

University Students' Awareness, Risk Perception and Acceptance of the COVID-19 Vaccine Booster Shots: A Multivariate Analysis of Variance (MANOVA) Approach

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ABSTRACT

Coronavirus disease 2019 (COVID-19) is a serious global health threat of the 21st century. To curb the spread of the COVID-19 virus, the government has taken effective preventive measures, such as implementing the Movement Control Order (MCO) and the National COVID-19 Immunization Program. Due to new variants of COVID-19 (i.e., alpha, beta, gamma, delta, and omicron) that are highly transmissible, booster shots of the COVID-19 vaccine are also strongly recommended to ensure better protection from getting infected against these new variants. This study assesses university students' awareness, risk perception, and acceptance of COVID-19 vaccine booster shots. A survey is conducted among students at Universiti Teknologi MARA Kelantan Kota Bharu Campus. The One-Way Multivariate Analysis of Variance (MANOVA) is used to examine whether there were differences in the awareness, risk perception, and acceptance toward COVID-19 vaccine booster shots according to gender (i.e., Male and Female), program enrolled by students (i.e., Science and Technology and Social Science), state of origin (i.e., Kelantan and Non-Kelantan) and COVID-19 infection history (i.e., Yes and No). The results revealed there were significant differences in the awareness and risk perception toward COVID-19 vaccine booster shots among the state of origin and COVID-19 infection history. These findings provide important guidance to the related authorities to take specific measures in promoting and increasing the COVID-19 booster shots uptake among students in the University.

Keywords: Multivariate Analysis of Variance (MANOVA), COVID-19 vaccine booster shots, awareness, risk-perception, and acceptance

1 INTRODUCTION

Coronavirus disease 2019 (COVID-19) has become a global public health threat in the 21st century. This novel coronavirus, specifically known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), first emerged in Wuhan, China, in December 2019. The virus has rapidly spread with a drastic increase in the number of cases reported, including the countries other than China, in a short period. As the virus continues to spread around the world (with 118, 000 cases reported in 114

countries, with 4, 291 deaths), thus on March 11, 2020, World Health Organization (WHO) characterized the COVID-19 outbreak as a global pandemic [1]. According to statistics from Our World in Data Website, retrieved on August 19, 2022, almost 600 million cases, with more than 6 million deaths, were recorded worldwide [2]. Meanwhile, almost 5 million confirmed COVID-19 cases, with 36, 117 deaths, had been reported in Malaysia [2].

The high infection rate of this new disease has sparked the greatest concern worldwide. Since the virus can be easily spread from human to human, therefore, social distancing is highly recommended to be practiced by the experts. In line with this suggestion, the authority in Malaysia has implemented the Movement Control Order (MCO), started on March 18, 2020 [3], as an effective measure to contain the outbreak of the COVID-19 virus within the community. The implementation of the MCO has forced many sectors, including educational institutions, to close, except for those providing essential services and items. Thus, all the campus activities must be postponed disrupting the teaching and learning process. Since the face-to-face delivery mode of teaching and learning cannot be conducted, the top management of the universities has decided to switch to online distance learning. This form of learning provides an alternative way to minimize physical contact between students themselves or between the students and the lecturers [4].

However, a sudden transition from a traditional face-to-face class to a fully online mode of teaching and learning has impacted the students at all levels (i.e., diploma, undergraduate and postgraduate communities) [5]. In fact, the online learning mode is not easy to implement as many students lack access to the online learning platforms, mostly due to poor internet connection. This condition will distract students' attention and focus on the class and, finally, impact their academic performance. In the worst situation, the COVID-19 outbreak also influenced the well-being and mental health, not only the students, but also the academicians of the universities [6]. It shows that, this pandemic has posed a serious issue to the education system requires specific attention.

Besides social distancing, vaccine administration is another preventive measure also highly suggested by the experts to combat the spread of the COVID-19 virus. The vaccine uptake is considered one of the best approaches to reducing the infection rate, the risk of symptoms of becoming severely ill and incline the likelihood of death. Thus, the National COVID-19 Immunization Program comprising three phases was initiated in a year 2021, with the aimed to achieve the highest immunization rate among its citizens and non-citizens who are staying in Malaysia. The first phase of the COVID-19 vaccination program was started from February to April 2021, where the former prime minister Muhyiddin Yasin became the first Malaysian to be vaccinated on February 24, 2021, followed by the frontliners in the government and private sectors [7]. In general, a high percentage of the total population would need to be vaccinated to achieve herd immunity against the COVID-19 virus. Herd immunity can reduce the chances of the COVID-19 virus from spreading within the community.

Recent data accessed from Our World in Data Website on August 19, 2022, showed that more than 70 million doses of vaccine had been administered to the people in Malaysia, with 27.5 million fully vaccinated either with any of three main types of vaccines known as Pfizer-BioNTech, AstraZeneca, and Sinovac [8]. Being fully vaccinated means that people have received the required doses of the COVID-19 vaccine for optimal protection against the virus. However, the existence of new variants (i.e., alpha, beta, gamma, delta, and omicron) that are highly transmissible which driven a new wave of COVID-19 cases in several countries, leading to the greatest concern to the authorities worldwide.

Therefore, taking COVID-19 vaccine booster shots are highly recommended for better immune from getting infected by these new variants.

Although experts have confirmed the safety and effectiveness of booster shots to increase protection levels in battling the spread of new variants of COVID-19, the need to take these booster shots is still a matter of debate among the public. People's reluctance to take the booster doses may be due to pre-existing health conditions, bad experiences while taking primary doses, fake news etc. As highlighted by previous studies, social media is one of the factors contributing to public hesitancy toward vaccines [9]. Most social media tend to spread fake news linked to health risks caused by vaccines [10-11], where people are exposed to misleading information such that the COVID-19 vaccine is dangerous and harmful [12]. As a result, it reduces people's confidence and intention to take the vaccine.

Besides, an empirical study in Saudi Arabia found that risk awareness can increase vaccine acceptance [13]. People with better awareness of the COVID-19 vaccine have a higher tendency to take the vaccine. The low awareness of the importance of vaccination among a certain group of people significantly influenced their acceptance of the COVID-19 vaccine [14-17]. The findings of previous studies shows that awareness of the COVID-19 vaccine can be affected by demographic factors such as religion [15], gender [16], ethnicity and region of residence [17].

Moreover, existing studies also linked risk perception with the acceptance of the COVID-19 vaccine [18] and booster doses [19]. Findings from an empirical study show that the public interest in risk perception regarding vaccine side effects is high [20], where the findings indicate that the public has a negative risk perception of the COVID-19 vaccine. Lack of trust and worry about the side effects, reduce the rate of COVID-19 vaccine and booster dose uptakes which in turn delay the government effort to fully stop the spread of the virus in the community. Since Malaysia still recorded quite high new COVID-19 cases per day (with 4071 new cases recorded on August 18, 2022) [21], thus taking booster doses is highly recommended. Therefore, the related authorities need to find a better approach to promote the booster dose uptake among the community.

Even though vaccine hesitancy and acceptance have been well studied previously, very few studies have been conducted on booster doses, especially among the public in Malaysia. Concern on this issue, One-Way Multivariate Analysis of Variance (MANOVA) was carried out to examine whether there were differences in the awareness, risk-perception, and acceptance toward COVID-19 vaccine booster shots between gender (i.e., Male and Female), program enrollment (i.e., Statistics and Non-Statistics), state of origin (i.e., Kelantan and Non-Kelantan) and COVID-19 infection history (i.e., Yes and No) among students in Universiti Teknologi Mara (UiTM) Kelantan Kota Bharu Campus. The findings of this study will significantly contribute to the top management of the UiTM, specifically, the UiTM Kota Bharu Campus. It will assist them in identifying better actions to enhance the COVID-19 vaccine booster shots uptake among the students. It is to ensure that the students are protected against the severe effects of the new variants of the COVID-19 virus and ultimately to make the campus a safe learning environment.

2 MATERIAL AND METHODS

The study was conducted using a cross-sectional design, in which data is collected at a single point among full-time students of UiTM Kelantan Kota Bharu Campus in the semester of March-August

2022. Respondents are selected using stratified random sampling, with a sample size recommended by the Raosoft calculator ($n=325$). In this study, the students were stratified according to their state of origin (i.e., Kelantan and Non-Kelantan). The semi-structured questionnaire consisted of four sections (Section A: Demographic Profile, Section B: Awareness, Section C: Risk Perception, Section D: Acceptance of COVID-19 Booster Shots), where section B-section D was constructed based on Likert scale (ranges from 1=Strongly Disagree to 7=Strongly Agree) using the Google Form platform. Then the generated link of this questionnaire was shared with the respondents via WhatsApp.

A pilot study was conducted using convenience sampling on 30 selected respondents to check the reliability of the questionnaire. The reliability analysis was done to assess the internal consistency of the items for each latent construct (i.e., Awareness, Risk Perception, and Acceptance of COVID-19 Booster Shots). The internal consistency of these latent constructs was examined based on Cronbach's Alpha coefficient. The value of the Cronbach's Alpha coefficient greater than 0.7 is considering good and acceptable [22].

The collected data were analyzed by using IBM SPSS Statistics for Window version 23. The One-Way Multivariate Analysis of Variance (MANOVA) was employed to examine whether there were differences in the awareness, risk perception, and acceptance toward COVID-19 vaccine booster shots according to gender (i.e., Male and Female), program enrollment (i.e., Science and Technology and Social Science), state of origin (i.e., Kelantan and Non-Kelantan) and COVID-19 infection history (i.e., Yes and No). The application of MANOVA requires certain assumptions to be fulfilled. These include multivariate normal distribution and homogeneity of variance-covariance matrices. The normality assumption for each variable across the groups was examined based on the value of skewness. The distributions are said to be approximately normal if the skewness ranges from -1 to +1 [23]. Meanwhile, the Box's M test was used to assess the assumption of homogeneity of variance-covariance matrices. The Box's M test should be non-significant (i.e., p-value should greater than significance level of α) to conclude that the homogeneity of variance-covariance matrices is met.

3 RESULTS AND FINDINGS

Figure 1 shows the distribution of respondents of this study according to their gender, program enrollment, state of origin, COVID-19 infection history before and after vaccination and booster shots status. Of 325 respondents recruited in this survey, 75% were female, and 25% were male. Most respondents (80%) were from social science programs, while the rest (20%) were from science and technology programs. Majority respondents involved in this survey were from Kelantan (76%), while only 24% of respondents were not from Kelantan. From this figure, it can also be seen that, before being vaccinated, most respondents were infected with the disease (89%). But after being vaccinated, the percentage of respondents infected with the disease reduced to 66%. Indirectly, it shows that the COVID-19 vaccine uptake effectively reduces the risk of infection.



Figure 1 : The Distribution of Respondents According to Gender, Program Enrollment, State of Origin, COVID-19 Infection History and Booster Shots Status

Table 1 presents the summary of the reliability analysis for the pilot study. As depicted in this table, the awareness (6 items, $\alpha=0.8351$), risk perception (8 items, $\alpha=0.8787$) and acceptance (7 items, $\alpha=0.9642$) subscales were found to be highly reliable. It implied that the items used to measure the dependent variables in this study have good internal consistency.

Table 1 : Summary of Reliability Analysis

Dependent Variables	Number of Items	Cronbach's Alpha
Awareness	6	0.8351
Risk Perception	8	0.8787
Acceptance	7	0.9642

Table 2 summarizes the skewness values for each of the dependent variables (i.e., Awareness, Risk Perception, and Acceptance of COVID-19 Booster Shots) across gender (i.e., Male and Female), program enrolled by students (i.e., Science and Technology and Social Science), state of origin (i.e., Kelantan and Non-Kelantan) and COVID-19 infection history (i.e., Yes and No). As can be seen in this table, all the skewness values lie within the range -1 and +1, shows that the assumption of the multivariate normal distribution required by MANOVA is fulfilled.

Table 2 : Summary of Skewness Across Gender, Program Enrollment, State of Origin and COVID-19 Infection History

Dependent Variables	Independent Variables	Categories	Skewness
Awareness	Gender	Male	-0.200
		Female	-0.606
Risk Perception	Gender	Male	-0.683
		Female	-0.703
Acceptance	Gender	Male	-0.710
		Female	-0.577
Awareness	Program Enrollment	S&T	-0.477
		SS	-0.264
Risk Perception	Program Enrollment	S&T	-0.214
		SS	-0.425
Acceptance	Program Enrollment	S&T	-0.835
		SS	-0.402
Awareness	State of Origin	Kelantan	-0.511
		Non-Kelantan	-0.868
Risk Perception	State of Origin	Kelantan	-0.599
		Non-Kelantan	-0.159
Acceptance	State of Origin	Kelantan	-0.322
		Non-Kelantan	-0.550
Awareness	COVID-19 Infection History	Yes	-0.736
		No	-0.403
Risk Perception	COVID-19 Infection History	Yes	-0.612
		No	-0.507
Acceptance	COVID-19 Infection History	Yes	-0.643
		No	-0.342

Note: S&T-Science and Technology; SS-Social Science

The summary of the results for the homogeneity of variance-covariance matrices is displayed in Table 3. The Box's M test indicates that the assumption of homogeneity of variance-covariance matrices across groups (i.e., Gender, Program Enrollment, State of Origin, COVID-19 Infection History) is assumed ((Box's M = 17.282, $F = 1.308$, $p = 0.372$); (Box's M = 9.732, $F = 1.011$, $p = 0.447$); (Box's M = 8.019, $F = 0.665$, $p = 0.781$); (Box's M = 6.574, $F = 0.468$, $p = 0.842$)).

Table 3 : Summary of Box's M test for Assessment of the Homogeneity Variance-Covariance Matrices

Dependent Variables	Independent Variables	Box's M	F	P-Value
Awareness Risk Perception Acceptance	Gender	17.282	1.308	0.372
Awareness Risk Perception Acceptance	Program Enrollment	9.732	1.011	0.447
Awareness Risk Perception Acceptance	State of Origin	8.019	0.665	0.781
Awareness Risk Perception Acceptance	COVID-19 Infection History	6.574	0.468	0.842

Table 4 shows the summary results of MANOVA across gender, program enrollment, state of origin and COVID-19 infection history. As indicated in this table, there were statistically significant differences in at least one of the dependent variables (i.e., awareness, risk perception, acceptance) based on the state of origin and COVID-19 infection history ((Wilk's Lambda = 0.659, $F = 9.626$, $p = 0.073$); (Wilk's Lambda = 0.405, $F = 12.753$, $p = 0.073$)) at 10% level of significance. However, there were no significant differences in the awareness, risk perception, and acceptance of COVID-19 booster shots across the gender and program enrollment. As depicted in Table 5, the results of univariate ANOVA showed significant differences in the awareness and risk perception according to the state of origin and COVID-19 infection history.

Moreover, the results of multiple comparisons shown in Table 6 indicate that the mean scores for both awareness and risk perception were significantly larger for the non-Kelantanese (Mean = 56.84; Mean = 61.02) compared to Kelantanese (Mean = 54.17; Mean = 58.36). Besides, students infected with COVID-19 (Mean = 62.13; Mean = 64.61) also have higher mean scores on awareness and risk perception than those who have never been infected (Mean = 59.40; Mean = 61.51). The findings were in line with the previous studies such that the demographic factors have significantly affected the awareness and risk perception of the COVID-19 vaccine among the public [13-16, 24-25].

Table 4 : Summary of One-Way Multivariate Analysis of variance (MANOVA) Across Gender, Program Enrollment, State of Origin and COVID-19 Infection History

Dependent Variables	Independent Variables	Wilk's Lambda	F	P-Value
Awareness Risk Perception Acceptance	Gender	0.735	3.504	0.109
Awareness Risk Perception Acceptance	Program Enrollment	0.961	6.982	0.413
Awareness Risk Perception Acceptance	State of Origin	0.659	9.626	0.089
Awareness Risk Perception Acceptance	COVID-19 Infection History	0.405	12.753	0.047

Table 5 : Summary of Univariate Analysis of Variance (ANOVA) Across State of Origin and COVID-19 Infection History

Dependent Variables	Independent Variables	F	P-Value
Awareness Risk Perception Acceptance	State of Origin	1.809 2.367 1.478	0.079 0.041 0.213
Awareness Risk Perception Acceptance	COVID-19 Infection History	2.440 2.635 1.991	0.039 0.022 0.119

Table 6 : Summary of Multiple Comparison for Awareness and Risk Perception Across State of Origin and COVID-19 Infection History

Dependent Variables	Independent Variables	Categories	Mean	P-Value
Awareness	State of Origin	Kelantan	54.17	0.063
		Non-Kelantan	56.84	
Risk Perception	State of Origin	Kelantan	58.36	0.041
		Non-Kelantan	61.02	
Awareness	COVID-19 Infection History	Yes	62.13	0.039
		No	59.40	
Risk Perception	COVID-19 Infection History	Yes	64.61	0.025
		No	61.51	

4 CONCLUSION

As previously mentioned, the study aimed to investigate whether there were any significant differences in the awareness, risk perception, and acceptance of COVID-19 vaccine booster shots based on gender (i.e., Male and Female), program enrollment (i.e., Statistics and Non-Statistics), state

of origin (i.e., Kelantan and Non-Kelantan) and the status of COVID-19 infection history (i.e., Yes and No). One-way MANOVA revealed statistically significant differences in student's awareness and risk perception toward COVID-19 vaccine booster shots according to the state of origin and COVID-19 infection history. Meanwhile, there were no statistically significant differences between the groups of students involved (i.e., gender, program enrollment, state of origin and status of COVID-19 infection history) in their acceptance of COVID-19 vaccine booster shots. Thus, it can be concluded that the students' awareness and risk perception toward COVID-19 booster shots were significantly affected by their state of origin and the status of their COVID-19 infection history.

The findings can help the top management of higher learning institutions, specifically in UiTM Kelantan Kota Bharu Campus, to make better plans in promoting the importance of COVID-19 booster shots uptake to those specific groups of students. Since the findings are limited to the students in UiTM Kelantan Kota Bharu Campus, thus, more empirical research is still needed to investigate the barriers and acceptance of COVID-19 vaccine booster doses among the public covering a wide geographical area as the findings can lead to better actions to curb the outbreak of COVID-19 virus in the community, ultimately end the COVID-19 pandemic.

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