

ORIGINAL ARTICLE

Willingness to receive a COVID-19 booster vaccine and its associated factors among adults with chronic disease: A cross-sectional study in Putrajaya, Malaysia

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Abstract

Introduction: Booster vaccination has been shown to reduce transmission and serious infection with COVID-19. This study examined the willingness to receive a COVID-19 booster vaccine and its associated factors among high-risk patients at Klinik Kesihatan Putrajaya Presint 9.

Methods: A cross-sectional study was conducted among patients aged ≥ 18 years attending Klinik Kesihatan Putrajaya Presint 9 with a high risk of contracting COVID-19 recruited via systematic random sampling. Data were collected using a self-administered questionnaire. A multiple logistic regression analysis was performed to identify the associated factors.

Results: The response rate for this study was 97.4% (N=489). The median patient age was 55 years. Approximately 51.7% were men, and 90.4% were Malays. Approximately 81.2% were willing to receive a COVID-19 booster vaccine. The patients who perceived COVID-19 as a serious illness (Adjusted Odd Ratio, AOR=2.414), those who perceived COVID-19 booster vaccines as beneficial (AOR=7.796), those who disagreed that COVID-19 booster vaccines have many side effects (AOR=3.266), those who had no doubt about the content of COVID-19 vaccines (AOR=2.649) and those who were employed (AOR=2.559) and retired (AOR=2.937) were more likely to be willing to receive a booster vaccine than those who were unemployed and those who did not have close friends or family members who contracted severe COVID-19 (AOR=2.006).

Conclusion: The majority of the participants were willing to receive a COVID-19 booster vaccine. Healthcare authorities should take initiatives to design targeted public intervention programmes to increase the willingness for COVID-19 booster vaccination.

Introduction

The spread of COVID-19, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has led to the declaration of a global public emergency in early 2020.¹ The prevalence of COVID-19 hospitalisation and mortality is higher in older individuals and patients with underlying comorbidities, such as cardiovascular disease, diabetes mellitus, hypertension and obesity.² COVID-19 booster vaccination has been shown to be effective in reducing mortality among patients with COVID-19.³

The studies conducted by Lee et al. in the United States of America and Tung et al.⁴ in China revealed high willingness of participants to receive a booster vaccine against COVID-19 (96.2% and 91.1%, respectively).⁵ A study conducted in Israel showed that there was low willingness

to be vaccinated (19%).⁶ Locally, Wong et al. reported that only 43.4% of their participants were definitely willing to receive a COVID-19 booster vaccine.⁷ Some studies have incorporated the Health Belief Model (HBM) into their surveys. This model has been widely used as a framework for investigating psychosocial determinants of health behaviours and is recognised as a determinant of vaccination uptake.⁸ Age, sex, educational level, income and employment status have also been reported to be associated with the willingness to receive a COVID-19 booster vaccine.^{9,10}

The government has implemented initiatives to widen the availability of booster vaccines and stricter policies to impose some restrictions on susceptible individuals who have not received booster vaccines.¹¹ In Malaysia, healthcare providers and frontliners

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received booster vaccines during the first phase, followed by senior citizens.¹² As of December 2021, 89.1% of Malaysia's adult population was fully vaccinated.¹³ The government has started the booster programme since 19 September 2021 for the above-mentioned high-risk groups. However, participation has not been encouraging. By December 2021, only 19.3% of the population in Malaysia had received their booster vaccines compared with 57.4% in Chile, 50% in the United Kingdom and 40.6% in Singapore.¹⁴ By 27 February 2022, 61.7% of adults in Malaysia had received a booster dose. Putrajaya ranked the lowest in terms of the proportion of booster recipients.¹⁵

No study in Malaysia has evaluated the willingness to receive a COVID-19 booster vaccine among high-risk patients, among whom rolling out of booster doses should be prioritised. We conducted this study to assess the willingness to receive a COVID-19 booster vaccine and its associated factors among high-risk patients at a primary care clinic in Putrajaya.

Methods

Study design and setting

A cross-sectional study was conducted at Klinik Kesihatan Putrajaya Presint 9 in Putrajaya, which is the federal administrative centre of Malaysia with a population density of 2215 population/km². It is the second most densely populated state in Malaysia. Putrajaya is predominantly populated by Bumiputeras (97.9%), followed by Indians (1.2%) and Chinese (0.6%). Data were collected from 4 January 2022 to 28 February 2022.

Patients aged 18 years and above who attended Klinik Kesihatan Putrajaya Presint 9 and were considered to have a high risk of contracting COVID-19 were included. The following patients were considered to have a high risk for COVID-19: elderly patients (aged 60 years and above), obese patients (body mass index of ≥ 27.5 kg/m²) and patients diagnosed with underlying chronic diseases, such as diabetes mellitus, hypertension, dyslipidaemia, asthma, chronic heart disease, chronic liver disease, chronic kidney disease and cancer. We excluded patients who were unable to understand either Bahasa Melayu or English, were diagnosed with neurocognitive disorders and were pregnant.

The sample size was calculated using the G*Power Version 3.1.9.6 (Universität Kiel, Germany, 2020) Germany to detect a medium effect size of 0.5 (two-sided), taking into consideration a significance level of 0.05, power of 80% and binomial chi distribution using an odds ratio of 1.73 ('think their healthcare provider would recommend COVID-19 booster vaccine').¹⁶ The highest feasible number of samples was 540 participants after considering 20% of non-response.

Data collection

The data collection started from the registration counter. Patients who were attended to at the registration counter were assessed for eligibility using the inclusion and exclusion criteria following the arithmetic sequence of three numbers. The starting number between 1 and 3 was picked randomly using the lottery method. The first and subsequent participants were selected using the systematic random sampling method. Eligible participants were approached and given explanation regarding the purpose and nature of the study. Written consent was obtained after the explanation and after agreement to join the study. Participants who agreed to join the study sat in a designated area and were given a self-administered questionnaire to be filled out. Participants included in the pilot testing were excluded as part of data collection. These patients were tagged to ensure non-selection for the study. The researcher was nearby whenever the participants needed any assistance. After the participants finished answering the questions, the forms were returned to the researcher and checked for completeness.

The participants had to answer a set of newly developed self-administered questionnaires, either in English or Malay, depending on the participants' preference. The questionnaire was divided into five sections: A to E. Section A gathered information regarding sociodemographic and clinical profiles. Section B assessed the participants' knowledge on SARS-CoV-2 infection and COVID-19 vaccination. Thirteen questions were asked; each correct answer was given 1 point, while each incorrect answer or answer of 'not sure' was given 0 points. The total knowledge score was calculated. Section C consisted of items based on the HBM. It included five constructs: perception of susceptibility,

severity, barriers, benefits and cues to action. For each item, the participants selected either agree, disagree or not sure. In Section D, the participants were asked whether they had received their COVID-19 booster vaccine based on their primary series, the type of booster vaccine and the side effects. The participants were then asked to state their willingness to receive a COVID-19 booster vaccine either with yes, no or not sure. When the participants had not received any dose of a COVID-19 booster vaccine, they were diverted to Section E, where they were asked whether they would want to receive a COVID-19 vaccine in the future.

The content validity of the questionnaire was evaluated by two family medicine specialists

and one infectious disease specialist. Face validity testing was conducted among 50 patients from Klinik Kesihatan Putrajaya Presint 9. Cronbach's alpha was 0.71 for perception of susceptibility and severity, 0.70 for barriers towards willingness to receive a COVID-19 booster vaccine, 0.70 for cues towards willingness to receive a COVID-19 vaccine and 0.63 for knowledge of COVID-19. These 50 patients were not included in the final sample size. Once selected as part of the pretest study, the patients were tagged to ensure non-selection for the study.

Operational definition

The severity of COVID-19 is categorised as follows:

Table 1. Severity of COVID-19

Severity category	Definition
CAT 1	The first stage of COVID-19 severity involves a positive test result with no symptoms.
CAT 2	The second stage involves a positive test result with mild symptoms (e.g. weakness, fever and dry cough).
CAT 3	The third stage involves some form of pneumonia, hypoxemic respiratory failure, sepsis and septic shock.
CAT 4	The fourth stage involves difficulty in breathing, requiring oxygen support.
CAT 5	The last stage involves the need for intubation and ventilation.

Data analysis

The Statistical Package for the Social Sciences version 26.0 was used for the statistical analysis. Categorical data were reported as frequencies and percentages, normally distributed continuous data as means and standard deviations and non-normally distributed continuous data as medians and ranges.

Categorical data that contained $\geq 20\%$ cells with an expected count of less than 5 or any cell with an expected value of less than 1 were re-categorised into meaningful categories according to their significance from the literature review. These variables included ethnicity, educational level, employment status, response in the HBM construct (yes vs not sure/no) and willingness to receive a COVID-19 booster vaccine (yes vs not sure/no).

A bivariate analysis was performed to identify

the associations between the willingness to receive a COVID-19 booster vaccine (dependent variable) and the sociodemographic and clinical profiles, total knowledge score and items in the HBM construct (independent variables). We used multiple logistic regression to identify the determinants of the willingness to receive a COVID-19 booster vaccine. The level of significance was set at $P < 0.05$.

Results

A total of 489 respondents participated in this study. **Table 2** shows the sociodemographic and clinical profiles and total knowledge scores of the participants. The median age was 55 years. The majority were men, Malay, married, college/university graduates and government servants. The median household income was RM 3500. The most prevalent comorbidity was high blood pressure. The median total knowledge score was 11 points.

Table 2. Sociodemographic and clinical profiles and total knowledge scores of the study population (N=489).

Variable	n	%	Median (IQR)
<i>Age (year)</i>			55 (24)
<i>Sex</i>			
Male	253	51.7	
Female	236	48.3	
<i>Race</i>			
Malay	442	90.4	
Chinese	21	4.3	
Indian	23	4.7	
Others	3	0.6	
<i>Religion</i>			
Islam	448	91.6	
Buddha	12	2.5	
Hindu	16	3.3	
Christian	7	1.4	
Others	6	1.2	
<i>Marital status</i>			
Single	58	11.9	
Married	359	73.4	
Divorced	26	5.3	
Widowed	46	9.4	
<i>Educational level</i>			
No formal education	5	1	
Primary school	36	7.4	
Secondary school	196	40.1	
College/university	252	51.5	
<i>Employment status</i>			
Government servant	148	30.3	
Private sector	59	12.1	
Unemployed	98	20	
Self-employed	42	8.6	
Retired	142	29	
<i>Household income (RM per month)</i>			3500 (5000)
<i>Co-morbidities</i>			
Elderly	189	38.7	
Obesity	151	30.9	
Diabetes mellitus	175	35.8	
High blood pressure	312	63.8	
High cholesterol level	253	51.7	
Heart disease	27	5.5	
Asthma	49	10	
Others	26	5.3	
<i>Total knowledge Score</i>			11 (1)

IQR, interquartile range. Obesity was defined as a body mass index of ≥ 27.5 kg/m²; individuals aged ≥ 60 years were considered elderly. The total knowledge score was calculated as the total number of correct answers out of 13 questions.

Table 3 shows the knowledge on SARS-CoV-2 infection and COVID-19 vaccination.

Table 3. Knowledge on SARS-CoV-2 infection and COVID-19 vaccination of the respondents (N=489).

Variable for the knowledge questionnaire	True, n (%)	False, n (%)	Not sure, n (%)
1. COVID-19 is caused by SARS-CoV-2.	273 (55.8)*	24 (4.9)	192 (39.3)
2. COVID-19 is transmitted via close contact with an infected person.	467 (95.5)*	5 (1.0)	17 (3.5)
3. Fever	484 (99.0)*	1 (0.2)	4 (0.8)
4. Cough	483 (98.8)*	1 (0.2)	5 (1.0)
5. Loose stool	395 (80.8)*	54 (11.0)	40 (8.2)
6. Sore throat	477 (97.5)*	5 (1.1)	7 (1.4)
7. Loss of smell	479 (98.0)*	4 (0.8)	6 (1.2)
8. Various COVID-19 vaccines are currently available.	474 (96.9)*	3 (0.6)	12 (2.5)
9. Antibiotics are the main treatment for COVID-19.	167 (34.2)	184 (37.6)*	138 (28.2)
10. Washing the hands with soap and water and wearing a face mask can lower the risk of COVID-19 transmission.	469 (95.9)*	9 (1.8)	11 (2.2)
11. Patients with underlying chronic diseases are at a higher risk of infection and death from COVID-19.	452 (92.4)*	7 (1.4)	30 (6.1)
12. Patients who have received the full dose of COVID-19 vaccination will not contract COVID-19.	26 (5.3)	380 (77.7)*	83 (17.0)
13. Patients who have been infected with COVID-19 in the past will not benefit from COVID-19 vaccination.	16 (3.3)	413 (84.5)*	60 (12.3)

* indicates the correct answer

In response to the items in the HBM construct, the perceived severity of COVID-19, perceived susceptibility towards SARS-CoV-2 infection and perceived benefit of COVID-19 vaccination were considerably high among the participants. The majority of the participants disagreed with the barriers that might prevent them from receiving a COVID-19 vaccine. Most participants expressed trust in healthcare authorities and pharmaceutical companies that produce the COVID-19 vaccine, as demonstrated in [Table 4](#).

Table 4. Responses to the Health Belief Model construct (N=489).

Frequency, n (%)		Disagree	Not sure	Agree
General perception towards vaccination	In general, I am in favour of vaccination.	14 (2.9)	37 (7.6)	438 (89.6)
Perception of severity	In my opinion, COVID-19 is a severe illness.	37 (7.6)	50 (10.2)	402 (82.2)
Perception of susceptibility	I think I am at risk of contracting COVID-19.	76 (15.5)	64 (13.1)	349 (71.4)
	I think my family member(s) are at risk of contracting COVID-19.	81 (16.6)	56 (11.5)	352 (72.0)
Perception of benefit	I think that COVID-19 vaccines can prevent me from contracting COVID-19.	25 (5.1)	83 (17.0)	381 (77.9)
	I think that COVID-19 vaccines can also prevent other people around me from contracting COVID-19.	30 (6.1)	80 (16.4)	379 (77.5)
	I think that COVID-19 booster vaccines can confer additional protection against COVID-19.	35 (7.2)	134 (27.5)	320 (65.4)

Table 4. Continued				
Frequency, n (%)		Disagree	Not sure	Agree
Perception of barriers	I think that COVID-19 vaccines have many adverse effects.	232 (47.4)	146 (29.9)	111 (22.7)
	I consider COVID-19 vaccination as against my religious belief.	425 (86.9)	51 (10.4)	13 (2.7)
	I am doubtful of the content of COVID-19 vaccines.	314 (64.2)	109 (22.3)	66 (13.5)
	I believe that there is a hidden agenda underlying the COVID-19 vaccination programme.	300 (61.3)	148 (30.3)	41 (8.4)
	I will not receive a COVID-19 vaccine if I have to pay for it myself.	229 (46.8)	77 (15.7)	183 (37.4)
Cues towards actions	I trust the pharmaceutical companies that produce COVID-19 vaccines.	23 (4.7)	176 (36.0)	290 (59.3)
	I trust the healthcare authorities that recommend COVID-19 vaccination.	22 (4.5)	63 (12.9)	404 (82.6)
		No		Yes
	I have close friends or family members who have contracted severe COVID-19 (CAT 4 and 5).	354 (72.4)		135 (27.6)
	I have close friends or family members who have died from COVID-19.	382 (78.1)		107 (21.9)
	I have contracted COVID-19 in the past.	428 (87.5)		61 (12.5)
Severity of past infection*	CAT 1			9 (11.5)
	CAT 2			35 (57.4)
	CAT 3			9 (14.8)
	CAT 4			7 (11.5)
	CAT 5			3 (4.9)

* Severity of COVID-19. CAT 1: the first stage of COVID-19 severity, wherein patients test positive with no symptoms; CAT 2: the second stage, wherein patients test positive with mild symptoms (e.g. weakness, fever and dry cough); CAT 3: the third stage, wherein patients develop some form of pneumonia, hypoxemic respiratory failure, sepsis and septic shock; CAT 4: the fourth stage, wherein patients have difficulty in breathing, requiring oxygen support. CAT 5: the last stage, wherein patients require intubation and ventilation.

More than half of the study population received Pfizer BioNTech as their COVID-19 vaccine. More than half experienced no side effect. Among the side effects encountered, the most frequent side effect was fever, as shown in [Table 5](#).

Table 5. Type of COVID-19 vaccine received as the primary series and self-reported side effects and their severity (N=489).

Item	Dose 1		Dose 2	
	n	%	n	%
Type of vaccine				
Pfizer BioNTech (Comirnaty)	252	51.5	252	51.5
Sinovac (CoronaVac)	161	32.9	161	32.9
Oxford-AstraZeneca (ChAdOx1-S)	75	15.3	75	15.3
Unsure	1	0.2	1	0.2
Self-reported side effect				
No side effect	286	58.5	208	42.5
Pain, swelling or redness at the injection site	70	14.3	71	14.5
Fever	84	17.2	82	16.8
Chills	11	2.2	10	2
Tiredness	31	6.3	41	8.4

Table 5. Continued

Item	Dose 1		Dose 2	
	n	%	n	%
Self-reported side effect				
Headache	15	3.1	13	2.7
Dizziness	43	8.8	14	2.9
Muscle and joint aches	43	8.8	55	11.2
Itchiness	7	1.4	9	1.8
Nausea	3	0.6	5	1
Severe allergic reaction	2	0.4	3	0.6
Others	12	2.5	13	2.7
Severity of side effect				
No side effect	286	58.5	281	57.5
Mild	121	24.7	119	24.3
Moderate	63	12.9	65	13.3
Severe	18	3.7	23	4.7
Extremely severe	1	0.2	1	0.2

The majority of the participants were willing to receive a COVID-19 booster vaccine. For the participants who already received their COVID-19 booster vaccine (n=324, 66.3%), their willingness was implied. For the participants who had not received a COVID-19 booster vaccine (n=165, 33.7%), they were required to answer the following item: 'Are you willing to receive a COVID-19 booster vaccine in the future?'. Of the 165 participants, 73 answered yes, while 92 answered no/not sure. In sum, 397 (81.2%) and 92 (18.8%) participants were willing and not willing to receive a COVID-19 booster vaccine, respectively.

Multiple logistic regression revealed that the patients who perceived COVID-19 as a severe disease (AOR=2.414), those who perceived COVID-19 booster vaccines as beneficial (AOR=7.796), those who disagreed that COVID-19 booster vaccines have many adverse effects (AOR=3.266), those who were not doubtful of the content of COVID-19 vaccines (AOR=2.649), those who did not have close friends or family members who have contracted severe COVID-19 (AOR=2.006) and those who were employed (AOR=2.559) and retired (AOR=2.937) were more likely to be willing to receive a COVID-19 booster vaccine than those who were unemployed (Table 6).

Table 6. Multiple logistic regression analysis of the determinants of the willingness for COVID-19 booster vaccination (N=489).

Variable	Simple logistic regression		Multiple logistic regression		UL	P-value
	Unadjusted Odds Ratio	P-value	Adjusted Odds Ratio	95% CI LL		
COVID-19 is a severe illness; disagree/not sure	1		1			
Agree	2.506	0.001	2.414	1.218	4.788	0.012
COVID-19 booster vaccines can confer additional protection against COVID-19; disagree/not sure	1		1			
Agree	12.047	<0.001	7.796	4.236	14.346	<0.001
I think COVID-19 vaccines have many adverse effects; disagree/not sure	4.802	<0.001	3.266	1.761	6.056	<0.001
Agree	1		1			
Doubtful of the content of COVID-19 vaccines; disagree/not sure	8.537	<0.001	2.649	1.333	5.263	0.005
Agree	1		1			
Employment; unemployed	1		1			
Employed	2.861	<0.001	2.559	1.307	5.011	0.006
Retired	3.439	<0.001	2.937	1.337	6.449	0.007
I have close friends or family members who have contracted severe COVID-19 (CAT 4 and 5); yes	1		1			
No	1.718	0.027	2.006	1.084	3.71	0.027

Discussion

The objectives of this study were to determine the proportion of high-risk patients at Klinik Kesihatan Putrajaya Presint 9 who were willing and not willing to receive a COVID-19 booster vaccine and the associated factors. In this study, 81.2% of the participants were willing to receive a COVID-19 booster vaccine, and 18.8% were not. This proportion is quite high and is consistent with international reports.^{10,17,18} Higher proportions have been reported by Lee et al., Sugawara et al. and Tung et al.^{4,5,19} This could be attributed to the sociodemographic differences among the study populations. For example, Sugawara et al. recruited medical students as their participants, while Lee et al. recruited university students, who may have a younger age and a higher educational level than our population. These studies were also conducted at different stages of the pandemic. The study conducted by Porat in Israel showed that 19% of 97 unvaccinated participants reported that they intended to be vaccinated.⁶ This low willingness could be attributed to the implementation of 'vaccine passports', which could lead to a rebound phenomenon in the reduction in vaccination willingness. This could be explained by the fact that the implementation of the above-mentioned control measure has frustrated people's autonomy, motivation and willingness to be vaccinated.

Previous studies conducted locally to determine the willingness to receive primary COVID-19 vaccines have shown that the percentage of willingness has remained high. Lau et al. reported a percentage of willingness of 93.2% and Syed Alwi et al., 83.3%.^{20,21}

In our study, the employed participants were 2.5 times more likely to be willing to receive COVID-19 vaccines than the unemployed participants, while the retired participants were three times more likely to receive such than their counterparts. The present findings and previous reports are mixed. Lai et al. reported that employed participants were more likely to receive a COVID-19 booster vaccine than those retired/out of work/still a student (AOR=1.84).¹⁰ Other studies showed no significant difference between any category of employment status.^{20,21} The majority of the employed participants in our study were employed in the public sector (30.3%). Most of the retired population in Putrajaya was also previously working under the government.

The government of Malaysia has been actively advocating for all civil servants to receive COVID-19 vaccines, even making vaccination compulsory.²² This could be an additional motivation for this specific group to be vaccinated.

From the HBM construct, we found five factors that determined the willingness to receive a COVID-19 booster vaccine. This finding supports the use of the HBM model in studying and predicting individual changes in health behaviours.

The participants who considered COVID-19 a severe illness were more likely to be willing to receive a COVID-19 booster vaccine (AOR=2.414, P=0.012). Our findings are similar to those reported by Kabir et al. and Lau et al.^{20,23} Perceiving COVID-19 as a severe illness will likely motivate an individual to take an action to prevent it, as proven in previous studies for other infections as well.²⁴

The perception that booster vaccines confer additional benefit is another determinant in this study. This is similar to the findings by Klugar et al. and Lai et al. that not all participants who received an initial COVID-19 vaccine consented to a booster dose, and one of the determinants was the effectiveness of the booster in prolonging protection.^{10,25} In our study, although the perceived effectiveness of COVID-19 vaccines in preventing COVID-19 was high, this factor did not predict the willingness to receive a COVID-19 booster vaccine. This finding highlights the importance of educating people regarding the benefit of COVID-19 booster vaccination in reducing the risk of hospitalisation, severe illness and mortality compared with only primary COVID-19 vaccination.³

The participants who disagreed that COVID-19 booster vaccines have many serious side effects and those who were not doubtful of the content of COVID-19 vaccines were also more likely to be willing to receive a COVID-19 booster vaccine (AOR=3.266, P<0.001; AOR=2.649, P=0.005, respectively). Concerns about side effects have also been shown to be a significant barrier to receiving a COVID-19 booster vaccine in other studies.¹⁰ Bono et al. found that Malaysia had the highest proportion of participants who feared vaccine side effects.²⁶ In our study, 58.5% of the participants reported no side effects, and

only 3.9% reported severe or extremely severe side effects after receiving their first dose of COVID-19 vaccine. Thus, the perception of COVID-19 vaccines causing severe side effects was not based on their personal experience but on an external source, which may be inaccurate. According to vaccination reports for COVID-19 booster vaccines in Malaysia up to January 2022, the adverse event rate is as low as 0.1 per 1000 doses.²⁷ Fearmongering against vaccination has recently become prevalent, especially with the spread of uncorroborated stories on the internet.²⁸ One of the measures to increase public confidence on the safety of both primary COVID-19 vaccine dose and booster dose is compliance with post-marketing surveillance and refinement of compensation policies in the presence of adverse events.²⁹

The content of vaccines, even for other infectious diseases, has been a common controversial topic to discourage people from being vaccinated. For Muslims, utilisation of animal products may also raise the issue of vaccines being 'halal'.^{20,24} As a response, Mesyuarat Khas Jawatankuasa Ugama Islam declared that COVID-19 vaccines are *harus* (permissible).³⁰

We also noted that not having close friends or family members who have contracted severe COVID-19 (CAT 4 and 5) was positively associated with the willingness to receive a COVID-19 booster vaccine (AOR=2.006, P=0.027). The connection between these two variables may be complex. During the study period, almost 80% of the Malaysian adults had completed two doses of COVID-19 vaccine. Not having any friends or family members with severe COVID-19 might infer that COVID-19 vaccination is effective in preventing severe COVID-19, thus increasing the participants' confidence in the vaccine. Conversely, the vaccine may be perceived as futile if someone they know still contracted severe COVID-19 even after vaccination.

Wong et al. evaluated the intention to receive a COVID-19 booster vaccine and its associated factors in Malaysia in May 2022.⁷ However, our study is the first to be conducted in Malaysia to specifically evaluate high-risk groups regarding contraction of COVID-19 and development of complications. Furthermore, the study population highly needs additional protection conferred by

booster vaccines and should thus be the focus of increased uptake of the booster dose. Many previous similar studies have been conducted online. Conducting our study physically reduced recall bias by counterchecking information regarding the participants, such as their clinical profile and body mass index. The communication between the researcher and participants enabled the questionnaires to be answered more accurately. This study was able to identify the perceptions and barriers towards vaccination and provide insights into vaccine willingness. The findings can be used to educate the public regarding the importance and benefit of vaccination.

There are also a few limitations of this study. Some participants had already received a COVID-19 booster vaccine when this study was conducted. This might have altered their perceptions regarding their susceptibility towards COVID-19 and vaccine side effects. Further, the majority of the participants were Malay Muslims, which are essentially representative of the Putrajaya population. Accordingly, the findings could not be generalised to other high-risk populations. Lastly, the side effects were self-reported by the participants, causing possible recall bias.

The efficiency of COVID-19 vaccines does not only depend on its efficacy but also on the uptake among the population. This study offers insights for healthcare authorities to design effective vaccination extension strategies and deliver targeted public intervention programmes to improve COVID-19 booster vaccination coverage. Evidenced-based facts should be disseminated to the public to eliminate all inaccurate information and scaremongering tactics.

Conclusion

The majority of our participants were willing to receive a COVID-19 booster vaccine. This corresponds to many previous reports. HBM analysis revealed that the determinants of this willingness were perceived seriousness of COVID-19; perceived barriers, including concern over side effects and content of the vaccine; and cues to action towards COVID-19 booster vaccination, including having close friends or relatives who have contracted severe COVID-19. The sociodemographic characteristic that significantly predicted this willingness was the employment status.

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Author contributions

SMC and NSA conceptualized the study. NSA performed the data collection, data analysis and wrote the manuscript with advice from SMC and HFA. All authors revised the manuscript.

Ethical approval

This study received ethics approval from the Medical Research Ethics Committee (MREC), Ministry of Health, Malaysia on 1st April 2021 (NMRR-21-490-58986(IIR))

Conflicts of interest

All authors declare no conflicts of interest.

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Data sharing statement

Raw data are only available upon request.

How does this paper make a difference in general practice?

- This study examined the determinants of the willingness to receive a COVID-19 booster vaccine among high-risk patients at Klinik Kesihatan Putrajaya Presint 9 based on sociodemographic and clinical profiles, knowledge regarding COVID-19 and items in the Health Belief Model.
- This study evaluated high-risk patients, the most vital group of people who need COVID-19 booster vaccination considering its effectivity in reducing severe infection and mortality.
- The findings could assist public healthcare authorities in designing a targeted promotional and intervention programme to ensure an optimal coverage of COVID-19 vaccination among high-risk groups.

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