to enhance intention of acceptance for new COVID-19 vaccines. It demonstrated that the extended TPB appears to be an efficient model with the focus on attitude, knowledge, risk perception, and past influenza vaccination uptake behaviors in explaining students' intention for COVID-19 vaccination. Groundwork for public acceptance of COVID-19 vaccines should be the foundation of vaccine distribution alongside public health campaigns that counter misinformation and conspiracy theories concerning the efficacy and safety of COVID-19 vaccines. Public health efforts to increase acceptability among student populations should start immediately.

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EXTENDED TPB on COVID-19 VACCINATION UPTAKE

Table 1. Participants' characteristics (N=3145)

	M (SD) or n (%)	Total range
Gender (female)	1578 (50.2%)	--
Age	20.80 (2.09)	18-40
Education level (undergraduate)	3026 (96.2%)	--
Professional (health-related)	241 (7.7%)	--
Knowledge	5.62 (1.15)	1-7
Risk perception	3.06 (1.18)	1-7
Past behavior relating to influenza vaccination	1.71 (0.84)	1-4
Attitude towards COVID-19 vaccination	5.82 (0.94)	1-7
Vaccination is a very effective way to protect myself against COVID-19	5.76 (1.16)	1-7
It is important that I get the COVID-19 vaccination.	5.93 (1.38)	1-7
Vaccination greatly reduces my risk of catching COVID-19.	5.94 (1.08)	1-7
The contribution of the COVID-19 vaccination to my health and well-being is very important	6.00 (1.06)	1-7
The COVID-19 vaccination plays an important role in protecting my life and that of others	5.88 (1.14)	1-7
Getting the COVID-19 vaccination has a positive influence on my health	5.42 (1.39)	1-7
Subjective norms toward COVID-19 vaccination	2.87 (0.82)	1-4
Perceived behavioral control toward COVID-19 vaccination	5.78 (1.24)	1-7
Intention toward COVID-19 vaccination	5.31 (1.44)	1-7

EXTENDED TPB on COVID-19 VACCINATION UPTAKE

	r						
	1.	2.	3.	4.	5.	6.	7.
1. Knowledge	1						
2. Risk perception	-.148**	1					
3. Attitude	.775**	-.093**	1				
4. Subjective norms	.013	.075**	.004	1			
5. Perceived behavioral control	.477**	-.096**	.558**	.017	1		
6. Past behavior[a]	.024	.112**	.011	.030	.016	1	
7. Intention	.367**	.096**	.487**	-.021	.280**	.061**	1

Table 2. Correlation matrix between variables used in the proposed model.

**p<0.01

[a] Past behavior relating to influenza vaccination

Table 3. Direct and indirect effects in the proposed model

Direct path	Coeff.	SE	t-value	p-value
Knowledge→Attitude	.983	.019	49.96	<0.001
Risk perception→Attitude	.084	.026	5.474	<0.001
Attitude→Intention	.698	.030	23.045	<0.001
Subjective norms→Intention	-.035	.019	-1.946	0.052
Perceived behavioral control→Intention	.008	.022	.281	0.778
Past behavior[a]→Intention	.097	.017	4.372	<0.001
Indirect path	Coeff.	SE	ULCI	LLCI
Knowledge→Attitude→Intention	.389	.020	.429	.350
Risk perception→Attitude→Intention	.011	.005	.023	.0002

Coeff. = coefficient (unstandardized coefficients 0029; SE = standard error; ULCI = upper limit of confidence interval at 95%; LLCI = lower limit of confidence interval at 95%.

The indirect paths were tested using bootstrapping methods (5000 bootstrapping samples).

[a] Past behavior relating to influenza vaccination