



Original Article

Factors Influencing the Acceptance of COVID-19 Booster Dose in Malaysia

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Abstract

Background: This cross-sectional study aimed to identify factors influencing the acceptance of coronavirus disease 19 (COVID-19) booster dose in Malaysia based on the health belief model during 2022.

Methods: Malaysians aged 18 and above were enrolled in a cross-sectional online survey. The convenient sampling method was used for data collection, and Google form was employed as an online questionnaire, which was distributed through social media by the authors. The sociodemographic characteristics of the respondents were assessed and summarized by performing descriptive and frequency analyses. Multivariate analysis was applied to measure the associations of factors influencing the acceptance of COVID-19 booster dose among respondents in Malaysia.

Results: A total of 467 responses were analyzed in this study. Participants with neutral perceptions who think that it is easy for them to get the COVID-19 vaccine if they wanted to were 0.042 times less likely to accept COVID-19 booster dose compared to others (95% CI of 0.003- 0.556 which was significant with $P < 0.05$ ($P = 0.016$)). Moreover, the participants were 0.012 times more likely to be females by neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to with a 95% CI of 2.166-461.040, which is significant.

Conclusion: The need for continued access to research and learning has never been more important, especially when it comes to a constantly mutating coronavirus. We also continue to work directly with agencies to support their work.

Keywords: COVID-19, Booster dose, SARS CoV-2, Vaccine acceptance, Adults, Malaysia

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Introduction

In late 2019, since the emergence of severe acute respiratory syndrome coronavirus 2, which was responsible for the cause of coronavirus disease 19 (COVID-19) infections, the world has been trapped in a deadly race with a virus. The COVID-19 mitigation policies employed by various governments to control the pandemic included wearing masks, hand sanitization, self-isolation, and lockdowns. These measures slowed the massive spread of the virus but imposed nearly unbearable implications on the healthcare system and the economy. The antiviral medication remdesivir issued a conditional recommendation against its use by the World Health Organization (WHO) at the end of 2020 due to the lack of evidence regarding remdesivir's ability to reduce COVID-19 mortality (1).

Nowadays, vaccination has become the game-changing approach that tops all other strategies to contain the COVID-19 spread. In spite of the well-known lengthy process of vaccine development, joint medical efforts

between countries, institutions, and researchers have accelerated the launching of vaccines for COVID-19. Seven vaccines have been approved under emergency use authorization, as well as hundreds under clinical trials in two years (1,2). According to previous studies, protection from COVID-19 vaccine effectiveness against hospitalization and mortality rate from severe COVID-19 disease was gradually decreasing after the second dose of COVID-19 vaccines. Therefore, the importance of receiving the COVID-19 vaccine booster dose is crucial for preventing infection with new COVID-19 variants. However, the efficacy and durability of the effect of the booster dose of vaccine against the new strain of COVID-19 were controversial among scientists (3).

According to the WHO, there is a 6-month interval between the second dose and booster dose administration to increase its protection against the variants (4). Under the development of vaccination strategies, on the 28th of December 2021, the Minister of Health of Malaysia



set a three-month interval for COVID-19 booster shots for Pfizer and AstraZeneca (AZ) recipients. Based on previous literature, there were multiple factors that influenced the acceptance of COVID-19 booster dose, including age, race, gender, occupation, education status, vaccine hesitancy sentiments, and the perceptions of the population in coping the COVID-19 infection (5-8).

The National COVID-19 Immunization Program in Malaysia was started on 24th February 2021 (5). At the time of preparing this article, 76.1% of the Malaysian population fully vaccinated against COVID-19 have so far accounted for more than 24,849,925 doses; however, only one study was conducted to record the vaccine effects with the population attitude and perceptions towards COVID-19, which generalizes the study to both vaccinated and unvaccinated population, making the results unable to be fully generalized among the vaccinated population (5,7).

Although many studies have evaluated COVID-19 vaccine acceptance by the public, showing that acceptance varied globally, there are very few studies about the acceptance of the COVID-19 booster dose worldwide. This study sought to identify factors influencing the acceptance of the COVID-19 booster dose in Malaysia. The study of booster acceptance will help provide evidence to improve COVID-19 booster delivery.

Materials and Methods

Study Design

A cross-sectional study was conducted to identify factors contributing to the acceptance of COVID-19 booster dose in Malaysia in 2022.

Data Collection

An online self-administered questionnaire was distributed among the Malaysian population through Google form. Invitations were individually sent via the link through social media platforms, including Instagram, Telegram, emails, WhatsApp, and Facebook to reach the targeted sample size for quality control and respondent sincerity. Participants were given informed consent prior to enrollment in the survey. The inclusion criteria were participants who were aged 18 years and above residing anywhere in Malaysia, agreed with informed consent prior to the study enrolment, and took at least one dose of the Malaysian mandated vaccines. This kind of online questionnaire is suitable to rapidly reach a group of people during the pandemic.

Study Instrument

The questionnaire had four main sections, including sociodemographic profiles, perception of a booster dose, the willingness of accepting the COVID-19 booster dose, and source of information. Sociodemographic factors consisted of questions about age, gender, nationality, marital status, race, education level, employment status, family income per month, and residency. The additional

questions asked as part of sociodemographic factors were the confirmation of healthcare workers and vaccination. This electronic questionnaire was created according to the previous literature related to the acceptance of the vaccine (2,9,10).

A pilot study was conducted to assess the validity and reliability of the questionnaire. The questionnaire was valid and reliable as the overall Cronbach alpha value was 0.726. Likewise, a similar study in Poland demonstrated good reliability as their Cronbach's alpha value was 0.82-0.93 (8).

In our study, the Health Belief Model (HBM) was used to analyze the acceptance of the COVID-19 booster dose among the public (11). This model consists of six dimensions such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy, and cues to action (12).

Sample Size Determination

The sample size (n) was calculated via the Raosoft sample size calculator using a 95% confidence interval (CI) and a 5% margin of error with a population proportion of 50%. The target population size is 32.7 million consisting of fully vaccinated, partially, and booster dose vaccination status people in Malaysia (2). By taking into consideration a 20% attrition rate, the minimal sample size required in this study was 457. In this cross-sectional study, the non-probability convenience sampling technique was used to recruit the sample. The inclusion criteria included Malaysians of 18 years and older who have taken at least one dose of the Malaysian mandated vaccines, while the exclusion criteria excluded anyone under the age of 18, unvaccinated, or rather vaccinated but not by any of the Malaysian mandated vaccines.

Statistical Analysis

Statistical Package for Social Sciences (SPSS, version 26.0) was applied to analyze the data. The respondents' sociodemographic characteristics were assessed and summarized by performing descriptive analysis and frequency analysis. Multivariate analysis was employed to measure the associations of factors influencing the acceptance of COVID-19 booster dose among respondents in Malaysia. In our study, *P* value less than 0.05 was considered statistically significant.

Results

According to Table 1, out of 467 respondents, most of them were in the age range of 18 to 39 years, and their mean age was 25.35 years with a standard deviation of ± 5.65 . It was found that the proportion of male respondents (51.0%) is higher than that of females (49.0%), and 53.3% of them were singles. In addition, 95.3% of respondents were mostly Malaysians and belonged to the race of Indians (53.3%), had tertiary education (59.5%), and were fully employed (38.3%) with a family income group of (45.4%). The majority of the respondents have been vaccinated

Table 1. Sociodemographic Characteristics of the Participants (N=467)

Variables	Frequency (N)	Percent
Age		
Young adults (18-39)	300	64.2
Middle adults (40-59)	119	25.5
Older adults (≥60)	48	10.3
Gender		
Male	238	51.0
Female	229	49.0
Marital status		
Single	249	53.3
Married	187	40.0
Divorced	16	3.4
Widowed	14	3.0
Others	0	0
Nationality		
Malaysian	445	95.3
Non-Malaysian	22	4.7
Race		
Malay	116	24.8
Chinese	73	15.6
Indian	249	53.3
Others	29	6.2
Education level		
No formal education	10	2.1
Primary	6	1.3
Secondary	40	8.6
Post-secondary (Pre-university, matriculation, A-level, diploma, foundation, and the like)	133	28.5
Tertiary (Bachelor, Degree, Master, and PhD)	278	59.5
Employment status		
Employed (full time)	179	38.3
Employed (part time)	47	10.1
Unemployed	9	1.9
Retired	51	10.9
Student	158	33.8
Others	23	4.9
Family income per month		
<RM 4849 (B40)	212	45.4
RM 4850 – RM 10960 (M40)	194	41.5
>RM 10960 (T20)	61	13.1
Residency		
Urban	385	82.4
Rural	82	17.6
Are you a healthcare worker?		
Yes	103	22.1
No	364	77.9
Are you vaccinated?		
First dose	3	0.6
Second dose	255	54.6
Booster dose	209	44.8
Not vaccinated	0	0

until the second dose (54.6%). Table 2 presents HBM factors; based on the results, 49.3% of respondents had an extremely high risk of the COVID-19 infection and agreed (49.9%) to a higher risk of the COVID-19 infection from a variant than from the existing strains; Further, 52.2% of them agreed with the high severity of COVID-19 infection and agreed (50.3%) to more severe illness caused by variants compared with the existing strains. The findings revealed that 47.3% of respondents believed in the high efficacy of the booster against early circulating strains, a booster to extend protection (49.5%), and a booster against variants (46.0%); in addition, they perceived high (47.3%) safety of COVID-19 boosters and were neutrally (36.0%) worried about serious adverse reactions after vaccination. Moreover, they agreed (42.2%) that it would be easy to get the COVID-19 vaccine if wanted. Additionally, they (54.8%) confirmed or suspected cases in daily close contacts and strongly agreed (52.7%) to know at least one foreign variant. Finally, most of them would accept (92.5%) COVID-19 booster if it is recommended as a supplement to the current vaccination schedule.

According to data in Table 3, 55.0% of participants strongly agreed and received sufficient information about the COVID-19 booster dose; however, 0.9% of them strongly disagreed with that statement. In this regard, news media affected their decisions on whether to receive the COVID-19 booster dose (38.5%, 10.7%, and 17.1% agreed, strongly agreed, and disagreed, respectively). Similarly, 32.1% of participants were neutral on family and friends' opinions affecting their decisions of whether to receive the COVID-19 booster dose, while 25.5% disagreed with that statement. The obtained data (Table 4) further demonstrated that male participants were 0.42 times more willing to accept the COVID-19 booster dose compared to female participants (95% CI: 0.217-1.038) with a *P*-value less than 0.05, which is significant. Participants with a family income group of M40 were 0.044 times less likely to accept the COVID-19 booster dose in comparison to the T20 group, which is significant beyond a *P*-value of less than 0.05 (95% CI: 0.015-1.123). The Omnibus Tests of Model Coefficients yielded a chi-square of 51.78 on 25 df, which is significant beyond 0.001. Therefore, adding variables mentioned in Table 4 could improve the model.

Based on data in Table 5, under perceived susceptibility, most of the participants agreed that the risk of COVID-19 infection is less likely to be high compared to having an extremely low risk of COVID-19 infection (95% CI: 0.018-0.641) with a *P* value less than 0.05, which is significant. Participants agreed that it is 0.043 times more likely for variants to have a higher risk of infection than the existing strains compared to those who strongly agree with that statement (95% CI: 1.053-31.461), which is significant as the *P* value is less than 0.05. Under the self-efficacy of HBM, the majority of the participants disagreed 0.001 times less likely easy to get the COVID-19 vaccine if wanted compared to those who strongly disagreed with it (95% CI: 0.005-0.289), which is significant since the

Table 2. Perceptions and Willingness of COVID-19 Booster Vaccination Acceptance Based on the Health Belief Model (N=467)

Variables	Frequency (N)	Percent
Perceived Susceptibility		
Risk of COVID-19 infection		
Very high	230	49.3
High	208	44.5
Neutral	25	5.4
Low	4	0.9
Very low	0	0
Variants have higher risk of infection than the existing strains		
Strongly agree	202	43.3
Agree	233	49.9
Neutral	28	6
Disagree	3	0.6
Strongly disagree	0	0
Perceived Severity		
Severity of COVID-19		
Very high	194	41.5
High	244	52.2
Neutral	24	5.1
Low	4	0.9
Very Low	0	0
Variants can cause more severe illness than the existing strains		
Strongly agree	197	42.2
Agree	235	50.3
Neutral	31	6.6
Disagree	3	0.6
Strongly disagree	0	0
Perceived Benefits		
Efficacy of boosters against early circulating strains		
Very high	176	37.7
High	221	47.3
Neutral	58	12.4
Low	7	1.5
Very low	5	1.1
Efficacy of boosters to extend protection		
Very high	169	36.2
High	231	49.5
Neutral	59	12.6
Low	5	1.1
Very low	3	0.6
Efficacy of boosters against variants		
Very high	173	37.0

Table 2. Continued

Variables	Frequency (N)	Percent
High	215	46.0
Neutral	63	13.5
Low	13	2.8
Very low	3	0.6
Perceived Barriers		
Safety of boosters		
Very high	173	37.0
High	221	47.3
Neutral	57	12.2
Low	10	2.1
Very low	6	1.3
Worry about serious adverse reactions after vaccination		
Very high	47	10.1
High	157	33.6
Neutral	168	36.0
Low	61	13.1
Very low	34	7.3
Self-efficacy		
It is easy to get the COVID-19 vaccine if wanted		
Strongly agree	85	18.2
Agree	197	42.2
Neutral	154	33.0
Disagree	28	6.0
Strongly disagree	3	0.6
Cues to Action		
Used to have confirmed or suspected cases in daily close contacts		
Yes	256	54.8
No	211	45.2
Know about at least one foreign variant		
Strongly agree	246	52.7
Agree	180	38.5
Neutral	32	6.9
Disagree	4	0.9
Strongly disagree	5	1.1
Willingness of Accepting COVID-19 Booster Dose		
If a COVID-19 booster is recommended as a supplement to the current vaccination schedule, would you accept it?		
Yes	432	92.5
No	35	7.5

Note. COVID-19: Coronavirus disease 19.

Table 3. Source of Information Regarding COVID-19 Booster Dose (N=467)

Variables	Frequency (N)	Percent
I have received sufficient information about COVID-19 booster dose.		
Strongly agree	257	55.0
Agree	148	31.7
Neutral	43	9.2
Disagree	15	3.2
Strongly disagree	4	0.9
News media affected the decision of whether to receive the COVID-19 booster dose.		
Strongly agree	50	10.7
Agree	180	38.5
Neutral	146	31.3
Disagree	80	17.1
Strongly disagree	11	2.4
Family and friends' opinions affected my decision on whether to receive the COVID-19 booster dose.		
Strongly agree	36	7.7
Agree	125	26.8
Neutral	150	32.1
Disagree	119	25.5
Strongly disagree	37	7.9

Note. COVID-19: Coronavirus disease 19.

P value is less than 0.05. The Omnibus Tests of Model Coefficients represented a chi-square of 140.569 on 37 df, which is significant beyond 0.001. Therefore, adding the mentioned variables (Table 5) could improve the model.

According to the obtained data (Table 6), Participants with neutral perceptions who think that it is easy for them to get the COVID-19 vaccine if they wanted to were 0.042 times less likely to accept COVID-19 booster dose compared to others (95% CI of 0.003- 0.556) with $P < 0.05$ ($P = 0.016$). Female participants who had neutral perception on that it is easy to get COVID-19 vaccine if they wanted to were 0.012 times less likely to accept COVID-19 booster dose compared to male participants which was significant with $P < 0.05$. Eventually, the participants were 0.034 times less likely to receive the second dose of COVID-19 vaccination by strongly agree on that the variant of COVID-19 has a higher risk of infection than the existing strains with a 95% CI of 0.124-2.049, which is significant since the *P* value is less than 0.05.

Sensitivity of this study was 99.3% which implied that if they were female who had neutral perception on that it is easy to get COVID-19 vaccine if they wanted to and those who received second dose of COVID-19 vaccine who strongly agreed that the variant of COVID-19 had a higher risk of infection than the existing strains had 99.3% chance of willingness to accept COVID-19 booster dose. The specificity of 45.7%, which meant that if you were male by not neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to and you received COVID-19

vaccination other than the second dose by not strongly agreeing that the variant of COVID-19 has a higher risk of infection compared to the existing strains; there was 45.7% chance of not willing to accept COVID-19 booster dose. However, overall, our prediction was correct out of 467 times for an overall success rate of 95.3%. According to Hosmer and Lemeshow test, since the *P* value was 0.995 (more than 0.05) and not significant, the data set fits well with the logistic model.

In this study, Cox and Snell's R-squared was 0.234. Thus, 23.4% of the willingness of accepting COVID-19 booster dose was explained by participants who were neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to, who were female participants by neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to and you received the second dose of COVID-19 vaccination by strongly agree that the variant of COVID-19 has a higher risk of infection than the existing strains.

The Nagelkerke R-squared was obtained as 0.566. It implied that there were 56.6% relationship between the willingness of accepting COVID-19 booster dose with those participants who had neutral perception on that it is easy for them to get COVID-19 vaccine if they wanted to, female participants those were neutral perception on that it is easy for them to get the COVID-19 vaccine if they wanted to and those received the second dose of COVID-19 vaccination who strongly agreed on that variant of COVID-19 have a higher risk of infection than the existing strains. Based on the result of the omnibus test of model coefficients, a chi-square of 124.288 was obtained on 35 df, which is significant beyond 0.001. Therefore, adding variables mentioned in Table 6 could improve the model. For checking the outliers, we had to save Cook's influential statistics; the cut-off point for Cook's influential statistics was 1.0. In our data, none was more than 1.0. Therefore, there were no influential outliers in our study.

According to the ROC curve (Figure 1), the models discriminated 95.0% (95% CI: 92.5-97.4) of the predicted willingness to accept the COVID-19 booster dose.

Discussion

This research was performed roughly four months after the implementation of the National COVID-19 Immunization Program in Malaysia. Malaysia had undergone 4 waves with the latest variant by date of this article being the Omicron variant, which became a dominant variant with an increase of sequence COVID-19 cases from 0.25% to 4% and rapidly escalated to 65% in just one month (8). In our research, 64.2% of our respondents were 18-39 years of age and participated in this survey, which aimed to measure their sociodemographic characteristics, perception, and willingness with regard to accepting COVID-19 booster vaccination based on the HBM (13). It was found that 92.5% of the respondents who participated in our survey were willing to accept the COVID-19 booster dose if

Table 4. Association Between Sociodemographic Variables on the Willingness to Accept COVID-19 Booster Dose in Malaysia Using Simple Logistic Regression (N = 467)

Variable	B	Wald	df	Crude Odds Ratio	95% CI (Lower)	95% CI (Upper)	P-value
Age							
Young adults (18-39)	-1.007	0.621	1	0.365	0.030	4.467	0.431
Middle adults (40-59)	-1.333	1.347	1	0.264	0.028	2.504	0.246
Older adults ≥60) ^{ref}							
Gender							
Male	-0.745	3.486	1	0.475	0.217	1.038	0.042
Female) ^{ref}							
Marital status							
Single	-15.487	0.000	1	0.000	0.000	-	1.000
Married	-14.988	0.000	1	0.000	0.000	-	1.000
Divorced	3.004	0.000	1	20.170	0.000	-	1.000
Widowed	-15.869	0.000	1	0.000	0.000	-	1.000
Others) ^{ref}							
Nationality							
Malaysian	-18.227	0.000	1	0.998	0.000	-	0.998
Non-Malaysian) ^{ref}							
Race							
Chinese	-17.818	0.000	1	0.000	0.000	-	0.998
Indian	-18.757	0.000	1	0.000	0.000	-	0.998
Malay	-17.437	0.000	1	0.000	0.000	-	0.998
Others) ^{ref}							
Education level							
No formal post-secondary	19.825	0.000	1	407157733.2	0.000	.	0.999
Primary	0.309	0.515	1	1.362	0.586	3.170	0.473
Secondary	18.113	0.000	1	73487334.82	0.000	.	0.999
Tertiary) ^{ref}	-0.004	0.000	1	0.996	0.269	3.689	0.996
Employment status							
Employed	-17.900	0.000	1	0.000	0.000	-	0.999
Others	-19.212	0.000	1	0.000	0.000	-	0.999
Retired	-17.764	0.000	1	0.000	0.000	-	0.999
Student	-18.201	0.000	1	0.000	0.000	-	0.999
Unemployed) ^{ref}							
Family income per month							
<RM 4849 (B40)	-0.641	0.362	1	0.511	0.057	4.555	0.548
RM 4850 – RM 10960 (M40)	-2.041	3.441	1	0.130	0.015	1.123	0.044
>RM 10960 (T20) ^{ref}							
Residency							
Rural	0.097	0.035	1	1.102	0.401	3.026	0.851
Urban) ^{ref}							
Are you a healthcare worker?							
No	-0.668	1.197	1	0.513	0.155	1.697	0.274
Yes) ^{ref}							
Are you vaccinated?							
Booster dose	1.122	5.542	1	3.070	1.207	7.813	0.019
First dose	18.101	0.000	1	726.783	0.000	-	0.999
Second dose) ^{ref}							
Not vaccinated	-	-	-	-	-	-	-

Note. COVID-19: Coronavirus disease 19; CI: Confidence interval.

Table 5. Association Between Perception Based on the Health Belief Model and Willingness to Accept COVID-19 Booster Dose Using Simple Logistic Regression (N = 467)

Variable	B	Wald	df	P-value	Crude Odds Ratio	95% CI	
						Lower	Upper
Perceived Susceptibility							
Risk of COVID-19 infection							
High	-2.225	6.002	1	.014	0.108	0.018	0.641
Low	-1.754	0.742	1	.389	0.173	0.003	9.372
Neutral	-1.363	0.722	1	.395	0.256	0.011	5.928
Very high	-	-	-	-	-	-	-
Very low ^{ref}	-	-	-	-	-	-	-
Variants have higher risk of infection than the existing strains							
Strongly disagree	-	-	-	-	-	-	-
Agree	1.750	4.079	1	0.043	5.756	1.053	31.461
Disagree	15.898	0.000	1	0.999	8023738.601	0.000	.
Neutral	0.695	0.197	1	0.657	2.003	0.093	43.063
Strongly agree ^{ref}	-	-	-	-	-	-	-
Perceived Severity							
Severity of COVID-19							
High	-15.756	0.000	1	1.000	0.000	0.000	.
Low	80.129	0.000	1	0.999	63028.000	0.000	.
Neutral	-13.197	0.000	1	1.000	0.000	0.000	.
Very high	-15.323	0.000	1	1.000	0.000	0.000	.
Very low ^{ref}	-	-	-	-	-	-	-
Variants can cause more severe illness than the existing strains							
Agree	1.594	3.107	1	0.078	4.926	0.836	29.005
Disagree	39.591	0.000	1	0.999	156345229024875392.000	0.000	.
Neutral	0.094	0.004	1	0.948	1.099	0.066	18.318
Strongly agree ^{ref}	-	-	-	-	-	-	-
Strongly disagree	-	-	-	-	-	-	-
Perceived Benefits							
Efficacy of boosters against early circulating strains							
High	-22.061	0.000	1	1.000	0.000	0.000	.
Low	-4.710	0.000	1	1.000	0.009	0.000	.
Neutral	-20.233	0.000	1	1.000	0.000	0.000	.
Very high	-22.007	0.000	1	1.000	0.000	0.000	.
Very low ^{ref}	-	-	-	-	-	-	-
Efficacy of boosters to extend protection							
High	56.688	0.000	1	.998	4160.000	0.000	.
Low	35.068	0.000	1	.999	1697.200	0.000	.
Neutral	54.049	0.000	1	.998	2972.000	0.000	.
Very high	57.974	0.000	1	.998	1506.000	0.000	.
Very low ^{ref}	-	-	-	-	-	-	-
Efficacy of boosters against variants							
High	63.771	0.000	1	0.999	4959.000	0.000	.
Low	42.144	0.000	1	0.999	2009.000	0.000	.
Neutral	61.138	0.000	1	0.999	3562.000	0.000	.
Very high	62.595	0.000	1	0.999	1530.000	0.000	.
Very low ^{ref}	-	-	-	-	-	-	-

Table 5. Continued

Variable	B	Wald	df	P-value	Crude Odds Ratio	95% CI	
						Lower	Upper
Perceived Barriers							
Safety of boosters							
High	-18.383	0.000	1	0.999	0.000	0.000	.
Low	-21.826	0.000	1	0.999	0.000	0.000	.
Neutral	-18.689	0.000	1	0.999	0.000	0.000	.
Very high	-19.333	0.000	1	0.999	0.000	0.000	.
Very low ^{ref}	-	-	-	-	-	-	-
Worry about serious adverse reaction after vaccination							
High	1.121	1.496	1	0.221	3.069	0.509	18.500
Low	2.377	3.221	1	0.073	10.768	0.803	144.324
Neutral	1.461	2.391	1	0.122	4.309	0.677	27.448
Very low	-	-	-	-	-	-	-
Very high ^{ref}	-	-	-	-	-	-	-
Self-efficacy							
It is easy to get the COVID-19 vaccine if wanted							
Agree	0.642	0.410	1	0.522	1.900	0.266	13.552
Disagree	-3.229	10.131	1	0.001	0.040	0.005	0.289
Neutral	.233	0.071	1	0.790	1.263	0.226	7.054
Strongly agree	-	-	-	-	-	-	-
Strongly disagree ^{ref}	-	-	-	-	-	-	-
Cues to Action							
Used to have confirmed or suspected cases in daily close contacts							
No	-0.337	0.299	1	0.585	0.714	0.213	2.389
Yes ^{ref}	-	-	-	-	-	-	-
Know about at least one foreign variant							
No	0.925	0.358	1	0.550	2.521	0.122	52.207
Yes ^{ref}	-	-	-	-	-	-	-

Note. COVID-19: Coronavirus disease 19; CI: Confidence interval.

Table 6. Association Between Sociodemographic Characteristics and Perception With the Willingness of Accepting COVID-19 Booster Dose Using Multiple Logistic Regression (N = 467)

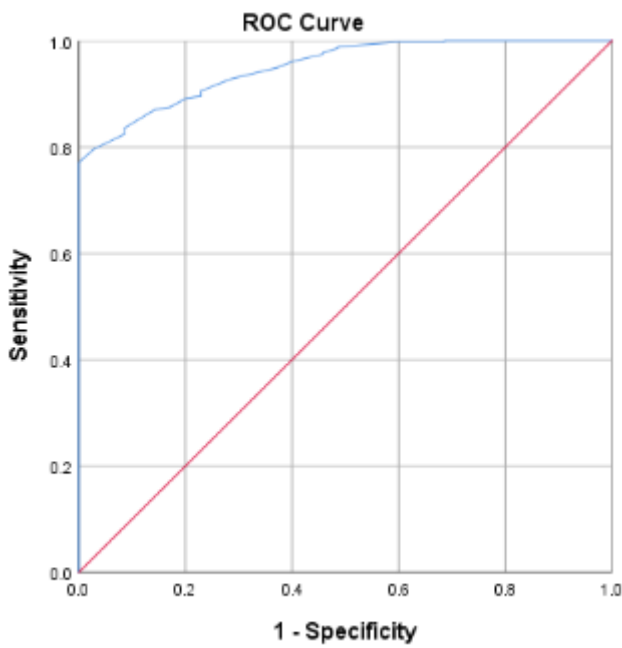
Variable	B	Wald	df	P Value	Adjusted Odds Ratio	95% CI	
						Lower	Upper
Neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to.	-3.172	5.782	1	0.016	0.042	0.003	0.556
Female by neutral on that it is easy for you to get the COVID-19 vaccine if you wanted to.	3.453	6.377	1	0.012	31.602	2.166	461.040
Second dose of COVID-19 vaccination by strongly agrees that the variants of COVID-19 have higher risk of infection compared to the existing strains.	-0.683	.914	1	0.034	0.505	0.124	2.049

Note. COVID-19: Coronavirus disease 19; CI: Confidence interval.

recommended as a supplement to the current vaccination schedule. This response recorded in our research may have been influenced by the government's decision of shortening the interval of boosted dose administration from six to three months for Pfizer and AstraZeneca COVID-19 vaccine recipients, and this was due to the

emerging Omicron threat (14).

Approximately 7.5% of the respondents are still unsure of accepting booster vaccination (15). This statement would be further investigated with how protection against the new circulating strains is associated with the willingness to accept. The main obstacle affecting their



Area Under the Curve				
Test Result Variable(s): Predicted probability				
Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.950	.012	.000	.925	.974

The test result variable(s): Predicted probability has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

- a. Under the nonparametric assumption
- b. Null hypothesis: True area = 0.5

Figure 1. ROC Curve to Discriminate Between Those Having Willingness to Accept COVID-19 Booster Dose and Those not having Willingness to Accept COVID-19 Booster Dose Among Adults in Malaysia. *Note.* COVID-19: Coronavirus disease 19.

acceptance is booster safety, which could be solved by building up people’s trust in the protection of boosters as 36% of the participants had a neutral opinion on serious adverse reactions after vaccination (16,17). This would be achieved by implementing the practice of monitoring the safety of boosters, which is also known as post-marketing surveillance (17,18). Some issues of concern to the fully vaccinated people were the recommendations of the vaccine and the necessity of receiving the vaccine again. Studies showed that the administration of mix and match COVID-19 boosters could provide long-lasting immunity to the COVID virus and its variants which the Malaysian officials support and agree with (19). This has created confusion among the general public as most individuals believe that getting the same brand of booster dose is safer and provides better protection which is a myth (20).

A study conducted in China aiming at evaluating the acceptance of COVID-19 booster vaccination had 84.80% of the respondents who were aged 18-59 years willing to accept the booster dose (2,21). In this study, the reason

for not accepting the booster dose was concerns related to vaccine safety and defense against current strains. Moreover in China, 92.8% of the citizens were willingness to pay for COVID-19 booster dose with Chinese Yuan (CNY) between 0 to 300 (22). On the other hand, the administration of COVID-19 booster dose is free of charge and on a voluntary basis in Malaysia, which has now become compulsory due to the Omicron threat (23). Research conducted in Jordan reported that 86.9% of its respondents had gotten vaccinated and 14.9% of its respondents are planning to get their booster dose administered (1,24). Based on the results of some studies conducted in Poland, 71% of participants were willing to accept the booster dose although 4.35 of them are unsure of it (13,24) They identified that 49.2% of their participants are not willing to accept the vaccine due to side effects they have experienced from previous COVID-19 doses, and most of them find the administration of booster dose to be unnecessary (25).

Our study was conducted based on the HBM, and it was proven that perceived susceptibility (95% CI: 0.018-0.641) and self-efficacy ($P < 0.05$) played an important role in the acceptance of the COVID-19 booster dose. As for the previous research in China, their findings revealed that perceived barriers (95% CI: (0.13-0.35) and perceived benefits (95% CI: 0.81-2.10) to vaccination were essential dimensions associated with the acceptance of COVID-19 boosters. However, perceived severity ($P = 1.00$), benefits ($P = 1.00$), barriers ($P = 0.99$), and cues to action ($P = 0.59$) were not significant predictors in our research (2,25). Prior studies reported that the effectiveness of vaccines is one of the important characteristics associated with the willingness of accepting the vaccine (15,26) Similarly, perceived barriers played a significant role where previous studies highlighted the vaccination for COVID-19, and it was pointed out that close surveillance should be organized on the development of booster vaccination (16,27). Moreover, eliminating barriers and enhancing health promotion would be important elements for increasing the willingness of accepting boosters among Malaysians. Hence, providing the public with clinically proven studies and delivering those results in condensed and accurate information would further increase the willingness to accept the boosters (27).

The multiple logistic regression of sociodemographic characteristics and perception with the willingness of accepting the COVID-19 booster dose indicated that female respondents were neutral on the COVID-19 booster vaccine being available easily, which is significantly 0.012 times higher as the odds ratio is 31.602. Further, the second dose recipients of the COVID-19 vaccine strongly agreed that variants of COVID-19 have a higher risk of infection compared to the existing strains, which is significantly 0.034 times less likely since the odds ratio is 0.505. These findings are incompatible with those of a similar study conducted in China which had a multiple logistic regression of those sociodemographic characteristics that

had participants aged 41-50 with higher education levels demonstrated significantly a lower booster acceptance rate, while employed or those prioritized for vaccination had higher booster acceptance (2,9). The relationship between sociodemographic characteristics and acceptance of the booster dose in this research provides preliminary results that would help shed light on the availability of COVID-19 booster doses and the risk of infection with the existing strains (9).

Additionally, more than 55% of them strongly agreed that they have received sufficient information about the COVID-19 booster. The Malaysian Ministry of Health has played a great part in being transparent while battling the pandemic by supplying sufficient and latest information to the general public. They have accomplished this by three vastly used platforms, including the Official Portal of the Ministry of Health, official Facebook, and Telegram accounts where they provided numerous infographics related to COVID-19 (22). In Jordan, 49.3% of participants were familiar with receiving the booster dose and 50.5% of them agreed to have previous knowledge of mixed vaccination programs (1,10). In addition, 38.5% of our participants agreed that news media affected their decisions of whether to receive the COVID-19 booster dose whereas 32.1% had a neutral opinion on the same statement. It is mentioned that during this pandemic, there has been a spike in misinformation about COVID-19 vaccines and their boosters by anti-vaxxers (11,24). To combat this, the Malaysian government has encouraged its people to always check the veracity of the COVID-19-related information with *Sebenarnya*, which is a portal created by the Malaysian Communications and Multimedia Commission (MCMC) or they can provide reports to MCMC itself (11,25,26).

There are several limitations that should be stressed in our research. Considering that this was a cross-sectional online survey, there are possibilities for some intrinsic weaknesses. There could be the existence of sampling bias in order to limit the representativeness of the possible outcome (12,20,21). This study attempted to reduce bias by finding a wide range of adult participants by the stratified sampling method. Moreover, in self-reported responses, there might have been recalling bias and a tendency to provide socially inclined responses. To reduce this bias, we conducted this study anonymously which would have enabled respondents to answer without any burdens. We hope future studies on this topic have more accuracy in order to avoid biases found in our research.

Conclusion

Overall, our research preliminarily identified a large group of participants willing to accept COVID-19 boosters in Malaysia. Furthermore, the study highlighted the need for joined-up solutions to end the pandemic, including the important role of international development assistance to support developing countries. This research could be used as a guide in Malaysia and other countries

in measuring factors influencing the COVID-19 booster dose acceptance in order to provide the public with better protection against the novel coronavirus.

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Conflict of Interests

There was no conflict of interests in this study.

Ethical Permissions

All the participants were provided with informed consent before the commencement of the survey. The ethical approval was acquired from the Centre of Research and Development, Asia Metropolitan University (HEC022022FOM0002), which was in accordance with the Declaration of Helsinki.

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