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ORIGINAL ARTICLE

Knowledge, Attitudes and Perceptions of Malaysian University Students Regarding COVID-19 Vaccination: An Online Cross-Sectional Survey

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ABSTRACT

Introduction: COVID-19 is a disease caused by the coronavirus SARS-CoV-2. Since the introduction of the national vaccination program in Malaysia, vaccine hesitancy has become a serious problem for the public authorities. This study determined the Knowledge, Attitudes, and Perceptions (KAP) of COVID-19 vaccination among university students in Malaysia. **Methods:** A cross-sectional study was conducted using a validated questionnaire of KAP on COVID-19 vaccination and distributed among targeted respondents. SPSS version 23 was employed for statistical analysis. 368 respondents were recruited. **Results:** Response rate of this survey was 95.58%. The mean age of participants in this study was 22.23 years (SD=2.35; range=18-33) with 286 female and 82 male respondents. Significant differences were detected between knowledge and area of study ($p<0.001$), income ($p=0.012$) and education ($p=0.047$). A significant difference was also detected between attitudes and living arrangement and risk of infection ($p=0.016$), race ($p=0.006$) and education ($p=0.003$), followed by a significant difference in perception based on chronic disease ($p=0.018$), living arrangement and risk of infection ($p=0.001$), area of study ($p=0.023$) and education ($p=0.049$). Pearson correlation analysis revealed that age was not significantly associated with KAP. A significant positive correlation was demonstrated between knowledge and attitudes ($r=0.21$, $p<0.001$), followed by knowledge and perception ($r=0.20$, $p=0.001$) and attitudes and perception ($r=0.76$, $p<0.001$). **Conclusion:** Generally, the respondents had good knowledge, positive attitudes, and a positive perception of COVID-19 vaccination. This finding may support future awareness strategies that can be used to convey messages on the importance of vaccination.

Keywords: Knowledge; Attitudes; Perception; COVID-19 vaccination; University students

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INTRODUCTION

COVID-19 is a well-known virus found in December 2019 in Wuhan, China (1). COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, which was recently found. The first case in Malaysia emerged on 24 January 2020 when a tourist from China was travelling passing through the border of Malaysia from Singapore (1). This started as the first wave in Malaysia. Since then, the Ministry of Health Malaysia has been working with the WHO Country Office in Malaysia to respond to the pandemic (1). As of 18 October 2020, the total number of local and imported cases was at 2,396,121 and active cases were still up to 89,173 cases (2). The Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJAV) was established on October 14, 2020, to manage the first formulation strategy on National COVID-19 Immunisation Programme, implementation, and monitoring. On January 5, 2021, the Public Accounts Committee approved the COVID-19 national vaccination recruiting strategy, and Malaysia got the first vaccines in February 2021 and Malaysia's National Immunisation Program began on February 24 with 43,881 doses given (3).

Vaccines have long been recognised as valuable interventions for reducing and preventing many diseases globally (4). Since the national vaccination program was introduced to the Malaysian public, vaccine hesitancy has become a serious problem faced by public authorities. Before the delivery of the appropriate vaccines, misinformation rumours about COVID-19 vaccines were widely propagated and even constantly shared on social media sites (5). Studies done by Betsch et al. and Nan et al. found that exposure to vaccine-critical websites and blogs has a negative impact on the decision to vaccinate (6,7). Given the availability of COVID-19 vaccines, there is little information available in Malaysia about public knowledge, perception, and attitudes toward the vaccines.

Therefore, this study will provide new insight into the factors that influence the decision to take the vaccine among Malaysian university students during the national immunisation program. Hence, this study aimed to assess the knowledge, attitudes, and perception of COVID-19 vaccination among university students in Malaysia.

MATERIALS AND METHODS

Sampling Method

This is an online-based cross-sectional study involving all Malaysian university students across Malaysia who were recruited randomly with a snowball sampling method and an online Google Forms questionnaire was shared via an access link to online platforms including Facebook, WhatsApp, Instagram and Twitter. Other incentives for pre-contacting potential participants (8) were done by emailing the Student Representative Council of various universities in Malaysia. The sharing then escalated by their family, friends and acquaintances from January to April 2022. The inclusion criteria are undergraduate and postgraduate students that are registered under any institute of higher education in Malaysia, giving their consent to fill in the form and understand English. Meanwhile, exclusion criteria are Malaysian students studying abroad, aged below 18 and who are in Malaysian Matriculation or STPM.

Sample size

The Raosoft calculator was utilised (9) for sample size calculation and advised a minimum sample size of 385 people needed at a 5% margin of error, a 95% confidence interval (CI) and a population size of 1.3 million at a 50% response distribution. As of November 3, 2020, the total number of students registered in higher education institutions in Malaysia is 1.3 million, according to Amir Hamzah Md. Isa, President of Malaysia's National Bumiputera Private Higher Education Institutions (10).

Study Instrument

The research instrument was a self-administered questionnaire and was written in the English language. The questionnaire consisted of four parts composed of social demographics, knowledge, attitudes, and perception of the COVID-19 vaccination that was adapted and modified from the previous studies (4,9). Details are shown in Tables I and II.

Knowledge was assessed using a 7-item questionnaire (Table I), and attitudes and perceptions were assessed using a 10-item questionnaire, respectively (Table II). For knowledge, the correct answer "Yes" to every

Table I : KAP on the COVID-19 vaccination (n=368).

Knowledge							
No	Statement	Yes		Not sure		No	
		n	%	n	%	n	%
1	COVID-19 vaccines are using inactivated coronavirus as the antigen.	223	60.6	131	35.6	14	3.8
2	COVID-19 vaccines are using genetic material from coronavirus as the active ingredient.	207	56.3	142	38.6	19	5.2
3	COVID-19 vaccine will stimulate human bodies to produce antibody to combat COVID-19 infection.	308	83.7	52	14.1	8	2.2
4	The vaccine production is involving animal study, 3 phases of clinical trials and it will be evaluated by the authority to ensure safety and its efficacy.	150	40.8	202	54.9	16	4.3
5	COVID-19 vaccines are administered via injection.	330	89.7	35	9.5	3	0.8
6	COVID-19 can have side effect.	332	90.2	29	7.9	7	1.9
7	Protective immunity against COVID-19 infection will be achieved 14 days after completion of COVID-19 vaccination (after second dose of a 2-dose series, or after one dose of a single-dose vaccine).	276	75.0	81	22.0	11	3.0

Table II : Attitudes and Perception on the COVID-19 vaccination (n=368).

Attitudes

No	Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
		n	%	n	%	n	%	n	%	n	%
1	I will accept COVID-19 vaccine without any hesitation.	166	45.1	110	29.9	66	17.9	17	4.6	9	2.4
2	I engage in any preventive measures such as wearing mask or visor, applying social distancing, frequent hand washing, use sanitiser or avoiding crowded places.	253	68.8	75	20.4	39	0.6	0	0	1	0.3
3	I believe that the COVID-19 vaccine will help to protect the people who take it.	185	50.3	111	30.2	61	16.6	8	2.2	3	0.8
4	I prefer to acquire immunity against COVID-19 by vaccination rather than natural infection (by having the disease/subclinical infection).	184	50.0	87	23.6	80	21.7	11	3.5	4	1.1
5	I value the advice of health professionals regarding the effectiveness of the COVID-19 vaccines.	192	52.2	116	31.5	55	14.9	4	1.1	1	0.3
6	I will also encourage my family/friends/relatives to get vaccinated.	207	56.3	93	25.3	52	14.1	12	3.3	4	1.1
7	I believe the comprehensive information on COVID-19 vaccines on social media was helpful to me.	157	42.7	129	35.1	66	17.9	14	3.8	2	0.5
8	I believe vaccines for COVID-19 will reduce my chances of becoming infected with the disease.	162	44.0	123	33.4	66	17.9	11	3.0	6	1.6
9	I will help to spread valid information (from reliable sources) of COVID-19 vaccine to the public to any platforms such as social media.	168	45.7	110	29.9	70	19.0	16	4.3	4	1.1
10	I believe that the government of Malaysia is handling the COVID-19 health crisis very well.	101	27.4	88	23.9	120	32.6	34	9.2	25	6.8

Perception

No	Statement	Strongly Agree		Agree		Neutral		Disagree		Strongly Disagree	
		n	%	n	%	n	%	n	%	n	%
1	Do you think COVID-19 are dangerous?	241	65.5	77	20.9	38	10.3	10	2.7	2	0.5
2	Do you aware that you can spread the virus to other people if you are infected?	276	75.0	64	17.4	25	6.8	2	0.5	1	0.3
3	Do you think COVID-19 vaccine are safe?	118	32.1	130	35.3	95	25.8	17	4.6	8	2.2
4	Do you think it is important to get vaccinated to protect people from COVID-19 infection?	195	53.0	119	32.3	44	12.0	6	1.6	4	1.1

5	Do you think waiting period for COVID-19 vaccines through MySejahtera is long?	139	37.8	112	30.4	90	24.5	18	4.9	9	2.4
6	Do you worry about the adverse effect of COVID-19 vaccines? (Adverse effect includes fever, fatigue, headache, muscle pain, chills, diarrhea, and pain at the injection sites)	116	31.5	128	34.8	80	21.7	31	8.4	13	3.5
7	Do you agree that scary information about COVID-19 vaccines is out of control on social media?	142	38.6	104	28.3	93	25.3	22	6.0	7	1.9
8	Do you think that COVID-19 vaccination should become a mandatory?	166	45.1	97	26.4	81	22.0	14	3.8	10	2.7
9	Do you think that herd immunity will be reached in Malaysia when the society are vaccinated?	154	41.8	119	32.3	74	20.1	19	5.2	2	0.5
10	Do you think that if everyone is vaccinated and maintains the preventive measures, the pandemic can be eradicated in Malaysia?	159	43.2	115	31.3	66	17.9	22	6.0	6	1.6

question will carry 1 mark, and “No” will carry a 0 mark (11). “Not sure” was added for frequency test analysis. As for attitudes and perception, a five-point Likert scale was utilised (From 1-strongly disagree to 5-strongly agree). High scores indicate to better positive attitudes and perceptions of COVID-19 vaccination (12). Score range interpretation that was used for knowledge: Low = 0.00-0.49, Moderate = 0.50-0.79, Good = 0.80-1.00. Meanwhile, score range interpretation for attitudes and perception: Poor/Negative = 1.00-2.60, Neutral = 2.70-3.40, Good = 3.50-5.00.

Pilot and Validation Study

A pilot study was done with 64 items and Cronbach’s alpha (CA) for the survey questionnaire was acceptable for knowledge (α = 0.66), perception (α = 0.78) and for attitudes (α = 0.92) the value was considered good. The value of CA for the pilot study and the collected participants were acceptable and the data was combined to increase the efficiency of the main study (13). The validity test consisted of face and content validity done by two experts in the related field and overall, the questions were clear and acceptable.

Data Analyses

SPSS version 26 was used to analyse data. Descriptive statistics were used to determine a population’s characteristics, knowledge, attitudes, and perception. Independent t-test and One-Way ANOVA test were used to analyse significant differences between KAP and sociodemographic characteristics. As for knowledge, “not sure” was analysed separately from the descriptive test, independent t-test, One-Way ANOVA test and Pearson correlation test. Under the Independent t-test, sociodemographic that were assessed such as gender, marital status, area of study, the status of living with someone who is at risk of getting COVID-19, status of chronic diseases, and infection status for themselves and their family members or friends. For One-Way ANOVA, sociodemographic that were assessed are race, income, education and living arrangement. Pearson correlation test was used to analyse the significant correlation between KAP and age and between KAP domains. The response rate was analysed to give an insight on how the survey is performing.

Ethics Approval

The university’s Institutional Ethics Committee approved this study (reference code: MSU-RMC-02/FR01/12/L1/126). Participants informed consent was obtained, and they were given a choice to refuse consent to participate or to pull out from the study at any time. All information was kept confidential.

RESULTS

Response Rate

From this study, the average of online survey response rate is 95.58% which indicates that sending an online survey to more participants will generate a higher response rate.

Sociodemographic Data

A total of 368 respondents participated in this online survey. The mean age was 22.23 years (SD=2.35; range=18-33) with 286 of the respondents being female and 82 male. The detailed characteristics of the respondents are shown in Table III.

Table III : Sociodemographic profile of Malaysian university students (n=368).

Variables	Categories	Number (n)	Percentage (%)	Age		
				MeanSD	Min	Max
Gender	Male	82	22.3	22.01 2.323	18	30
	Female	286	77.7	22.29 2.358	18	33
	Total	368	100	22.23 2.350	18	33

Variables	Categories	n	Percentage (%)
Age	18-21	137	37.2
	22-25	208	56.5
	26-29	18	4.9
	30-33	5	1.4
Race	Malay	163	44.3
	Chinese	123	33.4
	Indian	61	16.6
	Others	21	5.7
Income	B40 (Less than RM 4850)	272	73.9
	M40 (RM 4850 - 10970)	80	21.7
	T20 (Above RM 10971)	16	4.3
Education	Certificate or diploma	104	28.3
	Bachelor's degree	253	68.8
	Master's degree	11	3.0
Marital status	Single	362	98.4
	Married	6	1.6
Living arrangement	Live alone	114	31.0
	With others (not children)	202	54.9
	With others (including children)	52	14.1
Do you have chronic disease?	Yes	13	3.5
	No	355	96.5
If yes please specify your chronic disease	Asthma	4	1.1
	Hyperthyroid	2	0.5
	Leukemia	1	0.3
	Mosaic turner	1	0.3
	Secondary young hypertension	1	0.3
	Systemic lupus erythematosus(SLE)	2	0.5
	Confidential	2	0.5
Have you beeninfected withCOVID-19?	Yes	57	15.5
	No	311	84.5
Have your family members or friends been infected withCOVID-19?	Yes	267	72.6
	No	101	27.4
Have you lived with someone who is at higher risk of getting severe COVID-19 infection?	Yes	139	37.8
	No	229	62.2

Area of study	Health sciences	162	44.0
	Non-health sciences	206	56.0
Source of information	Healthcare personnel, scientists	178	48.4
	Mass media (i.e., television, general interest magazines)	257	69.8
	Social media (i.e., Facebook, Twitter, Instagram, WhatsApp)	323	87.8
	YouTube or similar web channel.	92	25
	Others (i.e., Google, from university, from course studied in the university)	3	0.8
Reasons of getting vaccinated	Because of effectiveness.	240	65.2
	Suggestion from doctors or Ministry of Health.	222	60.3
	Number of positive COVID-19 cases.	211	57.3
	Health status.	162	44
	Free vaccination.	178	48.4
	Duration of protection.	99	26.9
	Age.	38	10.3
	Type of vaccine offered to you.	108	29.3
	Country that produces the vaccine.	26	7.1
	Number of vaccine doses.	25	6.8
	Suggestion from family and friends.	112	30.4
	Others (i.e., after reading anddoing own research on the vaccine website, to go out, dine in and go on vacations, do not know the reason and being forced to do so).	4	1.1

Knowledge

The statement "COVID-19 can have side effect", had the most percentage of correct answers (90.2%). Table I shows the details of knowledge questions and percentages for each statement. The overall knowledge of Malaysian university students was good, based on Table IV. Table V shows positive significant differences in knowledge and area of study (p<0.001). The One-Way ANOVA test shown in Table VI indicates a positive significant difference between knowledge and income (p=0.012) and education level (p=0.047). No correlation was found between attitudes and age.

Attitudes

Table II shows the details on attitudes and perception questions followed by percentages for each statement. For attitudes, the statement "I engage in any preventive measures such as wearing mask or visor, applying social distancing, frequent hand washing, use sanitiser or avoiding crowded places", had the most correct answer (68.8%). Overall attitudes of Malaysian university students are also good, based on Table IV. The Independent t-test in Table V shows a positive significant difference between attitudes and living with a high-risk individual (p=0.016). ANOVA test in Table VI also revealed a positive significant difference between race (p=0.006) and education (p=0.003). No correlation was found between attitudes and age.

Perception

In Table II, statement for "Do you aware that you can spread the virus to other people if you are infected?" had the most correct answer at 75%. Based on Table IV, overall, students' perception was considered good. There was a positive significant difference between attitudes and participants and chronic disease (p=0.018), living with a high-risk individual (p=0.001), area of study (p=0.023), and education level (p=0.049) based on Tables V and VI. No correlation was also found between age and perception.

Knowledge has a significant association with attitudes and perception.

There is a weak positive and significant association between the knowledge and attitudes domain (r = 0.21, p-value < 0.001). Therefore, this finding indicated that positive attitudes have significantly improved as knowledge increases but the effect is small. Other than that, there was a weak

Table IV : Overall KAP of the respondents

Domain	Mean (M)	Standard Deviation (SD)	Score range	Interpretation
Knowledge	0.82	0.17	0.0-1.0	Good
Attitudes	4.18	0.69	1.0-5.0	Good
Perception	4.14	0.55	1.0-5.0	Good

Descriptive statistics. Score range interpretation for knowledge: Low = 0.00-0.49, Moderate = 0.50-0.79, Good = 0.80-1.00. Score range interpretation for attitudes and perception: Poor/Negative = 1.00-2.60, Neutral = 2.70-3.40, Good = 3.50-5.00.

Table V : Difference of KAP based on sociodemographic profiles

Knowledge

Sociodemographic	Mean (M)	Standard Deviation (SD)	df	t	*p*-value
Area of study					
• Health sciences	0.87	0.14			
• Non-health sciences	0.78	0.17	284.893	4.85	**<0.001**

Attitudes

Sociodemographic	Mean (M)	Standard Deviation (SD)	df	t	*p*-value
Have you lived with someone who is at higher risk of getting severe COVID-19 infection?					
• Yes	4.29	0.68	366	2.43	**0.016**
• No	4.11	0.70			

Perception

Sociodemographic	Mean (M)	Standard Deviation (SD)	df	t	*p*-value
Do you have chronic disease?					
• Yes	4.49	0.49			
• No	4.13	0.55	366	2.38	**0.018**
Have you lived with someone who is at higher risk of getting severe COVID-19 infection?					
• Yes	4.26	0.51	366	3.44	**0.001**
• No	4.06	0.56			
Area of study					
• Health sciences	4.21	0.54			
• Non-health sciences	4.08	0.55	366	2.28	**0.023**

Significant level was set at p<0.05.

positive and significant association between the knowledge and perceptions domain (r = 0.20, p-value = 0.001). Therefore, this showed that the higher the knowledge, the better the perception of COVID-19 vaccination even though the effect is also small.

Attitudes have a significant association with perception.

Based on the correlation test, a strong and significant association between attitudes and perception domain (r = 0.76, p-value < 0.001) . This indicates that the perception has significantly improved as positive attitudes increase.

Table VI : Comparison of KAP based on sociodemographic characteristics

Knowledge								
		Descriptives	One-Way ANOVA			Post-hoc Tukey HSD		
		Mean (M)	df	*F*	Sig.	(I)	(J)	Sig
Income	B40	0.81	2,284	4.49	**0.012**	B40	M40	**0.013**
	M40	0.88						
	T20	0.78						
Education	Certificate or diploma	0.78	2,284	7.82	**0.047**	Certificate or diploma	Bachelor's degree	**0.054**
	Bachelor's degree	0.84						
	Master's degree	0.87						

Attitudes								
		Descriptives	One-Way ANOVA			Post-hoc Tukey HSD		
		Mean (M)	df	*F*	Sig.	(I)	(J)	Sig.
Race	Malay	4.19	3,364	4.19	**0.006**	Indian	Malay Chinese	**0.047** **0.005**
	Chinese	4.28						
	Indian	3.92						
	Others	4.35						
Education	Certificate or diploma	3.98	2,365	5.91	**0.003**	Certificate or diploma	Bachelor's degree	**0.002**
	Bachelor's degree	4.25						
	Master's degree	4.32						

Perception								
		Descriptives	One-Way ANOVA			Post-hoc Tukey HSD		
		Mean (M)	df	*F*	Sig.	(I)	(J)	Sig.
Education	Certificate or diploma	4.03	2,365	3.04	**0.049**	Certificate or diploma	Bachelor's degree	**0.043**
	Bachelor's degree	4.18						
	Master's degree	4.22						

Significant level was set at p<0.05.

DISCUSSION

Knowledge

This study demonstrated that university students in Malaysia have good knowledge of COVID-19 vaccination. Other studies at the University of Antwerp, Belgium, and the University of Pisa, Italy showed that the students possess high knowledge of COVID-19 vaccines (14). This might be due to the students having better access to information on the COVID-19 vaccine that the general population (15). On the other hand, majority of the participants (54.9%) are not sure about the statement "The vaccine production is involving animal study, 3 phases of clinical trials and it will be evaluated by the authority to ensure its efficacy." This might be due to uncertainty on the clinical trials information that has been circulated online since half of the participants (56%) were in the non-health sciences study area. To support this discussion, around 323 students (87.8%) chose social media as their platform for the source of information in this study. Often, anti-vaccine viewpoints are widespread in social media. This might cause confusion and worries to the public or there is not much information on the clinical trials that was shared online by the government. A study that was done by Wong, 2023 that gathered public sentiment and responses by Malaysian social media users' messaging and commenting activities regarding the soon-available COVID-19 vaccine on Facebook shows that 74 participants depicted worries about the safety of COVID-19 vaccine, as there is a question where participants are in doubt on its experimental phase. Moreover, participants were also curious about the halal status and the use of mRNA technology in vaccine development. These problems might be prevented if the efforts focus on counteracting concerns uncovered in the study by promoting more information on how the clinical phase was done to make sure the safety of the vaccine (16).

Other than that, the results of participants who tend to choose 'not sure' also might be affected by participants who may interpret the midpoint (not sure) differently. A study that was done by Baka, 2012 stated that the midpoint is made up primarily of two groups of participants: non-attitude and undecided. Further investigations were done on how participants interpreted the midpoint in the questionnaire by having participants justify their responses. The results found that there are four justifications for choosing the midpoints: (i) lack of knowledge or indifference; (ii) participants felt ambivalent; (iii) participants were disputing aspects of the questions; or (iv) participants were indicating that they had no information on the issue (17,18). Further research needs to be done to investigate participants' exact interpretation of survey research.

This study also shows that the health-science students have significantly more knowledge of COVID-19 vaccination than non-health science students in the study, even though most respondents are from non-health science majors. To support this finding, a recent study from China among college students showed medical students tend to have better knowledge than those students from other majors (19). One possible reason for this finding is that students from other majors did not receive professional teaching on COVID-19 vaccination. Therefore, to improve the knowledge gap, schools should carry out various forms of lectures, leaflets, or knowledge contests to improve the knowledge gap (19). M40 participants possessed better knowledge than B40, indicating that the higher the income level, the higher the knowledge. Moreover, bachelor's degree students have good knowledge than certificate or diploma students. In sync with the study among Palestinians suggested that participants with higher education, bachelor's degree, and above are found to have higher knowledge scores compared with a lower level of education (20). This study suggested that higher education levels, higher income, were significantly associated with higher knowledge. A recent study that was done for the Malaysian population also showed that higher education levels, higher income, and living with high-risk individuals were significantly associated with higher knowledge scores (9). However oppositely, this study found students that who lived with high-risk individuals were not significantly associated with knowledge.

It is interesting to note that the Pearson correlation test also showed that knowledge levels did not change or really got better with age. Because the majority of the participants in this study were between the ages of 18 and 33, it is possible that during the pandemic phase, they received more accurate information about vaccination from their universities or other sources than they would have before the epidemic began. Prior to the COVID-19 infection, they might have relied only on the knowledge they acquired during training or when they enrolled in a vaccination program at the university. In contrast, a 2018 study on general vaccination revealed that age influences knowledge, attitudes, and confidence when examining the relationship between survey responses and the intention to vaccinate. Even though the age range was limited to students aged 18 to 20, 21 to 24, and under 25, older students nevertheless received higher marks (14). Factors that may contribute to these findings are the period when medical students received training on vaccinology in their university. Some might receive training later rather than earlier in their study, and older respondents may likely join the meningococcal health campaign a year before the study is conducted (14).

Attitudes

This study demonstrated good attitudes among Malaysian university students regarding COVID-19 vaccination. This might be due to the constant implementation of protective measures in universities or the public due to the emergence of new COVID-19 variants. In comparison, a study in China found that the attitudes of university students had the lowest score rate, and this is because the COVID-19 epidemic was slowing down and causing many students to believe that another wave is not likely to happen and the risk of infection is low (19). Minister of Higher Education of Malaysia, Noraini Ahmad, stated that students of higher education must be fully vaccinated to enter the campus and the Ministry of Higher Education will organise a campaign to get students vaccinated (21). This may be a factor that contributes to the results in this study that most students showed an excellent attitude. It was also found that the students who live with high-risk individuals show a significant association with attitudes. This finding indicated that students who lived with people at higher risk of getting severe COVID-19 infection have significantly more positive attitudes about COVID-19 vaccination than those who did not.

This might be because the students have better access to knowledge and preventive methods when living with high-risk individuals, leading to them protecting themselves more than other groups. On the other hand, they are aware that they will infect high-risk individuals if they are not protected. A study done among nurses and midwives showed that the main reasons for vaccination were the need for immunisation to protect themselves and their families (22).

This study also found that race and education level were significantly associated with attitudes. Different from knowledge, for attitudes, only Malay and Chinese students tend to have a better positive attitude than Indian students. Others show no association with other races. However, the results in this study may have been affected by the relatively smaller number of Indian students or the chances that different beliefs and intentions might affect the attitudes. A study that was done in Malaysian public universities regarding vaccination, in general, shows that medical student participants have more positive religious attitudes regarding vaccination, and the study discovered a difference in religious beliefs. This might be caused by the changes in the mindset of those involved in the medical course, debating that prevention measures such as vaccination should be assessed by the overall potential benefits while understanding that no preventive care is free from any risks (23). Other than that, bachelor's degree students tend to have better positive attitudes than certificates or diplomas—however no significant association between master's degree students with attitudes at this point. The Pearson correlation test revealed no significant correlation between attitudes and age. Interestingly, this is the first study that reports the effect of age on attitudes. A study done by Ilogu et al. shows that vaccine attitudes are influenced by age. However, the impact of age on attitudes was found to be conflicting, with other studies reporting improved confidence with increasing age while others suggesting inversely (14).

Perception

This is the first study to evaluate Malaysian university students' perception of COVID-19 vaccination. Overall, the perception of Malaysian university students was good on COVID-19 vaccination. Interestingly, this study found that the students with chronic disease, living with high-risk individuals, and the area of study were significantly associated with perception. This study suggested that participants who have chronic diseases have significantly more good perceptions in comparison with participants who are not having any chronic diseases. However, a study by Mohamed et al.,2021 reported that even though the overall perception of Malaysians was good, those with existing chronic diseases showed lower COVID-19 vaccination rates (9). COVID-19 patients with cardiovascular disease, hypertension, diabetes, congestive heart failure, chronic renal disease, and cancer have been demonstrated to have a higher risk of mortality (24). Hence, more information should be shared towards this group of patients. Based on the post-hoc test, this study also suggested that bachelor's degree students possessed significantly better perceptions compared to certificate or diploma students. However, there was no significant difference between bachelor's and master's degree students on separate analyses. On the other hand, a study that was done in Turkey showed that the participants with secondary school education or below than those with bachelor's degrees or above were more likely to have a positive perception towards COVID-19 vaccination (25). Interestingly, Pearson correlation analysis also showed no significant correlation between perception and age. This was the first study that reported no correlation between perception and age and a significant association between perception and living with high-risk individuals and the area of study. Therefore, further analysis is needed to support this evidence.

CONCLUSION

Malaysian university students generally possessed good knowledge, attitudes, and perception of COVID-19 vaccination. The findings of the study may support future awareness strategies, methods, and tools that can be used to convey and spread messages on the importance of vaccination in Malaysia.

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REFERENCES

1. World Health Organization. Coronavirus (COVID-19) in Malaysia. 2021 (accessed 19 October 2021). Available from: https://www.who.int/malaysia/emergencies/covid-19-in-malaysia
2. Ministry of Health Malaysia. COVIDNOW in Malaysia. COVIDNOW; 2021 [cited 19 October 2021]. Available from: https://covidnow.moh.gov.my
3. The Special Committee For Ensuring Access To COVID-19 Vaccine Supply (JKJAV). National COVID-19 Immunisation Programme. 2021 (accessed 20 October 2021). Available from: https://intl.upm.edu.my/upload/dokumen menul320210301113819Program_Imunisasi COVID-19_Kebangsaan_Versi_Bahasa_Inggeris_

(1).pdf
4. El-Elimat T, AbuAlSamen MM, Almomani BA, Al-Sawalha NA, Alali FQ. Acceptance and attitudes toward COVID-19 vaccines: A cross-sectional study from Jordan. PLoS One 2021; 16(4): e0250555. doi: https://doi.org/10.1371/journal.pone.0250555
5. Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. Human Vaccines & Immunotherapeutics 2020; 16(11):2586–2593. doi: https://doi.org/10.1080/2164551 5.2020.1780846
6. Betsch C, Renkewitz F, Betsch T, Ulshufer C. The Influence of Vaccine-critical Websites on Perceiving Vaccination Risks. Journal of Health Psychology 2010; 15(3):446–455. doi: https://doi.org/10.1177/1359105309353647
7. Nan X, Madden K. HPV vaccine information in the blogosphere: how positive and negative blogs influence vaccine-related risk perceptions, attitudes, and behavioral intentions. Health Communication 2012; 27(8):829-36. doi: https://doi.org/10.1080/10410236.2012.661348
8. Wu MJ, Zhao K, Fils-Aime F. Response rates of online surveys in published research: A meta-analysis. Computers in Human Behaviour Reports 2022; 7:100206. doi: https://doi.org/10.1016/j.chbr.2022.100206
9. Mohamed NA, Solehan HM, Mohd Rani MD, Ithnin M, Isahak CIC. Knowledge, acceptance and perception on COVID-19 vaccine among Malaysians: A web-based survey. PLoS One 2021; 16(8):e0256110. doi: https://doi.org/10.1371/journal. pone.0256110
10. Parzi MN. Belanjawan 2021: Nasib 600,000 pelajar IPTS perlu diberi perhatian. Berita Harian 2020. Available from: https://www.bharian.com.my/berita/ nasional/2020/11/749548/belanjawan-2021-nasib-600000-pelajar-ipts-perlu- diberi-perhatian
11. Al-Zalfawi SM, Rabbani SI, Asdaq SMB, Alamri AS, Alsanie WF, Alhomrani M, et al. Public Knowledge, Attitude, and Perception towards COVID-19 Vaccination in Saudi Arabia. International Journal of Environmental Research and Public Health 2021; 18(19):1-13. doi: https://doi.org/10.3390/ijerph181910081
12. Wirunpan M. Knowledge, attitudes and willingness of adolescents towards coronavirus disease 2019 vaccine in Bangkok, Thailand. International Journal of Medical Science and Public Health 2021; 10(2):197-203. doi: http://ijmsph.com/fulltext/67-1625314808.pdf
13. Thabane L, Ma J, Chu R, Cheng J, Ismaila A, Rios LP, et al. A tutorial on pilot studies: the what, why and how. BMC Medical Research Methodology 2010; 10(1):2-10.doi:https://doi.org/10.1186/1471-2288-10-1
14. Ilogu LC, Lugovska O, Vojtek I, Prugnola A, Callegaro A, Mazzilli S, et al. The intent of students to vaccinate is influenced by cultural factors, peer network, and knowledge about vaccines. Human Vaccines & Immunotherapeutics 2021; 18(1):e1938492. doi: https://doi.org/10.1080/2164551 5.2021.1938492
15. Aklil MB, Temesgan WZ. Knowledge and Attitude towards COVID-19 Vaccination and Associated Factors among College Students in Northwest Ethiopia,2021. Health Services Research and Management Epidemiology 2022; 9(1):1-9. doi: https://doi.org/10.1177/23333928221098903
16. Wong LP, Alias H, Wong YL, Megat Hashim MMAA, Lin Y, Hu Z. COVID-19 Anti-Vaccine Sentiments in Malaysia: Narratives of Comments from Facebook Post. Vaccines 2023; 11(4):834. doi: https://doi.org/10.3390/vaccines11040834
17. Baka AS, Figgou L, Triga V. "Neither agree, nor disagree": A critical analysis of the middle answer category in Voting Advice Applications. International Journal of Electronic Governance 2012; 5(3):244–263. doi: https://doi.org/10.1504/IJEG.2012.051306
18. Nadler JT, Weston R, Voyles EC. Stuck in the Middle: The Use and Interpretation of Mid-Points in Items on Questionnaires. The Journal of General Psychology 2015; 142(2):71-89. doi: http://dx.doi.org/10.1080/00221309.2014.994590
19. Jiang N, Gu P, Liu K, Song N, Jiang X. Acceptance of COVID-19 vaccines among college students: a study of the attitudes, knowledge, and willingness of students to vaccinate. Human Vaccines & Immunotherapeutics 2021; 17(12):4914–4924. doi: https://doi.org/10.1080/2164551 5.2021.2013077
20. Al-Kafarna M, Matar SG, Almadhoon HW, Almaghary BK, Zaazouee MS, Elrashedy AA, et al. Public knowledge, attitude, and acceptance toward COVID-19 vaccines in Palestine: a cross-sectional study. BMC Public Health 2022; 22(1):1-8. doi: https://doi.org/10.1186/s12889-022-12932-4
21. Menon S, Rajaendram R. Breathing life back into higher education. The Star 2021 September 19. Available from: https://www.thestar.com.my/news/education/2021/09/19/breathing-life-back-into-higher-education?fbclid=IwAR3HvOx5J5Y2mooIsbfYMk7Y5elooKN0JPIPevWQV06Ri5eC99gKxqeabJ8
22. Fakonti G, Kyprianidou M, Toumbis G, Giannakou K. Attitudes and Acceptance of COVID-19 Vaccination Among Nurses and Midwives in Cyprus: A Cross-Sectional Survey. Frontiers in Public Health 2021; 9:1-8. doi: https://doi.org/10.3389/fpubh.20 21.656138
23. Elkalmi RM, Dyab E, Mohd Suhaimi A, Blebil QA, Elnaem MH, Jamshed S, et al. Attitude, Familiarity and Religious Beliefs about Vaccination among Health Science and Non-Health Science Students

in a Malaysian Public University. European Journal of Investigation in Health, Psychology and Education 2021; 11(4):1462–1473. doi: https://doi.org/10.3390/ejihpe11040104

24. Ssentongo P, Ssentongo AE, Heilbrunn ES, Ba DM, Chinchilli VM. Association of cardiovascular disease and 10 other pre-existing comorbidities with COVID-19 mortality: A systematic review and meta-analysis. PLoS One 2020; 15(8):e0238215. doi: https://doi.org/10.1371/journal.pone.0238215
25. Sonmezer MC, Sahin TK, Erul E, Ceylan FS, Hamurcu MY, Morova N, et al. Knowledge, Attitudes, and Perception towards COVID-19 Vaccination among the Adult Population. A Cross-Sectional Study in Turkey. Vaccines 2022; 10(2):278. doi: https://doi.org/10.3390/vaccines10020278