Predictors for the Intention to Receive the Booster Dose of COVID-19 Vaccine: Implications for Public Health Communications

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Abstract

The purpose of this study was to investigate factors that predicted citizens' acceptance of public health messages recommending a booster dose in fighting against the mutated virus Omicron of the COVID-19. Data were provided by 531 adult citizens in a cross-sectional online survey between December 20, 2021 and January 15, 2022 in Taiwan. The results indicated that citizens' vaccination intention was predicted by their perceptions of the severity of COVID-19, the benefits and barriers to vaccination. Citizens' vaccination intention was also influenced by their trust in authorities handling the epidemic, media misinformation and interpersonal communication. In general, data also indicated that psychological factors predict the COVID-19 vaccination intention better than demographic, cultural and individual factors. Public health messages should be

tailored to communicate these issues, especially for older age groups and those without chronic diseases. The findings provided evidence in support of health behaviors theories in the context of receiving booster doses of the COVID-19 vaccine in a country where the pandemic was under control.

Introduction

COVID-19 has been raging for 2 years, and the death has exceeded 6 million globally. Even though the vaccine has been successfully developed and entered a new phase for the fight against the pandemic, vaccine hesitancy is still a problem to face in the fight against mutated COVID-19 virus. Under the attack of the mutated virus Omicron globally, the pandemic continued to heat up since late 2021. The Central Epidemic Command Center (CECC) of Taiwan advocates citizens to receive the third dose (booster) of the COVID-19 vaccine (CECC, 2021/12/02). Even though high numbers of infections and casualties may lead to increased risk awareness and intense fear, prolonged epidemics and lower mortality in younger populations may also lead to fatigue in practicing preventive measures and overly optimistic about disease susceptibility (Chu & Liu, 2021). Since the first dose of COVID-19 vaccination rate was about 81% and the second was about 74% by January 2022 in Taiwan (CECC, 2021/01/29), some citizens may hesitate to get a booster dose of COVID-19 vaccine due to lower risk perception and fear after 2 doses of the COVID-19 vaccine. However, the protective effect of the vaccine wears off over time, even for individuals who have completed a 2-dose primary series (Chen & Yang, 2022). Since receiving the booster dose of COVID-19 vaccine is essential to effectively prevent the infection by the Omicron or Delta variants and the development of severe illness (CECC, 2021/12/02; Chen & Yang, 2022), there is a need to comprehensively explore why citizens follow the advice of public health messages from the authority (CECC) and what factors influence their willingness to receive the booster dose of COVID-19 vaccine in the later phase of fighting against the pandemic.

The change in behavior and attitude toward vaccination of the public remains the only possible way that may be considered for prevention and

suppression of COVID-19 (Emojong, 2021), and vaccination campaigns are one of the effective ways to enforce the change. Previous studies indicated that factors affected the COVID-19 vaccination intention including demographic characteristics (e.g., Chu & Liu, 2021; Cordina et al., 2021; Paul et al., 2021; Shmueli, 2021; Song et al., 2022), vaccine risk perceptions (Zhenga, Jiangb, & Wub, 2022), cues to action (e.g., An et al., 2021; Ansari-Moghaddam et al., 2021; Chu & Liu, 2021; Shmueli, 2021), vaccine attitudes (Cordina, Lauri, & Lauri, 2021; Paul, Steptoe, & Fancourt, 2021), opinions of significant others (e.g., Cordina et al., 2021) and COVID-19 related factors (psychological), such as perceived of susceptibility, severity, vaccine benefits and vaccination barriers (e.g., Ansari-Moghaddam et al., 2021; Chu & Liu, 2021). These previous studies were mainly based on Health Behaviors Theories (HBTs), such as Health Belief Model (HBM), Theory of Reasoned Action (TPA), and Extended Parallel Process Model (EPPM), and were conducted in countries with severe COVID-19 outbreaks.

However, after fighting against the COVID-19 virus for two years, the public have accumulated rich experience and knowledge in fighting against the epidemic. Thus, the above predictors of vaccination intentions may not be sufficient to explain why individuals are reluctant or willing to follow the epidemic prevention advice, especially in a place where the pandemic is under control, such as Taiwan. For instance, being in a "virus-free" environment for a long period of time may lead most citizens to be overly optimistic about the perceived threat (severity and susceptibility) of the virus. Moreover, the perception of threat is affected by cultural and individual differences as suggested by EPPM (Witte, 1992). In addition to above factors explored in previous researches, there is a need to expand the discussion by considering cultural, individual and contextual differences associated with vaccination intentions. Based on HBTs (especially HBM, EPPM and TRA), this study aims

to investigate the effect of psychological, cultural and individual factors on the intention to receive a booster dose of vaccine against the mutated COVID-19 virus.

Psychological Factors

According to HBM, EPPM and TRA, individuals' perceptions of how severe the disease is and how likely it is to affect them should predict their willingness to be vaccinated. HBM and EPPM use similar constructs to measure individuals' perceptions of health risks including perceived severity and susceptibility to health threats after exposing to the message. Previous findings revealed that the level of perceived severity and susceptibility of COVID-19 infection was positively associated with the vaccination intention (e.g., Al-Amer et al., 2021; Ansari-Moghaddam et al., 2021; Shmueli, 2021). Furthermore, HBM, EPPM and TRA claim that attitudes toward and beliefs about the health behaviors recommended by the message also shape individuals' intention to accept them. These attitudes and beliefs are termed as perceived benefits and barriers of health behaviors in HBM, response efficacy in EPPM, and positive or negative behavioral beliefs in TPA. Research findings indicated that individuals perceived benefits of COVID-19 vaccine increasing, and perceived vaccination barriers decreasing their vaccination intentions (e.g., Ansari-Moghaddam et al., 2021; Chu & Liu, 2021; Shmueli, 2021). After integrating previous findings based on BHM, EPPM and TPA, it may be concluded that the following four psychological factors are important predictors of an individual's intention to receive a booster dose of COVID-19 vaccine: perceived severity of the pandemic, susceptibility to the virus, benefit of the vaccine, and barriers of vaccination.

Cultural and Individual Factors

Up to date, the effect of cultural and individual factors on COVID-19

vaccination intention has been understudied and lacks comprehensive investigations. After integrating previous studies, it may be concluded that media misinformation (Scannell et al., 2021), trust (Paul, Steptoe, & Fancourt, 2021), fatalism (Orna et al., 2009) and interpersonal communication (Cordina et al., 2021) may be important predictors of COVID-19 vaccination intention.

Media misinformation. Previous research indicated that misinformation reduces individuals' perception of the threat of the virus despite their general knowledge about COVID-19 and how to prevent it (e.g., Emojong, 2021; Scannell et al., 2021). Therefore, media misinformation remains a challenge to COVID-19 vaccination (Scannell et al., 2021). A meta-analysis of 30 studies across 7 countries indeed revealed that negative information about COVID-19 vaccines on social media was associated with lower vaccine acceptance (Al-Amer et al., 2021). Similarly, a study in Israeli also indicated that exposure to vaccine misinformation in the media was associated with negative impacts on attitudes towards vaccines and intentional delays in vaccination (Scannell et al., 2021). Based on the previous studies mentioned above, it may be concluded that media misinformation should be a predictor of citizens' willingness to receive a booster vaccine against the COVID-19 virus, regardless of cultural background.

Trust the CECC. Previous research indicated that vaccine knowledge alone was insufficient and trust in experts was needed to overcome COVID-19 vaccine hesitancy (Ledford et al., 2022). A study in United Kingdom indeed found that one of the largest predictors of the COVID-19 vaccine uncertainty and refusal was poor adherence to government guidelines (Paul et al., 2021). Previous finding indicated that valuing the advice of health professionals regarding the effectiveness of COVID-19 vaccine (Cordina et al., 2021) and low confidence in health systems (Al-Amer et al., 2021) was associated with lower vaccine acceptance. CECC is composed of epidemiological and health experts. Based on the experiences against SARS in 2002 to 2003, Taiwan had been well-prepared

in advance to successfully prevent and control any COVID-19 outbreak in the past two years. Citizens' trust in the CECC was considered to be one of the main factors why Taiwan can control and prevent the outbreak of COVID-19 pandemic (Chang et al., 2021). Based on the previous studies mentioned above, it may be concluded that citizens' trust in CECC recommendations should be a predictor of their intention to receive a booster dose of COVID-19 vaccine.

Fatalism. Fatalism is the belief that health is beyond an individual's control because it is a matter of fate or luck (Orna, Friedman, & Lernau, 2009). Fatalists believe that individuals cannot determine their own health because health is primarily influenced by chance and fate (Straughan & Seow, 2000). If death is doomed, nothing can be done to prevent it (Orna et al., 2009). There are two forms of fatalism. Fatalism in the form of external force refers to the belief that health is in the hands of God or destiny, and therefore it is a matter of luck and unpredictability; while fatalism in the form of survivorship is the belief that nothing prevents death (Orna et al., 2009). Both types of fatalism may prevent individuals from seeking prevention, such as vaccination. Research indeed validated that fatalistic beliefs were positively related to risk perception and negatively related to their behavioral willingness to take preventive measures (Lee, Ho, Chow, Wu, & Yang, 2013). In other words, fatalistic citizens will be less willing to receive the booster dose of COVID-19 vaccine.

Interpersonal Communication. Research based on Theory of Reasoned Action (TPA) found that attitudes of significant others in an individual's life have an important effect on whether individuals comply with performing a particular behavior (Fishbein & Ajzen, 1975). Therefore, positive health behavior can be enhanced, if those who are important in individuals' life encourage them to do so (Fishbein & Ajzen,1975), such as receiving COVID-19 vaccines. The attitudes of significant others about a vaccine influenced by the social representations individuals have of the vaccine (Cordina, Luri, & Lauri, 2021). According to

social representation theory, the common conception of things among members of a society is collectively produced through a process of communication between individuals. In other words, individuals' attitudes toward vaccination are through interpersonal communication with their group members. Research findings indeed validated that individuals' willingness to get vaccinated was associated with their significant others' attitudes toward the COVID-19 vaccine (Cordina et al., 2021). In other words, it may be concluded that citizens' interpersonal communication should be a predictor of their intention to receive a booster dose of COVID-19 vaccine.

Demographic Factors

The effect of demographic variables on the vaccination intention of COVID-19 had been inconsistent in previous findings. In general, males, older adults and individuals with higher education and income often show higher vaccination intentions, but the patterns of such difference vary across contexts (e.g., Chu & Liu, 2021; Cordina et al., 2021; Paul et al., 2021; Shmueli, 2021; Song et al., 2022). Since patients with chronic diseases are a high-risk group for COVID-19, it will be added as a predictor of willingness to receive a booster dose of the vaccine. Therefore, demographic variables of gender, age, education, and chronic diseases will include in this study to predict the vaccination intention.

Based on the above discussion, the present study aims to investigate the following hypotheses. Intentions to receive a booster dose of the COVID-19 vaccine are predicted by increasing perceived susceptibility and severity of COVID-19, perceived benefits of vaccination, interpersonal communication, and trust the CECC. Furthermore, vaccination intentions are also predicted by decreasing perceived barriers of vaccination, media misinformation and fatalism. This study will further compare the impact of these three groups of

variables (psychological, cultural and personal, and demographic factors) on the COVID-19 vaccination intention.

Methods

Participants

The purpose of this study was to investigate the factors that affected adult citizens' willingness to receive a COVID-19 vaccine booster in Taiwan. Snowball and convenience sampling methods were used to recruit participants nationwide. The survey was conducted before boosters of the COVID-19 vaccine were available to citizens of all ages, and adult citizens were invited to participate in the study through personal referrals via email, Line and Facebook between December 20, 2021 and January 15, 2022. A self-reported questionnaire was posted online via Google Forms to collect data for analysis. Each respondent was asked to read the consent form, and click to check "agree" before answering the questionnaire online.

Measurements

All questionnaire items were constructed for the purpose of this study. All scales were in a 7-point Likert-type format, from 1 (strongly disagree) to 7 (strongly agree). The questionnaire was presented in traditional Chinese. Before answering the questionnaire items, the following scenarios of evidence-based rational fear appeal were presented:

> At present, the world is attacked by the new coronavirus Omicron variant, and the epidemic is gradually heating up. According to the analysis of Omicron cases in my country, 99% of the cases can be detected within 10 days, and 1% may enter the community, posing a threat to the community.

Based on the experience of neighboring countries, individuals who have not been vaccinated against COVID-19 have higher rates of severe illness and mortality. The Central Epidemic Command Center advocates that if individual citizens have already received a second dose of the vaccine, the third dose must be completed as soon as possible. The public can go to a nearby local health office, medical facility or clinic to get vaccinated. Everyone should continue to follow the epidemic prevention measures and be prepared at all times.

Psychological Factors. Items used to measure COVID-19 related psychological variables were revised based on scales developed by An et al. (2021). These scales included: 1) perceived susceptibility of COVID-19 was assessed by three items; 2) perceived severity of COVID-19, three items; 3) perceived benefits of COVID-19 vaccine, four items; and 4) perceived barriers of COVID-19 vaccination, three items. These four subscales had reliability coefficient alpha ranging from .73 to .85 in this study. (see table 2)

Cultural and Individual Factors. The items used to measure cultural and individual variables were developed based on the existing literature discussed in the previous section. Media misinformation was measured using three items to investigate the types of information respondents received about the COVID-19 vaccine through the media. Trust in CECC was measured by three items to assess participants' confidence in government and the health service to handle the pandemic. Fatalism was measured by four items to investigate respondents' beliefs about individuals' self-confidence in determining their own health. Interpersonal communication was measured with three items to investigate how the COVID-19 vaccine was perceived by those around the respondent. These four scales had reliability coefficient alpha ranging from .72 to .96 in this study. (see table 1 and 2)

Table 1

Exploratory Factor Analysis for the Scale of Cultural and Individual Factors

	Factor			
Items	1	2	3	4
Trust in CECC: (α = .96)				
I trust the expert advice of the Central Epidemic Command Center.	.955	-.056	-.028	.124
I trust the epidemic prevention measures recommended by the Central Epidemic Command Center.	.952	-.078	-.027	.132
I believe that the Central Epidemic Command Center will help us overcome the threat of COVID-19 virus.	.924	-.043	-.035	.143
Media Misinformation: (α = .96)				
I often see media reports that many people have been given the COVID-19 vaccine with serious side effects.	-.006	.872	.122	-.010
I often see media reports of many people dying from Covid-19 vaccines.	-.014	.872	.144	.045
The media that I have been in contact with say that vaccines are not safe.	-.133	.717	.126	-.071
Fatalism: (α = .72)				
Illness and death will happen to me sooner or later, and it is useless to worry.	-.053	-.009	.820	-.034
It is difficult for people to change their fate of illness and death.	.144	.009	.729	.053
It seems that I may be exposed to the COVID-19 virus at any time, and it is useless to do anything.	-.028	.266	.711	-.032
With so much advice on the COVID-19, it's hard to know what's right.	-.168	.188	.633	.086
Interpersonal Communication: (α = .82)				
Everyone around me is vaccinated against COVID-19.	.305	-.057	.012	.704
People around me think the Covid-19 vaccine is safe.	.118	-.162	.089	.697
Everyone around me thinks COVID-19 is scary (deadly).	-.042	.363	-.049	.562

Vaccination Intention. The intention to receive the booster dose of COVID-19 vaccine was measured by three items. 1) I am willing to receive a third (booster) dose of COVID-19 vaccine. 2) I am going to get my third (booster) COVID-19 vaccine as soon as possible. 3) I will persuade others to receive a third (booster) dose of COVID-19 vaccine. This scale had reliability coefficient alpha .91 in this study. (see table 2)

Analytic Procedure

Data were analyzed via SPSS version 27. Exploratory factor analysis and reliability analysis were used to ensure scale validity and reliability. Pearson's correlation was used to check scale correlations. Hierarchical regression analysis was used to test hypotheses and compare the effects of demographic, psychological, cultural and individual factors on the COVID-19 vaccination intention.

Results

Preliminary Analyses

A total of 531 respondents participated in this study including 184 (34.7%) males and 347 (65.3%) females. They averaged 33.5 (SD=15.55) years of age (range from 18 to 68), and reported having 14.79 (SD=1.88) years of education. Among the 531 respondents, there were 119 (22.4%) with high school education, 137 (25.8%) with junior college, 222 (41.8%) with bachelor's and 53 (10.0%) with master's and doctoral degree. There were 72 (13.6%) respondents were chronically ill, and 459 (86.4%) were not. Among 531 respondents, 49 (9.2%) had never been vaccine, 44 (8.3%) received only 1 dose, 405 (76.5%) 2 doses, and 31 (6.0%) 3 dose. None of them had ever been infected with the COVID-19 virus.

　　To check the convergent and discriminative validity for the scale of cultural and individual factors, exploratory factor analysis was conducted via principal component procedure, varimax rotation and an eigenvalue of 1.0 for factor extraction. This scale was loading in four factors with 67.10% of total variance explained: trust in CECC, media misinformation, fatalism and interpersonal communication. The scale reliability was confirmed by Cronbach's alpha values ranging from .72 to .96 in this study. (see table 1)

　　In general, most respondents were highly educated (M=14.79, SD=1.88), young (M=33.5, SD=15.55) and without chronic diseases (86.4%). In average, our participants were willing to receive a booster dose (M=5.54, SD=1.84), highly trusted the CECC (M=5.03, SD=1.67), less influenced by media misinformation (M=3.61, SD=1.37) and perceived low susceptibility to the threat of COVID-19 (M=3.30, SD=1.55). (see table 2)

　　Results from bivariate correlations indicated that the intention to receive a booster dose was significantly associated with perceived susceptibility (r=.16, p<.01), severity (r=.33, p<.01), vaccine benefits (r=.70, p<.01), trust CECC (r=.53, p<.01) and interpersonal communication (r=.30, p<.01), while negatively related with perceived vaccination barriers (r=-.61, p<.01), media misinformation (r=-.18, p<.01) and fatalism (r=-.11, p<.05). The vaccination intentions had significant correlation with age (r=-.13, p<.01) and chronic diseases (r=.10, p<.05). Participants with chronic diseases were more likely to receive the booster dose than those without. The vaccination intentions had no significant correlation with gender (r=-.01, p>.05) and years of education (r=-.06, p>.05). Age was negatively associated with perceived severity of COVID-19 (r=-.18, p < .01), trust in the CECC (r=-.18, p < .01), and vaccination intention (r=-.13, p < .01), but positive with vaccination barriers (r=.13, p < .01). (see table 2)

Table 2

Pearson Scale Correlations, Means, Standard Deviations and Reliability

scale	1	2	3	4	5	6	7	8	9	10	11	12	13
1. gender	-												
2. years of education	-.05												
3. age	.01	.05											
4. chronic disease	.00	-.10*	.08										
5. media misinformation	-.07	.03	-.10*	-.06									
6. fatalism	-.06	.00	-.13**	.01	.28**								
7. trust CECC	-.06	-.04	-.18**	.07	-.13**	-.07							
8. interpersonal communication	-.03	.10*	.04	-.01	.05	.06	.31**						
9. susceptibility	-.03	.04	-.07	.01	.10*	.06	.10*	.15**					
10. severity	.02	-.03	-.18**	.05	.13**	.05	.19**	.29**	.42**				
11. vaccine benefits	.05	-.06	.04	.06	-.18**	-.07	.51**	.34**	.08	.26**			
12. vaccination barriers	-.05	.13**	.13**	-.06	.38**	.23**	-.37**	-.09	.00	.01	-.48**		
13. vaccination intention	-.01	-.06	-.13**	.10*	-.18**	-.11*	.53**	.30**	.16**	.33**	.70**	-.61**	-
M	-	14.79	33.5	-	3.61	4.03	5.03	4.77	3.30	4.16	4.77	3.32	5.54
SD	-	1.88	15.55	-	1.37	1.35	1.67	1.07	1.55	1.54	1.54	1.43	1.83
Cronbach α	-	-	-	-	.96	.72	.96	.82	.84	.78	.85	.73	.91

N=531
** $< .01$ * $< .05$
CECC= Central Epidemic Command Center (中央疫情指揮中心)

Hierarchical Regression Analyses

Data were analyzed by a three-stage regression procedure to test hypotheses. First, socio-demographic factors were entered to predict participants' vaccination intention. These variables explained 2% of the variance in intention to receive COVID-19 vaccine (adjusted R^2=.02), and increasing the explained variance from 0% to 3% ($\triangle R^2$=.03). The increase in R^2 value is meaningful because the F value is significant [$F_{(4, 526)}$ change=3.96, p<.01]. The older the participants

were, the less willing they were to receive the booster dose ($\beta = -.13$, p<.01). Participants with chronic diseases were more likely to receive the booster dose than those without ($\beta = .10$, p<.05). There was no significant effect for gender ($\beta = -.01$, p>.05) and years of education ($\beta = -.04$, p>.05) on the vaccination intention.

In the second step, cultural and individual factors were entered into the model. These variables explained 32% of the variance in intention to receive COVID-19 vaccine (adjusted $R^2 = .32$), and increasing the explained variance from 3% to 33% ($\triangle R^2 = .30$). The increase in R^2 value is meaningful because the F value is significant [$F_{(4, 522)}$ change= 59.61, p<.01]. Media misinformation, trust the CECC and interpersonal communication predicted participants' vaccination intention. Media misinformation decreased the intention to receive the booster dose ($\beta = -.12$, p<.01). The more the participants' trust on the CECC ($\beta = .44$, p<.01) and interpersonal communication ($\beta = .18$, p<.01), the higher intention they were to receive the booster dose. There was no significant effect for fatalism on the vaccination intention ($\beta = -.07$, p>.05).

In the third step, psychological factors were entered into the model. These variables explained 64% of the variance in intention to receive COVID-19 vaccine (adjusted $R^2 = .64$), and increasing the explained variance from 33% to 64% ($\triangle R^2 = .31$). The increase in R^2 value is meaningful because the F value is significant [$F_{(4, 518)}$ change=115.25, p<.01]. Results indicated that the perception of severity, vaccine benefits and vaccination barriers predicted participants' vaccination intention. The more the participants perceived the message about severity of Omicron virus and benefit of vaccination, the higher intention they were to receive the booster dose ($\beta = .16$, p<.01). The more the participants perceived the vaccination barriers, the lower intention they were to receive the booster dose ($\beta = -.36$, p<.01). There was no significant effect for perceived susceptibility on the vaccination intention ($\beta = .04$, p>.05). (see table 3)

Table 3

Hierarchical Regression Analysis for Dependent Variable of Vaccination Intention

model	variables	β	R^2	$\triangle R^2$	$\triangle F$
1	gender	-.01	.03	.03	3.96**
	age	-.13**			
	years of education	-.04			
	chronic diseases	.10*			
2	gender	.01	.33	.30	59.61**
	age	-.08*			
	years of education	-.04			
	chronic diseases	.07			
	media misinformation	-.12**			
	fatalism	-.07			
	Trust CECC	.44**			
	interpersonal communication	.18**			
3	gender	-.04	.65	.31	115.25**
	age	-.04			
	years of education	.02			
	chronic diseases	.04			
	media misinformation	.02			
	fatalism	-.01			
	trust CECC	.14**			
	interpersonal communication	.03			
	perceived susceptibility	.04			
	perceived severity	.16**			
	perceived vaccine benefits	.40**			
	perceived vaccination barriers	-.36**			

N=531

** < .01 * < .05

CECC= Central Epidemic Command Center (中央疫情指揮中心)

Over all, trust the CECC, perceived severity of pandemic, vaccine benefits

and vaccination barriers better predicted participants' intentions to receive the booster dose of COVID-19 vaccine. In general, psychological factor were better predictor of vaccination intention than cultural and individual factors, as well as demographic factors. Additionally, a multicollinearity test among the variables in three models showed that variance inflation factors (VIF) ranged from 1.02 to 1.85, which was within the acceptable range. Therefore, there were no multicollinearity problems in the analysis.

Discussion

This study aimed to investigate factors that predicted citizens' acceptance of public health messages recommending a booster dose in fighting against the mutated virus Omicron of the COVID-19. The results indicated that citizens' vaccination intention was predicted by their perceptions of the severity of COVID-19, the benefits and barriers to vaccination. Citizens' vaccination intention was also influenced by their trust in authorities dealing with epidemics (CECC), media misinformation and interpersonal communication. Public health messages should be tailored to communicate these issues, especially for older age groups and those without chronic diseases. The findings provided evidence in support of Health Behaviors Theories in the context of receiving a booster dose of the COVID-19 vaccine in a country where the pandemic was under control.

In general, the hypotheses were partially supported by data. Intentions to receive a booster vaccine were predicted by increasing perceived severity of COVID-19, benefits and barriers of vaccination. This is consistent with most previous findings in vaccination intentions (e.g., Ansari-Moghaddam et al., 2021; Shmueli, 2021), except the predictor of perceived susceptibility toward COVID-19 virus. Overall, our participants perceived a lower susceptibility to COVID-19, and it was proved to be a less powerful predictor of the intention to

receive the booster dose of vaccine than other COVID-19 related psychological factors. Averagely, our participants reported a higher level of vaccination intentions (M=5.54, SD=1.83) and a lower level of susceptibility (M=3.30, SD=1.55). This suggested that most of them accepted the recommendation in the public health messages, even though they might not perceive the immediate threat of virus infection (low susceptibility), while they perceived the severity of Omicron variants and benefits of a booster dose of COVID-19 vaccine. This can be reasonably explained by our participants' belief that severity of COVID-19 and the benefits of vaccination should be based on trusting information from the authorities (CECC), since they live in a place where the pandemic is under control and they have never been infected with COVID -19 virus. This may also explain why trust the CECC to be a powerful individual factor to predict their willingness to be vaccinated against COVID-19 with the booster dose. This also echoed previous findings that the adherence to government guidelines and trust in experts were the largest predictors for the COVID-19 vaccine hesitancy (Ledford et al., 2022; Paul et al., 2021).

Furthermore, vaccination intentions were also predicted by the effect of media misinformation, interpersonal communication and trust in CECC, except fatalism. According to the data, our participants appeared to be less affected by fatalism (M=4.03, SD=1.35). This may be the reason why the effect of fatalism on the vaccination intention is not significant. It could also be that COVID-19 is a global pandemic (unlike cancer), everyone can be infected, and nonetheless it can be prevented simply by vaccination (if the vaccine is safe), no painful and lengthy treatment process, therefore no need to leave life to fate. Furthermore, most of our participants were in middle-aged. For them, a young life is good and full of hope, and they also have to undertake large responsibilities and obligations to their families and society, and no need to surrender their lives to their destiny.

Finally, our data indicated that age had a negative effect on the vaccination

intention. This may be that older participants trusted the CECC less according to our correlation analysis. This is in line with the CECC's data that Taiwan's two-dose vaccination rate was 74% for the entire adult population, but only about 68% for the elderly over 75 years old (CECC, 01/29/2022). In contrast to previous findings (e.g., Cordina et al., 2021; Paul et al., 2021; Shmueli, 2021; Song et al., 2022), our data revealed that gender and education had no significant effect on vaccination intentions. This may be because our participants were young and highly educated. Both males and females of young generation in Taiwan have to work and share responsibilities for their household finances and family care so that the impact of the epidemic on both is similar. It was also possible that the epidemic in Taiwan has been brought under control, and most citizens are working and living normally, so there is no significant difference in the perception of the susceptibility and severity of the epidemic between males and females (as our correlation analysis indicated), and there is no significant difference in their intention to vaccinate. However, this finding echoed a previous finding that no demographic variables were found to have a significant effect on COVID-19 vaccination intention (e.g., Chu & Liu, 2021).

Implications and Future Studies

The results of this study provided theoretical and practical implications in several ways. This study was to contribute the scholarship on integrating HBTs to comprehensively investigate factors affect the intention to receive the booster dose against the COVID-19 variants. This study demonstrates that factors of cultural and individual differences should be incorporated into HBTs, especially in the context of vaccination intentions.

Unlike previous studies, this study was conducted in the absence of a COVID-19 outbreak (December 2021 to January 2022) with sufficient publicly

funded vaccines, and all of our participants were never be infected (total 14,616 local cases reported nationally by January 7, 2022), so citizens' perceived susceptibility was low, and there was no immediate urgency to get a booster dose of vaccine. In this case, trust in government and health services is particularly important to increase willingness to vaccinate for a booster dose. Citizens may perceive the threat (severity and susceptibility) of COVID-19 differently during or after experiencing an outbreak. In addition, the majority of our participants (76.5%) had already received two doses of vaccines, so their perceptions of vaccine benefits and barriers would vary from those in previous studies. In other words, vaccination campaigns should pay attention to the context of the pandemic development and should take these concerns into account when designing public health messages.

Moreover, the results indicated that vaccination intentions were primarily predicted by trust in the CECC, perceptions of COVID-19 severity, vaccine benefits, and barriers to vaccination. Our data also indicated that age was negatively associated with perceived severity of COVID-19 and trust in the CECC, and positive with vaccination barriers. In other words, older citizens were less willing to receive the booster dose of vaccine because they underestimate the severity of mutated COVID-19 virus, perceived more vaccination barriers (e.g., side effect), and trust less in the CECC's warning as stated in the message. In this case, interventions to increase vaccination rates should concern these variables, and public health messages should be tailored to address these issues, especially in older age groups.

Overall, these findings provided important evidences for planning interventions to ensure successful mass vaccination campaigns. Vaccine safety communication is needed to increase public trust before convincing the public to accept a booster dose of a COVID-19 vaccine. Information and communication about the benefits and efficacy of booster doses are critical to controlling the

pandemic. This has been proven in Taiwan, where the epidemic is under control. It is important to note that citizens' trust in the CECC is developed over time. For instance, the CECC has held daily press conferences to report on the development of the pandemic and answer questions to provide a two-way communication since the outbreak of COVID-19 pandemic in January 2020. The public's trust in the CECC was one of major reasons why Taiwan could quickly achieve a two-dose vaccination rate of 74% within half year by January 2022 (77.2% by March 2022) while the outbreak under control. In this case, the outbreak can be viewed as a cue to action (as argued by HBM) to motivate the public to vaccinate.

Limitation

There are several limitations of this study. First, data were collected using an online survey and so there is the risk of inaccurate self-reporting and selection bias. Furthermore, our outcome variable was a measure of behavioral intentions, rather than actual behaviors, and this is likely to be an under-estimation of future behaviors. In addition to convenient and snow-ball sample resulting in high homogeneity, this study is limited by the imbalance ratio of gender, education, chronic disease and age groups across the entire sample. Participants were recruited through the researcher's social networks to referral so that most respondents were highly educated, young and without chronic diseases. This may limit the results that can be generalized to different social groups in Taiwan, and therefore hurt the external validity of this study. Among 531 participants, 65.3% were females, 34.7% males. Previous findings indicated that females had lower intention to receive the COVID-19 vaccine compared to males. A high proportion of females may have biased our sample to those who were lower intention in vaccination individuals. Despite these problems with the characteristics of sample, the scales used in this study yielded data that were statistically significant and consistent with previous researches.

Conclusion

Based on the integration of the Health Behavior Theories, this study provides up-to-date data on factors of socio-demographic, psychological, cultural and individual to predict the intention of the general public to receive the booster dose vaccine against the mutated COVID-19 virus. This was one of few studies on vaccination intention against a variant of COVID-19. As the results of this study suggested, public perceptions of the COVID19 virus and vaccine will vary as the pandemic develops. While experts suggest that the COVID-19 virus will be flu-like, humans will live with the virus forever. High vaccination rates with booster doses in the general population are essential to overcoming the mutated virus of COVID-19. In the face of the constant mutation of the COVID-19 virus, fighting the epidemic will be an arduous and long-term battle. As this pandemic sustained, and the development of vaccines against mutant viruses continues, it will be important for the future research to track changes in vaccination attitudes and intentions over time.

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COVID-19 疫苗加強劑接種意願的預測因素：對公共衛生傳播的影響

鄭媷媷

摘要

　　本研究的目的是檢視影響台灣民眾接受加強劑疫苗以對抗COVID-19變異病毒 Omicron的公共衛生說服訊息的因素。研究數據是在2021年12月20日至2022年1月15日期間經由橫斷面研究在線調查531名台灣成年國民所蒐集的。結果顯示，預測受試者接受加強劑接種意願的因素包括：感知COVID-19的嚴重性、加強劑接種的益處和障礙，以及對疫情處理當局的信任、媒體錯誤訊息和人際溝通的影響。整體而言，本研究的數據還顯示，心理因素比人口、文化和個人因素更能預測 COVID-19 疫苗接種意向。此研究結果建議，疫情控制當局應該考量上述問題來調整公共衛生訊息，特別是針對老年人和沒有慢性病的人。這些研究發現在疫情得到控制的國家，以及在接受COVID-19疫苗加強劑的情境背景下，提供了支持健康行為理論的證據。

關鍵詞：加強劑量、疫苗接種意願、健康行為理論、Omicron, COVID-19變種

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