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Research

Pre-COVID19: Knowledge and Level of Vaccine Acceptance Among University Students

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ABSTRACT

Vaccine confers acquired active immunity against many diseases. The emergence of anti-vaccine groups has reinstated the outbreak of many vaccine preventable diseases (VPD), which was once thought to be eradicated from the face of earth, mostly due to ever-present misinformation and disinformation spread through various channels of communications. Hence, public awareness on immunization is vital to prevent the re-emergence of VPD. In this study, we targeted students from Universiti Kebangsaan Malaysia (UKM) and aimed to obtain the level of awareness and perception regarding vaccination among these students. We acquired information on the knowledge of vaccines and the degree of acceptance of vaccines among the university students, and through educational intervention, including the Islamic view on vaccination, we aimed to increase their awareness on immunization and the adverse effects of anti-vaccination. The questionnaires used in the present study were validated by reliability analysis. The study was conducted for a duration of four months, from January to April 2019. A total of 929 respondents were interviewed, and the degree of acceptance on vaccination was at satisfactory level, and none of the students rejected vaccination. Out of 929 respondents, 36 attended the vaccine workshop to undergo the educational intervention, and were asked to refill the questionnaires, and the results of pre- and post-workshop questionnaires were compared. Vaccine workshop successfully improved the knowledge and awareness of the participants on vaccines. The number of participants who can explain herd immunity has also increased. However, there were participants who still believed that vaccine-related information retrieved from social media can be trusted without consideration. Therefore, educational intervention is suggested to be used in public as a tool to combat the expansion of the anti-vaccination community since it was shown to give positive outcomes among the students.

Key words: Alpha Cronbach, herd immunity, questionnaire, sentiment analysis, vaccine, vaccine preventable diseases

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INTRODUCTION

The layman term for vaccine is, the artificial introduction of parts of the pathogen that causes disease to your body with the objective of 'teaching' your immune system before the infection by the real pathogen (CDC, 2012). The main objective of vaccination is to prevent an outbreak of contractible diseases in a community or society. The concept of vaccination was first applied in the 18th century to curb the outbreak of smallpox disease (Plotkin, 2014). Since then,

many vaccines have been produced along the line to prevent the outbreak of numerous infectious diseases in order to minimize the pandemicity of many pathogens around the world (Ozawa & Stack, 2013). The anti-vaccine movement predates the first vaccine on the basis of religion at first, however, more recently the movement became more aggressive when fabricated findings of measles, mumps, and rubella (MMR) vaccines-induced autism were reported (Rao & Andrade, 2011). Although the report has been retracted, doubts on the safety of vaccines have been seeded, hence many around the globe are hesitant about vaccination.

Vaccine preventable diseases (VPD) are diseases that can be prevented and mitigated through vaccination, such as smallpox, measles, diphtheria, whooping cough (pertussis), chicken pox, rubella, and polio (Hamborsky *et al.*, 2015). Smallpox is one of the eradicated diseases due to the implementation of aggressive vaccination programs during the 1980s (Heymann, 2006), followed by the mitigation of several diseases such as measles (CDC, 2020) and diphtheria (Clarke *et al.*, 2019). Several diseases have re-emerged due to vaccine refusal or hesitance. Measles, also known as Rubeola is a highly contagious disease (WHO, 2019), and was reported to re-emerge in the United States of America (USA) from 2014 to 2015 (Zipprich *et al.*, 2015). The most highlighted case was the one reported to be originated from the Disneyland theme park, in California in 2014, which swiped through seven states in the US alone and 2 neighboring countries. The most devastating part of this incidence was, that among the 37 infected individuals, 28 were intentionally unvaccinated (Zipprich *et al.*, 2015). More recently, another VPD, diphtheria, caused by *Corynebacterium diphtheriae* bacteria re-emerged in Malaysia, causing 5 deaths and dozens of severe infections in Sabah, Melaka, Kedah, and Negeri Sembilan (Abdullah, 2019; KKM, 2017; Liow *et al.*, 2018). Similar to the US measles outbreak, intentional vaccine refusal was reported as one of the causes (Jay, 2016).

According to Wan Rohani *et al.* (2017), the commonest reason for vaccine refusal was the assumption of vaccine-induced adverse health effects, followed by religious beliefs and lack of information on the severity and the outcome of VPD. Similarly, a lack of understanding of the information of vaccination has been found to have positive correlation with vaccination practice among Malaysian parents (Awadh *et al.*, 2014). In a separate study, out of 44 parents interviewed, 18.2% refused to immunize their children to enroll them in alternative treatments (75%), while 37.5% doubted the efficacy of vaccine. Some parents defaulted (missed) vaccines for reasons such as business, long waiting hours in the clinic, child health, and religious beliefs (Lim *et al.*, 2016). In Malaysia, the majority of the anti-vaccine groups are still rejecting vaccination owing to their religious belief (Wan Rohani *et al.*, 2017), and pseudo religious arguments such as using weak hadith, or partial understanding or usage of certain verses of the Quran even though the Malaysia *fatwa* council and other Muslim scholars have unanimously proclaimed that immunization is consistent with *Maqasid Syariah*.

University students at the crossroads between late adolescence and early adulthood, are ideal target groups for vaccine-related educational intervention, to prevent further expansion of anti-vaccination group in the future. A case study also showed a lack of vaccination knowledge among college students in India (Dhanasi *et al.*, 2016) and there are limited studies about vaccination knowledge and perception among Malaysian university students. Therefore, in this study, a survey and an educational intervention was conducted on the students of Universiti Kebangsaan Malaysia (UKM), with an aim to provide them with the most appropriate information regarding the use of vaccines. We intended to reduce the anti-vaccine attitude towards higher vaccine compliance among university students, which we hope will eventually decrease the number of parents with anti-vaccine attitude in the future.

MATERIALS AND METHODS

Surveillance and Subject of Study

The surveillance method used in this study was in the form of a questionnaire in the Malay language. A total of 929 respondents have participated in this surveillance. The questions composed of three sections, including knowledge and point of view towards vaccines, source of knowledge, and determination of behavior. The questions were designed based on Larson *et al.* (2015) with some modifications. The subjects recruited randomly in this surveillance consisted of Bachelor's degree students from various faculties in the UKM, Bangi campus. The questionnaires were designed with answers in a 5-point Likert scale manner (from minimum 1 to maximum 5) in which the answers: (1) Strongly disagree, (2) Agree, (3) Neutral, (4) Agree and (5) Strongly agree, in response to the questions or statements (Preedy & Watson, 2010).

Validation of Questionnaire

The questionnaire was proofread by a few experts in immunology and vaccination, and appropriate amendments were made based on their comments. Then questionnaires from 28 respondents were

used to analyze the reliability of the questionnaire and Cronbach's alpha value was obtained to determine the validity of the surveillance. These 28 respondents consisted of students from the Microbiology program who have taken Immunology subjects in their studies. The data obtained from the validation of questionnaires were collected and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.

Grouping and Analyzing of Respondents

The study was conducted for a duration of four months, between January and April 2019. An online survey was used to analyze, and group the respondents into neutral, positive or negative behavior toward vaccines. Other information included in the analysis were gender, age, religion, race, and faculty. The origin of respondents was recorded based on the distance between their living places to the nearest downtown. The results from the survey were compared between the students who have taken fundamental microbiology subjects and those who have not. The subject was taught by senior lecturers with microbiology backgrounds from the Department of Biological Sciences and Biotechnology, Faculty of Science and Technology, UKM. Students who have taken this subject were believed to have more knowledge about vaccination and have a positive impression of vaccination. Students who had neutral or negative impressions towards vaccination were selected to attend a workshop or seminar related to vaccination.

Sentiment Analysis

Sentiment-based questions were asked at the end of the surveillance to enable the process of sentiment analysis regarding vaccination. To analyze the sentiment for each extracted comments, the lexicon based approach was performed which is known as Valence Aware Dictionary and Sentiment Reasoner (VADER), an open-source tool. The comments were classified by VADER as positive, negative, or neutral based on the inputs retrieved from the questionnaires. A compound score, also known as the VADER score was calculated by summing the valence scores of each term in the lexicon, adapted to the rules, and then standardized to range from -1 (most extreme negative) to +1 (most extreme positive).

Educational Intervention Workshop

A face-to-face workshop related to vaccination, conducted in the Malay language, was organized in May 2019 to provide an educational intervention. The speakers of this workshop consisted of senior lecturers in Microbiology Program as well as PhD and final-year Microbiology students. The topics were discussed prior to presentation in the workshop to ensure the accuracy of the information given to the attendees. In this workshop, the participants were introduced with vaccine-preventable diseases (VPD) and the Islamic point of view on vaccination was also shared. The participants were randomly divided into two groups and each was assigned a facilitator with a microbiology background during the workshop. The information about VPD was given in the form of visual presentation, explanation and benefits of the vaccine, side effects of vaccine, as well as rumors regarding the vaccination, were also discussed. The Islamic point of view regarding vaccination was done through the sharing of information concerning vaccines and vaccination practice. Short statements, phrases from articles and Sunnah related to VPD, and effects of VPD on unvaccinated individuals were also explained. After the workshop, participants were requested to refill the same questionnaire in order to evaluate their understanding on the presented topics. The results obtained before and after the workshop were compared, to assess the effectiveness of educational intervention on the improvement of vaccination knowledge.

Interview

A total of 8 out of 36 individuals were interviewed 3 months post-intervention program to discuss their knowledge, perception, and comments. Perceptions and comments on vaccines and vaccination were gathered. Participation was voluntary.

RESULTS AND DISCUSSION

Validation of questionnaire

Arranged Accuracy and consistency of a questionnaire are important in order to obtain correct and reliable information from subjects. In this study, 28 respondents were randomly picked to analyze the consistency of the questionnaire through Cronbach's alpha analysis using SPSS. The Cronbach's alpha value obtained from the reliability analysis was $\alpha = 0.834$ (Figure 1). Cronbach's alpha values range from 0 to 1 and a score of $0.75 \leq \alpha < 0.9$ indicates an acceptable consistency of the test (Tavakol & Dennick, 2011). Therefore, the surveillance used in this study was confirmed to be reliable and hence further analysis was done.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.834	.822	28

Fig. 1. Cronbach's alpha value obtained from reliability analysis of the questionnaire.

Socio-demographic characteristics of respondents

In the present study, responses from 929 students were collected. The socio-demographic information was collected, and respondents who did not provide educational and socio-demographic information were labelled as Anonymous. The students were categorized into two subgroups: students who have enrolled in the fundamental microbiology subject (FM) and students who have not (NFM). Students in the category of NFM were from the faculties of Science and Technology (FST), Islamic Study (FPI), Economy and Management (FEP), Engineering and Environmental Building (FKAB), Education (FPEND), Information Science and Technology (FTSM), Social Science and Humanity (FSSK) and Law (FUU). The respondents who were categorized in the FST group were students who did not take the Microbiology course. The number of respondents in the category of FM was 105 (11.3%), NFM was 644 (69.3%), and Anonymous was 180 (19.4%). The survey involved 717 (77.2%) female and 212 (22.8%) male respondents. Out of all the respondents, 802 (86.3%) were at the age of 20 – 24 years old, 37 (4.0%) were below the age of 19, and 90 (9.7%) were above the age of 24. The respondents consisted of 675 (72.7%) Malay, 89 (9.6%) Chinese, 38 (4.1%) Indians, 21 (2.2%) from other races, and 106 (11.4%) Anonymous. Majority of the respondents were originated from city (5 – 10 km) with n = 533 (57.4%), outskirts (10 – 20 km) with n = 209 (22.5%), town (20 – 40 km) n = 94 (10.1%), countryside (40 – 50 km) with n = 87 (9.4%), and inland (> 50 km) with n = 6 (0.6%). The transportation time required for the respondents to reach the nearest hospital or health facilities from their living places by car was recorded as 561 (60.4%) taking 5 – 10 minutes, 307 (33.0%) taking 10 – 20 minutes, whereas 61 (6.6%) taking more than 20 minutes. Among all the respondents, 603 (63.9%) were single, 14 (1.5%) were married, and 312 (33.6%) did not reveal their marital status.

Knowledge and perception of respondents towards vaccine

Based on the completed surveillance form, the respondents' degree of knowledge about vaccines was categorized based on a scoring system. A total of 18 questions were asked in this section and students were asked to choose a score from 1 to 5 in each question. Questions (Q) 1, 2, 3, 6, 7, and 8 were knowledge-based questions regarding vaccination, and the mean score of respondents on these questions were compared between FM and NFM. For knowledge score, the higher the score indicates the better the knowledge about vaccination. The students who have taken the Fundamental Microbiology subject scored better in this section compared to the students who did not take Fundamental Microbiology (Figure 2). The scores for basic knowledge about the vaccine (Q1 – Q3) were almost similar in both categories, but the true determination of knowledge in vaccination was Q4 and Q5, which asked about the herd immunity and their ability to explain about herd immunity (data not shown). This finding indicates that the students are aware of the protective effects of vaccine at the individual level, but do not understand how vaccination actually protects a whole community, including those who have not and could not be vaccinated. Therefore, more emphasis must be placed on herd immunity in order to improve public knowledge about the benefits of vaccination.

Questions related to propaganda of anti-vaccination, perception of the effects of anti-vaccination, and belief in social media about the negative effects of vaccination were also asked and scored. For the perception score, we intended to see how respondents from different faculties fare. The respondents from FM and NFM had similar perceptions, however, the Anonymous group scored slightly lower than the rest (Figure 3), suggesting that differences in knowledge level on vaccination do not affect the perception of respondents towards vaccination much. A previous study reported that knowledge about vaccines was a factor that influenced vaccination hesitancy in pregnant women in Rome, Italy (Massimi *et al.*, 2017). Similarly, in a cross-sectional study involving six Southeast Asian countries (Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam), education level was reported to be associated with hesitancy in COVID-19 where less educated people were believed to have less knowledge of

vaccines (Marzo *et al.,* 2022). The discrepancy between our findings, and these studies could be due to the benefits of vaccination being well-advertised by our local government and the participants that participated in our study were only university students. Another factor that could contribute to this discrepancy is the different vaccination policies implemented by the two different governments (Sheikh *et al.*, 2018). In terms of respondents considering the negative effects of vaccination are just propaganda, more than 50% of the respondents agreed that the negative effects of vaccination are just propaganda, whilst a portion of the respondents stayed neutral (11.1%) and a small group of respondents disagree (5.6%).

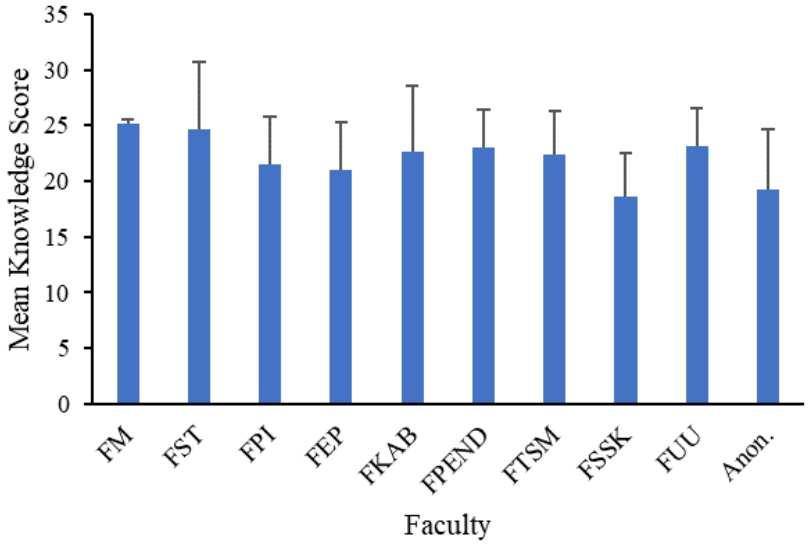

Fig. 2. Mean knowledge score of respondents from different faculties. Comparison between FM and NFM groups were analyzed using Student's t-test. The significance level of **** indicates $p < 0.0001$.

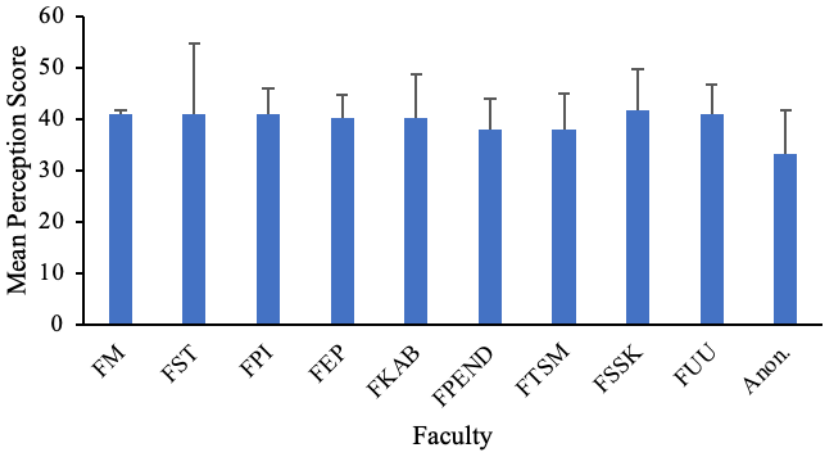

Fig. 3. Mean perception score of respondents from different faculties regarding vaccination, anti-vaccination propaganda and side effects of vaccination. The significance of the comparison was analyzed using Student's t-test and showed no significant difference between FM and NFM groups ($p > 0.05$).

Source of vaccination information

Through this section, we investigated how the respondents identify the media to obtain information on vaccination. There were six statements in this section which included the respondents' accessible sources to obtain information pertaining to vaccination and their trust towards these sources. Statements 1 to 4 explored how much the students agreed to the sources of information from the Ministry of Health Malaysia (MOH), internet, radio, or television, and information from their schoolteachers during their

earlier educational level. The results showed that most of the respondents obtained the information of vaccination from MOH and the internet with more than 70% agreement for both sources in all faculties, except FTSM and FSSK with approximately 60% of respondents who agreed (Table 1).

There was a high percentage of respondents (>70%) who obtained vaccination information from the Internet (Table 1). A previous study carried out in Vietnam showed that mass media reporting Adverse Effects Following Immunization (AEFI) strongly contributed to hesitancy and refusal of childhood vaccination (Tran *et al.*, 2018). As the internet has been used as a medium of mass communication, validation of information from the internet is also important in order to prevent the anti-vaccination movement. As a result, the government and the internet play major roles in disseminating information about vaccination.

Statement number 5 was about whether social media is the most convenient source of information related to vaccines, and the majority agreed with this. Lastly, statement number 6 mentioned about the reliability of the source of information regarding vaccination. Generally, less than half of respondents from most of the faculties agreed with this statement (<50%) but surprisingly, a high percentage of respondents from FSSK agreed with it (72.6%) (Table 1). It is alarming that there is a high percentage of students who do not consider the reliability of the source of information prior to being influenced by its contents. Social media such as Facebook, Twitter, and Instagram are easy-to-be-accessed sources of information with just a "hashtag" function, and this could threaten vaccination as faulty information regarding vaccines has been spread through these media (Cohen, 2019; Rimmer, 2019).

Table 1. Percentage of respondents who agreed with statements regarding source of vaccination information

Statement	Percentage of respondents who agreed (%)									
	FM	FST	FPI	FEP	FKAB	FPEND	FTSM	FSSK	FUU	Anon.
1	87.6	89.1	71.9	80.6	74.1	91.5	69.2	61.3	82.0	72.2
2	85.8	87.5	71.9	80.6	72.8	88.6	73.1	80.6	84.0	79.4
3	79.0	81.1	75.5	79.0	67.5	82.8	55.8	38.7	72.0	57.2
4	82.9	83.5	79.0	59.7	60.9	62.9	55.7	50.0	72.0	62.3
5	79.0	74.8	68.4	75.8	66.3	80.0	59.6	54.9	70.0	63.8
6	43.8	42.9	31.5	25.8	34.4	22.8	26.9	72.6	34.0	28.4

Behavioral determinant

In this section, the respondents were provided with four positive statements regarding vaccine and vaccination, and they were asked to judge those statements based on the scores given. A total score of 16 – 20 indicated a positive response towards vaccination, and a total score of ≤ 8 indicated a negative response towards vaccination. The fifth question was asked about their perception of vaccination among children in Malaysia, and the respondents were requested to leave their comments freely for this question. The comments were used for sentiment analysis. For the first four questions, most of the faculties scored more than 16, which indicates a positive response towards vaccination in Malaysia (Figure 4). Only the FSSK and Anonymous groups scored less than 16 and none less than 8. This could be due to a small group of respondents showing negative responses or staying neutral towards the statements. Our findings revealed that the information about vaccination is still inadequate to make the respondents confident about vaccination in Malaysia. A similar scenario occurred in Botswana, the Dominican Republic, and Greece, where the survey participants requested additional vaccine information to be provided by the media and to be given to the caretakers for dissemination to the public (Handy *et al.*, 2017). To tackle this problem, an education intervention was carried out, to improve the respondents' knowledge and clarify rumors regarding vaccines, and the side effects of vaccination as well as discussion of vaccination from an Islamic point of view.

Sentiment analysis of respondents' behavior towards vaccination

In the last question, the respondents were allowed to comment freely about vaccination to ensure no bias or restriction to respondents' comments. Some of the respondents provided reasons why vaccination in childhood is important. The reasons given were vaccination is to protect the children from disease, and vaccination could help to improve the immunity of children especially babies who have a weak immune system. These comments were used to perform a sentiment analysis. A sentiment analysis is an automated classification of one's thought, opinion, or behavior based on emotion instead of reason using natural language processing (NLP) and computational techniques (Rimmer, 2016) whether it is positive, negative, or neutral. A total of 478 data were collected from students who responded to the last part of the questionnaire. Among these 478 respondents, 236 (49%) had positive, 179 (38%) had

neutral, while 63 (13%) had negative impressions on vaccine/vaccination (Figure 5). This finding is on par with their responses in behavioral determinant, where the majority of the respondents gave positive and neutral comments about childhood vaccination. Taken together, students in UKM showed a good awareness of vaccination, but educational intervention was still carried out in order to target the small group of respondents who had hesitancy and skepticism towards vaccination.

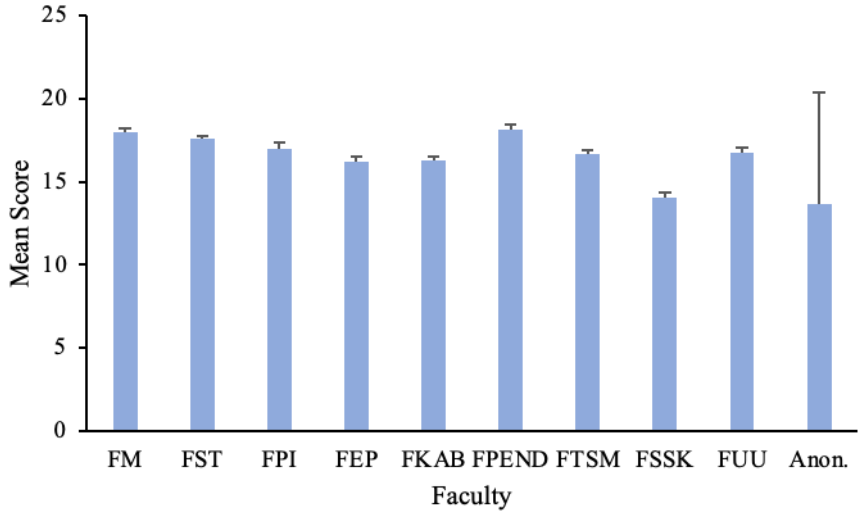

Fig. 4. Mean score of response of respondents from different faculties towards positive statements regarding vaccine and vaccination.

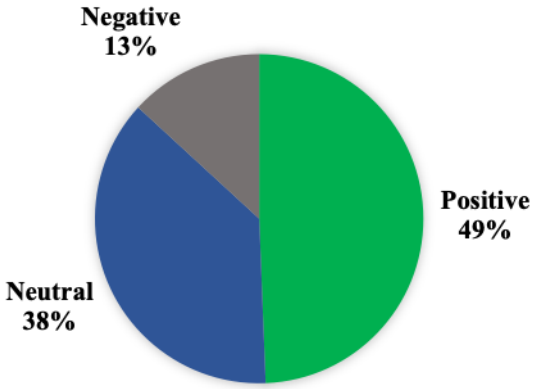

Fig. 5. Sentiment distributions of respondents towards vaccine/vaccination.

Effect of Education Intervention on Respondents' Attitude towards Vaccination

Education intervention can change the attitude of parents toward vaccination from disagreement to agreement (Choi *et al.*, 2017). Therefore, in order to reduce the diffidence of respondents towards vaccine and vaccination, an education intervention was carried out in a workshop. During the workshop, information related to vaccines, components in vaccines, herd immunity, possible AEFI, some vaccine-preventable diseases, and how vaccination effectively eradicated those diseases were shared and discussed. Since the majority of the respondents were Muslim, an Islamic point of view towards vaccination was also provided.

Only 36 respondents (3.9%) joined the workshop due to timetable clashes, and all of them were from the NFW category. Following the education intervention, respondents were requested to answer the same questionnaire again. The pre and post-intervention data of the 36 respondents were compared. There was a significant increase in mean knowledge score ($p < 0.001$) following the workshop and the perception score was also increased ($p < 0.05$) (Figure 6). Hypothetically, the respondents' perception about vaccination increased as their knowledge about the vaccine was greatly improved during the workshop, with more accurate information pertaining to the vaccine was delivered to them during the

intervention. A similar study done by Choi *et al.* (2017), using telephone interviews, has also reported significant improvement regarding immunization following education intervention in a different cohort, parents.

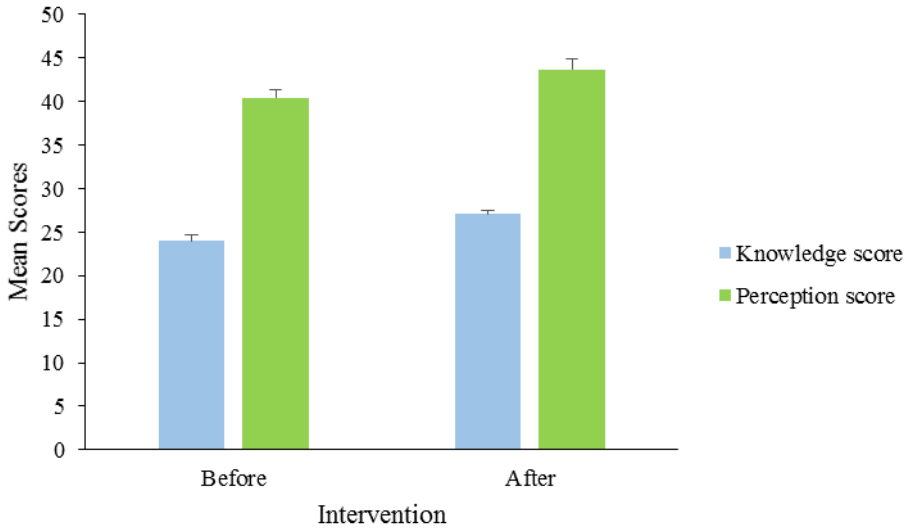

Fig. 6. Mean score of knowledge and perception scores of respondents before and after education intervention. Student's t-test was used to analyze the data comparison between both knowledge and perception scores before and after the educational intervention. The significance level of * indicates $p < 0.05$, while the significance level of *** indicates $p < 0.001$.

For the second section, the average score of each statement regarding the source of vaccine information before and after the workshop was compared. We noticed an increase in percentage of respondents agreeing to the source of vaccination-related information in all statements (Table 2). As for statement number 6, many of the students disagree with trusting information regarding vaccination from unreliable sources, indicating that they started to be aware of the reliability of information sources. However, there was still a small group of respondents who did not change their opinions towards this statement, and therefore warrants further improvement of the information provided in future workshops.

The response of students towards positive statements of vaccination before and after attending the workshop was compared using the mean score obtained through the surveillance. The data showed that the response of students improved slightly but significantly ($p < 0.001$) after attending the workshop (Figure 7). This showed that the education intervention program has further strengthened their knowledge of vaccines and vaccination along with their confidence towards childhood vaccination.

Table 2. Percentage of respondents who agreed with the statements regarding the source of vaccination before and after an education intervention

Faculty	Percentage of Respondents Giving Perfect Score (%)
FM	26.7
FST	28.6
FPI	22.8
FEP	11.3
FKAB	13.2
FPEND	45.7
FTSM	15.4
FSSK	1.6
FUU	12.0

DISCUSSION

Herd immunity against a disease can be achieved when a large population of a community is vaccinated against the disease; hence, the spreading of an outbreak in the community can be restricted (Fine *et al.*, 2011; Turner, 2011). In the case where not all individuals is being vaccinated, a threshold of immunity is required in order to contain a disease outbreak. However, this threshold will be violated if the unvaccinated individual count is getting higher by the day. For instance, if only one individual in the community remains unvaccinated, then the disease incidence will be limited to one, however, if half the

population is not vaccinated, then the disease incidence will be higher. The re-emergence of diseases such as measles, diphtheria, and whooping cough is unlikely to occur as these diseases are included as part of the recommended childhood vaccination regime in most of the countries including Malaysia. Despite diphtheria being listed as one of the recommended childhood vaccines, a diphtheria outbreak was unexpectedly reported in Malaysia between June and July 2016 in several states with five death cases and dozens of severe infections (KKM, 2017; Jay, 2016).

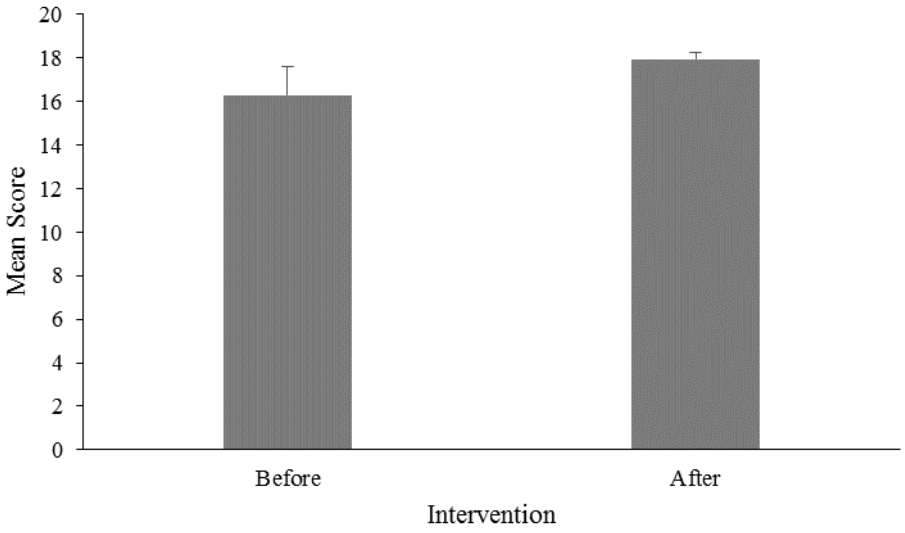

Fig. 7. Mean score of respondents towards positive statements of childhood vaccination before and after an education intervention. The comparison was statistically analyzed using Student's t-test. The significance level of *** indicates $p < 0.001$.

Statistics from WHO showed that some VPD incidences have increased in Malaysia since the last decade (WHO, 2020), due to omnipresent anti-vaccine movements finding their roots in Malaysia. Existing literature suggests lack of knowledge and religious belief as the commonest factors contributing to the anti-vaccine attitude among the parents. Hence, we organized a workshop to disseminate accurate information regarding vaccines to reduce the number of vaccine hesitancy. Our results indicated that UKM students are adequately aware of vaccination in general. However, their knowledge on the content of vaccines and herd immunity was insufficient. Therefore, educational intervention was carried out to improve their knowledge of vaccine/vaccination. Based on our findings, we encourage more educational intervention to improve the public knowledge pertaining to the content, safety, and side effects of vaccination, and herd immunity.

An interview session was also carried out to understand more deeply regarding the perception and comments on vaccination. Based on the comments, it can be concluded that refusal or hesitance in vaccination could be due to less exposure to vaccine information in society. The interviewees suggested that introduction to vaccination should be started even in early education and among family members. They think that earlier education about vaccines can make people more understand about this topic. They also suggested that public engagement is also important and that awareness through exhibitions, contests, and roadshows should be organized. Besides that, they realized that miscommunication and misinterpretation of vaccine information also lead to vaccination hesitancy. This is because knowledge of vaccines among them is not strong and incorrect information about vaccines that spread on the internet i.e. social media will influence their choice of vaccination. Some people also think that vaccination discourses on human rights because they can choose not to be vaccinated. In Islamic point of view, some interviewees think that vaccination hesitancy among Muslims is due to the practice of *tawakkal* concept and this should be an issue to be emphasized in the future. The interviewees also believed that improvement in government policy could help in combating vaccination refusal and hesitancy issues such as making vaccination compulsory for all citizens. Taking into account on the comments given, more information on human rights and the Islamic point of view such as the *tawakkal* concept, could be added in an education intervention.

LIMITATION OF CURRENT STUDY

The subjects who attended the education intervention program represent only a small portion of the

pre-workshop respondents, as such a higher number of participants should be required in the future to validate our preliminary finding. In addition, there were no participants that represented anti-vaccination supporters among the respondents. Although education intervention improved the current cohort's knowledge and understanding of vaccination, it is out of the scope of this study to determine whether education intervention could change the perception of participants from the negative perception group about vaccination. This study only represents the perception of students from UKM and it is not reflective of the general Malaysian population. We recommend that future studies to encompass a bigger target population of various backgrounds in order to compare the perceptions towards vaccines and vaccination among Malaysians.

CONCLUSION

In conclusion, the perception of UKM students towards vaccination is on the positive side and education intervention improved the knowledge of students regarding vaccines and vaccination. However, further data are required in order to truly understand the effect of education intervention in changing or improving the perception towards vaccination.

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ETHICAL STATEMENT

This study was conducted in UKM, Bangi Campus and the ethical approved was obtained from the Research Ethics Committee, UKM with the reference number JEP-2020-046. Informed consent was obtained from all subjects.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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