

# Vaccine Hesitancy Amongst Health Professional Undergraduates in Manipal University College Malaysia During the COVID-19 Pandemic

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## Abstract

On 31st of December 2019, Wuhan Municipal Health Commission, China, reported a cluster of cases of pneumonia in Wuhan, Hubei Province which was eventually identified as caused by a novel coronavirus, COVID-19. Since then, the disease had spread all over the world until finally, on March 11th 2020, WHO declared the pandemic status of COVID-19, which is also the first pandemic caused by a coronavirus. As the pandemic grows and has taken millions of lives, pharmaceutical companies such as Pfizer raced to develop an effective vaccine to control the spread of this infection. However, as the vaccines are developed in such a short time, vaccine hesitancy emerged as one of the biggest challenges to be overcome. A cross-sectional study was conducted among the undergraduates students of Manipal University College Malaysia (MUCM) to study the factors affecting COVID-19 vaccine hesitancy among them. An online questionnaire was distributed to all batches in MUCM and a total of 223 responses were accepted. All the data obtained were analysed using Epi Info version 7.1 software. The statistical tests used in this study were Pearson's Chi-Square test and multiple logistic regression for the measure of association between the selected factors and resulting COVID-19 vaccine hesitancy. The findings demonstrated 30.9% of the students are vaccine-hesitant with the majority of them (82.6%) are concerned about the side effects of the vaccine. The attitude towards COVID-19 and COVID-19 vaccination was found to have a significant negative association with COVID-19 vaccine hesitancy as suggested by OR of 0.83, p-value <0.001, and 95% CI of 0.78-0.89. Students who come from a household with a monthly income of RM 9,619 and less are found to be more likely to be hesitant on getting vaccinated against COVID-19 as compared to those with higher income households (more than RM 9,619). In summary, almost one-third of MUCM students are categorized as vaccine-hesitant in regards to COVID-19 vaccination. The factors found to influence their decision in receiving the COVID-19 vaccine are their household income, their attitudes towards the disease and its vaccination, and their decision to not get vaccinated in the past.

## Keywords

Vaccine Hesitancy, COVID-19, Medical Student, Cross-sectional study, Malaysia

Received: March 29, 2021 / Accepted: April 28, 2021 / Published online: May 1, 2021

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## 1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus that causes COVID-19, reached pandemic status on March 11th, 2020. As of January 2021, the virus

had spread to 221 countries and territories, infected over 100 million people, and resulted in over 2 million deaths worldwide [1, 2]. The SARS-Cov-2 infection is known to transmit among humans by direct contact and inhalation of droplets. The virus can also be contracted when a person has

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contact with a surface contaminated with the virus by entry through the eyes, nose, or mouth. The infection is said to be more infectious when infected to immunocompromised individuals. The community spread of the SARS-Cov-2 virus is circulating quickly and sustainably among populations in many countries. Due to the extensive spread of the virus, many scientists across the globe have worked together to come up with a vaccine to help tackle and reduce the spread of the disease [3].

Vaccination has become the mainstay in healthcare that is used to work alongside one's immune system to help prevent diseases. Vaccination has assisted the reduction in mortality and morbidity rates of various diseases and has even contributed to the eradication of multiple diseases. Vaccination does not only help oneself but the entire community as well as herd immunity is achieved whereby a population becomes immune to a particular disease [4].

Several human clinical trials commenced for the search of the most appropriate and efficient COVID-19 vaccine to be used across the globe, while the first trial began on the 3rd of March 2020 in the USA. As of February 2021, 20 vaccines had advanced to Phase 3 clinical trials, 7 vaccines had been approved for early or limited use while 3 vaccines are approved for full use [1, 5]. In Malaysia the Pfizer-BioNTech's vaccine would be available for use for the COVID-19 pandemic following conditional approval by the National Pharmaceutical Regulatory Agency (NPPRA), earliest by late February 2021 [6]. The vaccine is said to be distributed amongst the population in 3 phases. The first phase involves health and non-health frontliners which is expected to end in April. The second phase involves COVID-19 high risk groups (senior citizens, immunocompromised individuals and disabled persons). The third phase includes adults aged 18 and above [7].

However, vaccine hesitancy has become a salient issue in healthcare and it has stemmed along with the growth of the ever so bustling healthcare industry [4]. Vaccine hesitancy has been listed as one of the top 10 threats to global health in 2019 by the World Health Organisation (WHO). The term "anti vax" which has been globally used in current times is the reluctance or refusal to be vaccinated despite unassailable scientific evidence. Hesitancy on the other hand narrates individuals that are sceptical but not totally opposed to the idea of vaccination [8, 9]. In current times, patients are more actively involved in decision making when it comes to their health and this has brought upon the rise of hesitance [4].

Complacency, confidence and convenience are the three focus areas in describing vaccine hesitancy [11, 12]. Complacency is the term used to describe a low perception of the need for vaccination while low confidence in vaccine

means there are concerns over the efficacy and safety of a vaccine [15-17]. The term convenience in this context refers to how accessible is a vaccine to the population [13]. Typically, vaccine hesitancy occurs when there are complacency and low confidence in the vaccines [11, 12]. In a study conducted among the general population of the United Kingdom (UK), it was revealed that people of female gender, younger age, lower education level and lower income are more vaccine hesitant than that of the opposites [14]. The same study also proved that individuals who are at great risk of getting severe COVID-19 infection show lowest vaccine hesitancy as compared to those who are at moderate and low risk with people at low risk of getting severe COVID-19 illness showing the highest rate of vaccine hesitancy [14].

A similar study was conducted among medical students in the United State of America (USA) where they found out that 23% of the students were unwilling to take the COVID-19 vaccine upon approval by the FDA despite almost all of them (98%) agreed that they were likely to be exposed to COVID-19 [10]. It was also found that concern for serious side effects of the vaccine was associated with the low intent to participate in a COVID-19 vaccine trial [10]. In December 2020, the Ministry of Health (MOH) Malaysia conducted an online survey regarding the acceptance and refusal of COVID-19 vaccination in the general population of Malaysia where it was found that 67% of Malaysians agreed to take the vaccine and 16% refused the vaccination while another 17% were unsure whether to take it or not [18].

The aim of this research is to assess the vaccine hesitancy amongst health professional undergraduates in Manipal University College Malaysia (MUCM). Health professional undergraduates are equally at a high rate of being exposed to COVID-19. Therefore it is crucial to have this group protected against the virus to avoid them being a potential vector for the spread of the disease as well as contracting the illness themselves. This research will help recognize potential contributors to vaccine hesitancy and make way for the development of schemes to educate and reduce the hesitancy amongst this particular group [10].

## 2. Methods

### 2.1. Study Design, Time, Setting, Study Population

The study was conducted as a descriptive cross-sectional study which includes health professional undergraduates from Manipal University College Malaysia (MUCM). The study was carried out since February 2021 and ended in March 2021 for a period of five weeks. MUCM, Malaysia consists of two campuses, Melaka campus which is situated

in Malacca state and Muar campus in Johor state. This private medical college offers three courses, Bachelor of Medicine and Bachelor of Surgery (MBBS), Bachelor of Dentistry (BDS) and Foundation in Science (FIS). Our study population includes all undergraduate MBBS and BDS students as well as FIS students from both Melaka and Muar campuses.

## 2.2. Sample Size

According to a previous study done among medical students in U.S. regarding COVID-19 vaccine hesitancy, it was learned that 23% of the study population showed hesitancy on COVID-19 vaccine. [17] Consequently, the minimum sample size (n) for our study was calculated through StatCalc using the Epi Info application version 7.1, with the following parameters:

Population size: 1800 health professional undergraduate students of MUCM, Malaysia

Expected frequency: 23.0% showed hesitancy

Accepted margin of error: 6.0%

Population size:	1800	Confidence Level	Cluster Size	Total Sample
Expected frequency:	23 %	80%	77	77
Confidence limits:	6 %	90%	124	124
Design effect:	1.0	95%	171	171
Clusters:	1	97%	205	205
		99%	276	276
		99.9%	411	411
		99.99%	527	527

Figure 1. Calculation of minimum sample size.

The minimum sample size required in our study was 171 according to the 95% confidence interval. In addition, a non-response rate of 20% was expected and taken into consideration. The final sample size was calculated using the following formula:

$$n_{final} = \frac{n_{calculated}}{1 - nonresponse \%} = \frac{171}{1 - 0.2}$$

$$n_{final} = 214$$

Therefore, the minimum sample size would be 214 students. Additionally, nine responses were obtained and hence the final sample size was 223 participants.

## 2.3. Sampling

The sampling method used in our study is a non-probability sampling method known as purposive sampling. The inclusion criteria for this study were MBBS, BDS, and FIS

students of Manipal University College Malaysia (MUCM) in Muar and Melaka campuses, who willingly participated in the study and completed all required parts of the questionnaire provided. The exclusion criteria were students who denied informed consent and submitted incomplete questionnaires.

## 2.4. Data Collection

In this study, an electronic questionnaire form (Google Form) was used and distributed to all batches of students in Manipal University College Malaysia (MUCM). The questionnaire consisted of a total of 37 items which were divided into 6 sections; the first section (Section 1) had 10 items in it, inquiring about sociodemographic information of the participants such as age, gender, ethnicity, nationality, monthly household income, smoking status and presence of chronic illnesses.

Section 2 of the questionnaire consisted of three items, assessing the participant's opinion about vaccination in general. The participants were required to choose one out of four choices, whether they strongly agree, agree, disagree or strongly disagree with the following statements:

In my opinion, I think people receive more vaccines than what are required for them.

Vaccines are important for me to stay healthy as a future physician.

It is my role as future physician to learn about vaccines for myself and my patients.

Section 3 involved thirteen items about personal views on COVID-19 and COVID-19 vaccination specifically, for examples, "COVID-19 vaccination is important for overall public health of our communities", "The COVID-19 vaccination should be mandatory for the general public" and "The COVID-19 vaccination should be mandatory for all health care providers". The participants were asked to what extent do they agree with the statements, the responses available being "strongly agree, agree, disagree and strongly disagree".

The next part of the questionnaire (Section 4) was regarding the participants' personal experience with COVID-19 infection, which consisted of four items. In this section, questions such as, "Have you had COVID-19 infection?" and "Do you personally know someone who has died from COVID-19 infection?", were asked and the participants needed to answer with a "yes" or a "no".

In Section 5, there were three questions asked regarding personal vaccination behaviour of the participants. For example, the first question in this section is, "As an adult, have you ever delayed getting a vaccine for reasons other

than illness or allergy?”, and the responses available are “yes” and “no”.

The last part of this questionnaire (Section 6) was about the willingness of the participants to be vaccinated against COVID-19, consisting of 4 items. There were two questions where the participants needed to answer with a “yes” or a “no” and another two multiple answers questions. As an example, for the question “Would you vaccinate yourself for COVID-19?”, the answer would be either a “yes” or a “no”. If the person answered “no” in the previous question, they were required to answer the next question which was “If no, what are your concerns?” where they were given multiple choices and allowed to select more than one answer.

## 2.5. Data Processing and Data Analysis

Data was collected through the Google Forms given to the participants. The data was then compiled in Microsoft Excel and Epi Info application version 7.1 was used to statistically analyse the obtained data. For the qualitative data (programme and academic year, household income, chronic illnesses, general attitude on vaccination, personal views on Covid-19 and its vaccination, experience with Covid-19 and personal vaccination behaviour), the frequency was counted and the percentages were calculated. In addition, mean and standard deviation and range were calculated as well. Level of significance was set at  $p= 0.05$  with a 95% confidence level. Statistical tests used for the hypothesis testing were determined based on the independent and dependent variable and the details are tabulated as below.

**Table 1.** Variables and statistical tests used in data analysis.

Independent variable	Dependent variable	Statistical test
Programme and Academic year	Vaccine Hesitancy	Chi-Square test
Household Income	Vaccine Hesitancy	Chi-Square test
Chronic Illness	Vaccine Hesitancy	Chi-Square test
General attitude on vaccination	Vaccine Hesitancy	Logistic Regression
Personal views on COVID-19 and it's vaccination	Vaccine Hesitancy	Logistic Regression
Experience with COVID-19	Vaccine Hesitancy	Chi-Square test
Personal vaccination behaviour	Vaccine Hesitancy	Chi-Square test

## 2.6. Ethical Consideration

This study was solely based on voluntary participation as each student was given the option of denying to participate in the study at their own will. Discrete informed consent was obtained at the beginning of the questionnaire as an

indication of voluntary participation. Confidentiality and anonymity of the information provided by each student was maintained throughout the study.

In addition, the study was approved to be ethical by the Research Ethics Committee, Faculty of Medicine of Manipal University College Malaysia (MUCM).

## 3. Results

**Table 2.** Socio-demographic information.

Variable	n (%)
Age	
<22	107 (48.0%)
>22	116 (52.0%)
Mean (SD)	21.5 (1.9)
Min-max	16.0-25.0
Gender	
Male	55 (24.7%)
Female	168 (75.3%)
Ethnicity	
Chinese	56 (25.1%)
Malay	39 (17.5%)
Indian	95 (42.6%)
Others	33 (14.8%)
Nationality	
Malaysians	201 (90.1%)
International students	22 (9.87%)
Programme	
MBBS	104 (46.6%)
BDS	83 (37.2%)
FIS	36 (16.1%)
Household income	

Variable	n (%)
Above RM 9619	91 (40.8%)
Between RM 4360- RM 9619	97 (43.5%)
Less than RM 4360	35 (15.7%)
Do you live with any of the following at home? (multiple answer)	
Newborns/Infants (below 1 year of age)	3 (1.3%)
Elderly (above 65 years of age)	52 (23.3%)
Immunocompromised individuals	17 (7.6%)
Chronic smokers	5 (2.2%)
Pregnant women	2 (0.9%)
None of the above	155 (69.5%)
Do you have any of the following chronic illnesses? (multiple answer)	
Asthma	16 (7.2%)
Hypertension	2 (0.9%)
Diabetes	2 (0.9%)
Epilepsy	1 (0.4%)
Others	5 (2.2%)
None	201 (90.1%)
Smoking status	
No	219 (98.2%)
Yes	4 (1.8%)
If yes	
Daily	2 (50.0%)
Less than daily	0 (0.0%)
Do not know	2 (50.0%)

**Table 3.** Personal Vaccination Behaviour and Acceptance for Future COVID-19 Vaccine.

Personal Vaccination Behaviour	Yes n (%)	No n (%)
As an adult, have you ever delayed getting a vaccine for reasons other than illness or allergy?	26 (11.7%)	197 (88.3%)
As an adult, have you ever decided not to get a vaccine for reasons other than illness or allergy?	25 (11.2%)	198 (88.8%)
Have you vaccinated for seasonal influenza?	93 (41.7%)	130 (58.3%)
Acceptance for Future COVID-19 Vaccination	Yes n (%)	No n (%)
Would you vaccinate yourself for COVID-19?	154 (69.1%)	69 (30.9%)
If no, what are your concerns? (multiple answers)		
Side effects	57 (82.6%)	
Wait until tested by others	45 (65.2%)	
Efficiency rate	41 (59.4%)	
Poor quality control	20 (29.0%)	
I feel like I'm healthy enough	16 (23.2%)	
Physiological immunity is better	15 (21.7%)	
Media Influence	12 (17.4%)	
Poor health status	6 (8.7%)	
Would you ask your family members to vaccinate for COVID-19?	151 (67.7%)	72 (32.3%)
If no, what are your concerns? (multiple answers)		
Side effects	62 (87.3%)	
Wait until tested by others	45 (63.4%)	
Efficiency rate	40 (56.3%)	
Poor quality control	21 (29.6%)	
Physiological immunity is better	17 (23.9%)	
Poor health status	14 (19.7%)	
Media Influence	10 (14.1%)	

Table 2 shows the sociodemographic information of the students who participated. Majority of the students are above 22 years old (52%) and the remaining students are below 22 years (48%). There were more female students (75.3%) compared to male students. Besides that, the highest percentage of students that participated based on their ethnicity was Indians (42.6%). Among all the programmes the most participants came from MBBS (46.6%) followed by BDS (37.2%) and FIS (16.1%). Majority of them have a household income of RM4360- RM 9619 (43.5%). Most of the participants did not live with any infants, elderly,

immunocompromised individuals, chronic smokers and pregnant women (69.5%). However, there were 23.3 % of them who live with an elderly, 7.6% who live with an immunocompromised individual, 2.2% who live with chronic smokers, 1.3 % who live with an infant and 0.9% who live with pregnant women. Most of the participants do not have any chronic illness (90.1%). 7.2% of them have asthma, 0.9% has hypertension, 0.9% has diabetes and 0.4 % has epilepsy. Moreover, 98.3% of the participants do not smoke and 1.8% of them do. The participants who smoke usually do it on a daily basis which is 50% of them and the remaining 50% do

not know how frequent they smoke.

Table 3 shows the personal vaccination behaviour of the students and their acceptance for future COVID-19 vaccination. Majority of the students have never delayed getting a vaccine (88.3%) or decided not to get vaccinated (88.8%) for reasons other than illness and allergy. Moreover, almost half of the participating students (41.7%) have the habit of getting vaccinated for seasonal influenza while 58.3% did not. Therefore, it is safe to say that generally the students have a good personal vaccination behaviour. When asked whether they would vaccinate themselves against COVID-19, 69.1% of the students answered yes while another 30.9% said no to the

vaccine. This means almost one third of the students are vaccine hesitant where the majority of them are most concerned about the side effects of the vaccine (82.6%). 65.2% of the vaccine hesitant participants want to wait until the vaccine is tested by others before taking it for themselves and 59.4% of them are in doubt about the efficacy of the vaccine. Besides that, 67.7% of the participants would like their family members to be vaccinated against COVID-19 while 32.3% do not want the same with the biggest concerns being the side effects of the vaccine (87.3%), followed by wanting to wait until tested by others (63.4%) and doubted efficiency rate (56.3%).

**Table 4.** General attitude on vaccination.

General attitude on vaccination	Strongly agree n (%)	Agree n (%)	Disagree n (%)	Strongly disagree n (%)
People receive more vaccines than what are required for them	9 (4.0%)	33 (14.8%)	126 (56.5%)	55 (24.7%)
Vaccines are important for me to stay healthy as a future physician	129 (57.9%)	89 (39.9%)	5 (2.2%)	0 (0.0%)
It is my role as a future physician to learn about vaccines for myself and my patients	170 (76.2%)	51 (22.9%)	2 (0.9%)	0 (0.0%)

Table 4 shows that 81.2% of the participants disagreed with the statement “People receive more vaccines than what are required for them” while only 4.0% strongly agreed to it. In addition, 97.8% of the participants agreed to the statement that emphasised on the importance of vaccines for a future physician to be healthy, whereas only 5 out of the 223

participants believed otherwise. Majority of the participants (99.1%) felt that a future physician must learn about vaccines for themselves and for their patients, while only 2 participants disagreed with this. This proves that the majority of the participants generally have a good attitude towards vaccination.

**Table 5.** Attitude on COVID-19 and COVID-19 vaccine.

Attitude on COVID-19 and COVID-19 vaccine	Strongly agree n (%)	Agree n (%)	Disagree n (%)	Strongly disagree n (%)
Development of a COVID-19 vaccine is important to decrease spread of the disease	121 (54.3%)	98 (44.0%)	4 (1.8%)	0 (0.0%)
COVID-19 vaccination is important for the overall public health of our communities	128 (57.4%)	93 (41.7%)	2 (0.9%)	0 (0.0%)
I am likely to be exposed to COVID as a future physician	101 (45.3%)	99 (44.4%)	18 (8.1%)	5 (2.2%)
COVID-19 vaccination is important for me as a future health care provider	124 (55.6%)	91 (40.8%)	7 (3.1%)	1 (0.5%)
I would like to be involved in a COVID-19 vaccine trial	34 (15.3%)	89 (39.9%)	78 (35.0%)	22 (9.9%)
I will take the COVID-19 vaccine as soon as an approved vaccine by Ministry of Health is available	68 (30.5%)	116 (52.0%)	31 (13.9%)	8 (3.6%)
I am concerned that a COVID-19 vaccine may not be effective	46 (20.6%)	120 (53.8%)	53 (23.8%)	4 (1.8%)
I am concerned about serious side effects from a COVID-19 vaccine	68 (30.5%)	105 (47.1%)	40 (17.9%)	10 (4.5%)
I need more information about the COVID-19 vaccine	118 (52.9%)	98 (44.0%)	7 (3.1%)	0 (0.0%)
I trust the information I am receiving about the COVID-19 vaccine from the public health experts	43 (19.3%)	139 (62.3%)	33 (14.8%)	8 (3.6%)
The COVID-19 vaccination should be mandatory for the general public	72 (32.3%)	110 (49.3%)	35 (15.7%)	6 (2.7%)
The COVID-19 vaccination should be mandatory for all health care providers	113 (50.7%)	98 (44.0%)	10 (4.5%)	2 (0.9%)
The only reason I will get a COVID-19 vaccine is if it is mandated by the health system/medical school	33 (14.8%)	73 (32.7%)	85 (38.1%)	32 (14.4%)

Table 5 demonstrates the attitude of participants on COVID-19 and COVID-19 vaccines. Nearly all of the students (99.1%) realised that COVID-19 vaccination is important for overall public health. 54.3% of the participants strongly agreed that development of COVID-19 vaccine is inevitable in order to decrease the spread of disease. Most of the participants (89.7%) agreed to the statement “I am likely to be exposed to COVID as a future physician” while 10.3% of them disagreed. Although 96.4% of students are aware of the importance of COVID-19 vaccine in their career as a future physician, only 55.2% of them are keen to be involved in a

COVID-19 vaccine trial. Furthermore, 74.4% of the participants are concerned about the ineffectiveness of the vaccine, likewise 77.6% of them worry about the side effects they could face after vaccination. In fact, a large number of students (81.6%) have confidence in information about COVID-19 vaccine brought out by public health experts, however only 3.1% of students believed that they have enough knowledge on COVID-19 vaccine. On the other hand, a majority of the participants (94.7%) agreed that COVID-19 vaccine should be compulsory for all health care providers. Contrastingly, half of the them (47.5%) are willing to take

COVID-19 vaccine only if it is mandatory.

**Table 6.** Experience with COVID-19.

Experience with COVID-19	Yes n (%)	No n (%)
Have you had COVID-19 infection?	4 (1.8%)	219 (98.2%)
Do you personally know someone who has had COVID-19 infection?	102 (45.7%)	121 (54.3%)
Have you cared for someone with COVID-19 infection?	39 (17.5%)	184 (82.5%)
Do you personally know someone who has died from COVID-19 infection?	13 (5.8%)	210 (94.2%)

Table 6 illustrates the participants' experiences with COVID-19. 98.2% of the participants have not had COVID-19 infection and 54.3% also did not personally know someone who has had COVID-19. Nonetheless, 39 out of the 223

participants have cared for someone with COVID-19, however the majority (82.5%) have not. Only 5.8% of the participants personally knew someone who has died from COVID-19 infection.

**Table 7.** Attitude towards vaccination amongst health professional undergraduates.

Variables	Mean (SD)	Min - Max
General attitude on vaccination	10.3 (1.2)	7-12
Attitude on COVID-19 and COVID-19 Vaccine	37.2 (5.1)	21-50

Table 7 shows the general attitude on vaccination and attitude of COVID-19 as well as the COVID-19 vaccine. For the general attitude on vaccination, most of the participants scored more than half of the total score with the mean of 10.3. This shows that most of the health professional undergraduates have a good attitude towards vaccination in

general. For the attitude of COVID-19 and the COVID-19 vaccine, participants scored more than half of the total score as well with the mean of 37.2 which indicates that the majority of the participants are well aware of COVID-19 and have a good attitude towards its vaccine.

**Table 8.** Multiple logistic regression analysis of vaccine hesitancy based on the general opinion on vaccination and attitude of COVID-19 and COVID-19 vaccine.

Independent variable	Odds Ratio	95% CI	Standard Error	P-value
General attitude on vaccination	1.70	1.36 - 2.14	0.12	0.000
Attitude on COVID-19 and COVID-19 vaccine	0.83	0.78 - 0.89	0.03	0.000

Table 8 shows an association between the general attitude on vaccination and the attitude on COVID-19 and COVID-19 vaccine towards vaccine hesitancy. A positive association was seen between the general attitude on vaccination and vaccine hesitancy with an odds ratio of 1.70, showing that more participants were likely to be vaccine hesitant if they had a good attitude towards vaccination. The 95% confidence level was 1.36 - 2.14, 1 was not in this range showing that there was a statistical significance between the general attitude on vaccination towards vaccine hesitancy. The p-

value was  $< 0.05$ , which shows there is a statistical significance as well.

A negative association was seen between the attitude on COVID-19 and COVID-19 vaccine and vaccine hesitancy. An odds ratio of 0.83 is found, showing that participants with a better attitude on COVID-19 and its vaccine had a lower vaccine hesitancy. The 95% confidence level was 0.78 - 0.89 and p-value was  $< 0.05$ , showing that there was statistical significance.

**Table 9.** Association between the programme, household income and chronic illnesses towards the vaccine hesitancy.

Independent variable	Vaccine Hesitancy		OR (95% CI)	Chi-square	P value	
	Yes n (%)	No n (%)				
Programme	FIS	15 (41.67)	21 (58.33)	2.67 (1.18-6.00)	5.79	0.02
	BDS	25 (30.12)	58 (69.88)	1.61 (0.83-3.12)	1.97	0.16
	MBBS	22 (21.15)	82 (78.85)	Reference		
Household income	Less than RM 4360	16 (45.71)	19 (54.29)	3.95 (1.68-9.30)	10.56	0.001
	Between RM 4360 - RM 9619	30 (30.93)	67 (69.07)	2.10 (1.05-4.19)	4.52	0.03
	Above RM 9619	16 (17.58)	75 (82.42)	Reference		
Chronic illness	Yes	8 (36.36)	14 (63.64)	1.56 (0.62-3.92)	0.90	0.35
	No	54 (26.87)	147 (73.13)	Reference		

Table 9 shows the association between the programme, household income and chronic illness towards vaccine hesitancy. A positive association is seen between the FIS programme and vaccine hesitancy as an odds ratio of 2.67

was found. This shows that a person is 2.67 times more likely to be vaccine hesitant if they are from the FIS programme and it is statistically significant since the 95% confidence level is between 1.82-6.00 and the p-value is 0.02. There is

also a positive association seen between BDS programmes and vaccine hesitancy as the odds ratio is 1.61. This shows that a person is 1.61 times more likely to be vaccine hesitant if they are from the BDS programme however it is statistically not significant since the 95% confidence level is between 0.83-3.12 and the p-value is 0.16. There is a positive association between household income for less than RM 4360 and vaccine hesitancy as the odds ratio is 3.95. This shows that a person is 3.95 times more likely to be vaccine hesitant and it is statistically significant since the 95% confidence level is between 1.68-9.30 and the p-value is

0.001. A positive association is also seen between household income between RM4360-RM9619 as an odds ratio of 2.10 was obtained. This shows that a person is 2.10 times more likely to be vaccine hesitant and it was statistically significant as well since the 95% confidence level is between 1.05-4.19 and with a p-value of 0.03. A positive association is seen between chronic illness and vaccine hesitancy as the odds ratio is 1.56 which means the person is 1.56 times more likely to be vaccine hesitant but it is not statistically significant as the 95% confidence level is between 0.62-3.92 and the p-value is 0.35.

**Table 10.** Association between the experience with COVID-19 towards vaccine hesitancy.

Experience with COVID-19		COVID-19 Vaccine Hesitancy		OR (95% CI)	Chi-square	P value
		Yes n (%)	No n (%)			
HAVE YOU HAD COVID-19 INFECTION?	Yes	3 (75.0%)	1 (25.0%)	6.95 (0.71- 68.10)	3.70	0.054
	No	66 (30.1%)	153 (69.9%)	Reference		
DO YOU PERSONALLY KNOW SOMEONE WHO HAS HAD COVID-19 INFECTION?	Yes	34 (33.3%)	68 (66.7%)	1.23 (0.70- 2.17)	0.50	0.478
	No	35 (28.9%)	86 (71.1%)	Reference		
HAVE YOU CARED FOR SOMEONE WITH COVID-19 INFECTION?	Yes	8 (20.5%)	31 (79.5%)	0.52 (0.23- 1.20)	2.41	0.121
	No	61 (33.2%)	123 (66.9%)	Reference		
DO YOU PERSONALLY KNOW SOMEONE WHO HAS DIED FROM COVID-19 INFECTION?	Yes	2 (15.4%)	11 (84.6%)	0.39 (0.08- 1.80)	1.56	0.211
	No	67 (31.9%)	143 (68.1%)	Reference		

Table 10 shows the association between the experience with COVID-19 and the vaccine hesitancy. A positive association is seen between having had the COVID-19 infection and vaccine hesitancy as an odds ratio of 6.95 is found. This shows that a person is 6.95 times more likely to be vaccine hesitant if they have been infected with COVID-19, however it is not statistically significant since the 95% confidence level is 0.71-68.10 and with a p-value of 0.054. A positive association is also seen between personally knowing someone who has had COVID-19 infection and vaccine hesitancy. An odds ratio of 1.23 shows a person is more likely to be vaccine hesitant if they know someone who has had COVID-19 infection, however a 95% confidence level of 0.70- 2.17 and p-value of

0.478 shows that it is not statistically significant. A negative association is observed between caring for a person with COVID-19 infection and vaccine hesitancy. The odds ratio is 0.52, proving that a person is less hesitant to get the COVID-19 vaccine if they have cared for someone with COVID-19. Nevertheless the 95% confidence level is 0.23- 1.20 and p-value is 0.121 showing that this is not statistically significant. Finally, another negative association is seen between personally knowing someone who had died from COVID-19 infection and vaccine hesitancy as an odds ratio of 0.39 is found, this is once again not statistically significant since the 95% confidence level is 0.08- 1.80 and p-value is 0.211.

**Table 11.** Association between Personal Vaccination Behaviour and COVID-19 Vaccine Hesitancy.

Personal Vaccination Behaviour		COVID-19 Vaccine Hesitancy		OR (95% CI)	Chi-square	P value
		Yes n (%)	No n (%)			
As an adult, have you ever delayed getting a vaccine for reasons other than illness or allergy?	Yes	12 (46.2%)	14 (53.9%)	2.11 (0.92-4.83)	3.19	0.074
	No	57 (28.9%)	140 (71.1%)	Reference		
As an adult, have you ever decided not to get a vaccine for reasons other than illness or allergy?	Yes	15 (60.0%)	10 (40.0%)	4.00 (1.69-9.44)	11.13	0.001
	No	54 (27.3%)	144 (72.7%)	Reference		
Have you vaccinated for seasonal influenza?	Yes	30 (32.3%)	63 (67.7%)	1.11 (0.63-1.97)	0.13	0.179
	No	39 (30.0%)	91 (70.0%)	Reference		

Table 11 depicts the association between personal vaccination behaviour and COVID-19 vaccine hesitancy. There is a positive association between having delayed getting a vaccination and COVID-19 vaccine hesitancy with the odds ratio of 2.11, however it is not a statistically significant association as the p value is more than 0.05 and the 95% confidence interval includes the value 1. However, a person is 4.00 times more likely to be vaccine hesitant if they

have ever decided not to get vaccinated, as shown in the table where there is a significant positive association ( $p < 0.05$ ) between the two variables mentioned. Lastly, there is a positive association between having been vaccinated for seasonal influenza and COVID-19 vaccine hesitancy with the odds ratio of 1.11. The association is not significant however, seeing that the p value is 0.179 which is greater than the determined level of significance (0.05).



## 4. Discussion

This cross-sectional study was conducted to investigate the vaccine hesitancy among health professional undergraduates in Manipal University College Malaysia (MUCM) during the COVID-19 pandemic. Furthermore, we aim to determine the perception of students towards vaccination and their acceptance to COVID-19 vaccine. When participants were asked if they would vaccinate themselves for COVID-19, the majority of the participants (69.1%) were willing to vaccinate themselves and 30.9% were hesitant. Among participants who were hesitant, the main concerns were side effects, wanting to wait till the vaccine is tested by others and the efficiency rate. When asked if they would ask their family members to vaccinate for COVID-19, 32.3% of the participants were hesitant. A previous study amongst medical students in the United States showed that nearly one quarter of the students were hesitant to take the vaccine with concerns of serious vaccine side effects and lack of trust in the information received from public health experts [17]. A recent study on the COVID-19 vaccine acceptance among health care workers in Malaysia showed that 69.7% of the participants are willing to take the vaccine. 17% of the participants were hesitant with concerns of the side effects, vaccine efficacy and the safety of the vaccine [19]. Based on the results of this research, there is a positive general attitude and positive perception towards COVID-19 and its vaccination amongst health professional undergraduates in MUCM.

According to the findings, there was an overall positive attitude towards vaccination with the lowest hesitancy rate coming from the MBBS programme. Besides that, most of them having a household income of more than RM 9619 show a positive attitude towards getting the COVID-19 vaccine. Based on previous studies from 19 different countries regarding the COVID-19 vaccine hesitancy, it shows that those with a higher household income are less likely to have COVID-19 vaccine hesitancy compared to those with a lower household income [20]. Based on the responses we have received it shows that there is no significance between vaccine hesitancy with COVID-19 experience. Previous studies from the United States show that despite the high incidence of COVID-19 among associates of the respondents, there was no statistical association of COVID-19 vaccine attitudes towards the closeness of the relationship. Those who knew multiple people with the disease were no more likely to intend to vaccinate than those who did not have a relationship with someone with COVID-19 [21]. Based on our study conducted, it shows that a person is more likely to be vaccine hesitant if they have ever decided not to get vaccinated for

reasons other than illness or allergy.

Based on the results, the analysis of the students' general attitude towards vaccination showed that there was an overall positive attitude on vaccination, in which most of them are aware of the importance of vaccinations as a future healthcare professional. A cross sectional study done among students from Belgrade University, Serbia showed that 83.7% of the medical students acknowledged the importance of vaccination coverage among the public to avoid the emergence of a new epidemic, with a significant difference as compared to non-healthcare professional students who gave lower percentages. [22] Majority of the participants have good perception on the broad impact of COVID-19 vaccination could bring to interrupt disease spread and agreed with vaccine mandates among healthcare personnel. This came to support the findings from a recent study on COVID-19 vaccine acceptance among the general population presented by M Kazi Abdul et al. which showed 81.5% of the participants agreed that it is important to get a vaccine to protect people from COVID-19. [23] As compared to another study among the health care workers from mainland China, 95% of the healthcare workers are aware of the necessity of development of COVID-19 vaccination, similar to findings from our study. [24] Conversely, despite the positive attitude among the participants, only approximately half of them showed willingness in joining a COVID-19 vaccine trial. Based on a cross-sectional survey carried out among 1,287 adults in Jordan, 36.1% reported to be willing to participate in clinical trials of the COVID-19 vaccine with the desire to return to normal life. [25] On the other hand, our study also reported half of the participants (47.5%) agreed to take COVID-19 vaccine only if it is mandatory by the healthcare system. Similarly, a survey done in the U.S among the general population revealed that 40.9% respondents regarded requiring COVID-19 vaccination in state mandates for adults acceptable. Compared with state mandates for adults, slightly more respondents (47.7%) found employer-enforced employee mandates acceptable. [26] Regarding vaccine mandates, our study generally demonstrates acceptability more than unacceptability, suggesting a potential role for health care to increase COVID-19 vaccine uptake, particularly among key groups such as frontline workers.

The results obtained from this study also showed that attitude towards COVID-19 and COVID-19 vaccination is negatively and significantly associated with COVID-19 vaccine hesitancy. Students with higher scores in attitude are less likely to be hesitant in receiving the said vaccine, which supports our hypothesis. Higher scores in attitude mean the students have a better or positive attitude towards COVID-19 and its vaccination, therefore they tend to accept the vaccine when an approved vaccine is available for the community. A

cross-sectional study conducted in China found that there is a positive association between believing that COVID-19 vaccination is an effective way to prevent and control the infection and the acceptance rate of COVID-19 vaccine among the general population [27]. In this study, the people who believed in the efficacy of the vaccine in preventing and controlling the spread of the disease (89.5%) were showing a positive attitude towards the vaccine and it was found that these people wanted to get vaccinated as soon as possible as compared to those who wanted to delay the process [27]. Another study, which was conducted by Kendall Pogue, Jamie L. Jensen, Carter K. Stancil and others in the United States, also found that positive attitude is positively associated with acceptance for COVID-19 vaccine [21]. Most of the respondents in the study were agreeable to COVID-19 vaccination (46.1% strongly agreed and 22.5% somewhat agreed that they are likely to be vaccinated when a vaccine becomes available) with an overall positive attitude among them (54.83% strongly agreed and 23.36% somewhat agreed that a vaccine is important to stop the COVID-19 pandemic) [21]. Based on these findings, it is safe to say that those who have a positive attitude towards COVID-19 vaccination are more likely to be vaccinated against the infection thus less likely to hesitate in taking the vaccine.

There were few limitations in our study. The main one was that our study was only done in one private medical college; hence the results cannot be generalized to other populations.

## Appendix

Vaccine Hesitancy amongst health professional undergraduates in Manipal University College Malaysia during the COVID-19 pandemic

Principal Investigators:

Pavitraa Ramakrishnan

Sabrikresha Ravisha

Ho Wen Huey

Ezzatul Aliyah binti Che Hasan

Malisha Dimithri Marasingha

You are being invited to take part in a research project which aims to determine the Vaccine Hesitancy amongst medical undergraduates in Melaka Manipal Medical College during the COVID-19 pandemic. It will ask for basic information without breaking anonymity. This survey will take about 5-10 minutes. Participation in this study is voluntary and you have the right to deny and/or withdraw from the study at any time, no need to give any reason, and this will not have negative impact on you. Any information you provide is anonymous. Results of the study will be reported as total picture and not individually. We would like to thank you for your time and participation.

Consent

I have read the above information. I am 18 years of age or older. I consent to participate in the study as titled above of my own free will. I further understand that I have the freedom to choose not to participate in the study. No reward or inducement has been offered to me to participate as a volunteer in the study.

Another limitation of our study was that although the population of medical students in the assessed institution was large, the sample size of participants that responded was small. Also, this study was a cross-sectional study conducted for a period of five weeks which only allowed us to observe participants at one point in time.

From our study, we would recommend future researchers to ensure the inclusion of a wide range of medical students from different medical institutions to increase the generalisability factor amongst a larger population. Moreover, we would recommend including a few more questions about COVID-19 to assess the knowledge of the disease amongst medical students. Finally, another recommendation is to include COVID-19 disease in the curriculum for students so that they can further broaden their knowledge and awareness.

## 5. Conclusion

Based on our study, vaccine hesitancy amongst health professional undergraduates in MUCM is 30.9%. While the main concerns for vaccine hesitancy were side effects encountered due to the vaccine, the students want to wait till the vaccine is tested by others and the efficiency rate. In addition, students with higher scores in attitude towards COVID-19 and COVID-19 vaccination are less likely to be hesitant in receiving the vaccine.

a) I consent to participate in the study as titled above on my own free will

b) I do not want to participate in this survey

Thank you so much for your participation.

.....  
Section 1. Sociodemographic information

1.1 Age: \_\_\_\_\_ year-old

1.2 Gender

- i. Male
- ii. Female

1.3 Ethnicity

- i. Malay
- ii. Chinese
- iii. Indian
- iv. Others

1.4 Nationality

- i. Malaysian
- ii. International students

1.5 Program & Academic year

- i. MBBS clinical year (Semester 6-10)
- ii. MBBS pre-clinical year (Semester 1-5)
- iii. BDS clinical year (Year 3-5)
- iv. BDS pre-clinical year (Year 1-2)
- v. FIS students

1.6 Household income

- i. Less than RM 4360
- ii. Between RM 4360-9619
- iii. Above RM 9619

1.7 Do you live with any of the following at home? (You may select multiple answers)

- i. Newborns / infants (below 1 year of age)
- ii. Elderly (above 65 years of age)
- iii. Immunocompromised individuals (cancer patients, patients on corticosteroids etc.)
- iv. Chronic smokers (more than 1 pack everyday for at least 10 years)
- v. Pregnant women
- vi. None of the above

1.8 Do you have any of the following chronic illnesses? (You may select multiple answers)

- i. Asthma
- ii. Hypertension
- iii. Diabetes

iv. Epilepsy

v. Others

vi. None

#### 1.9 Smoking Status

i. Yes

ii. No

#### 1.10 If yes, how often do you smoke?

i. Daily

ii. Less than daily

iii. Don't know

Section 2. The following questions are about vaccines in general.

		Strongly agree	Agree	Disagree	Strongly disagree
2.1	People receive more vaccines than what are required for them				
2.2	Vaccines are important for me to stay healthy as a future physician				
2.3	It is my role as a future physician to learn about vaccines for myself and my patients				

Section 3. The following questions are about COVID-19 and the COVID-19 vaccine, specifically.

		Strongly agree	Agree	Disagree	Strongly disagree
3.1	Development of a COVID-19 vaccine is important to decrease spread of the disease				
3.2	COVID-19 vaccination is important for the overall public health of our communities				
3.3	I am likely to be exposed to COVID as a future physician				
3.4	COVID-19 vaccination is important for me as a future health care provider				
3.5	I would like to be involved in a COVID-19 vaccine trial				
3.6	I will take the COVID-19 vaccine as soon as an approved vaccine by Ministry of Health is available				
3.7	I am concerned that a COVID-19 vaccine may not be effective				
3.8	I am concerned about serious side effects from a COVID-19 vaccine				
3.9	I need more information about the COVID-19 vaccine				
3.10	I trust the information I am receiving about the COVID-19 vaccine from the public health experts				
3.11	The COVID-19 vaccination should be mandatory for the general public				
3.12	The COVID-19 vaccination should be mandatory for all health care providers				
3.13	The only reason I will get a COVID-19 vaccine is if it is mandated by the health system/medical school				

Section 4. The following questions are about your experience with the COVID-19 infection.

		Yes	No
4.1	Have you had COVID-19 infection?		
4.2	Do you personally know someone who has had COVID-19 infection?		
4.3	Have you cared for someone with COVID-19 infection?		
4.4	Do you personally know someone who has died from COVID-19 infection?		

Section 5. The following questions are about your personal vaccination behavior.

		Yes	No
5.1	As an adult, have you ever delayed getting a vaccine for reasons other than illness or allergy?		
5.2	As an adult, have you ever decided not to get a vaccine for reasons other than illness or allergy?		
5.3	Do you vaccinate for seasonal influenza?		

## Section 6. Acceptance for future COVID-19 vaccination

### 6.1 Would you vaccinate yourself for COVID-19?

- i. Yes
- ii. No

### 6.2 If no, what are your concerns? (You may select multiple answers)

- i. Poor quality control
- ii. Side effects
- iii. Wait until tested by others
- iv. Efficiency rate
- v. Physiological immunity is better
- vi. Media influence
- vii. Poor health status
- viii. I feel like I'm healthy enough

### 6.3 Would you ask your family members to vaccinate for COVID-19?

- i. Yes
- ii. No

### 6.4 If no, what are your concerns? (You may select multiple answers)

- i. Poor quality control
- ii. Side effects
- iii. Wait until tested by others
- iv. Efficiency rate
- v. Physiological immunity is better
- vi. Media influence
- vii. Poor health status

refer and use her questionnaire from her study.

## Acknowledgements

Firstly, we would like to express our appreciation and gratitude to our participants who agreed and voluntarily participated in our study. Furthermore, we would like to thank Prof. Dr. Adinegara Lufti Abas (Dean of the Faculty of Medicine & Head of Department of Community Medicine), Prof. Dr. Htoo Htoo Kyaw Soe (Department of Community Medicine, MUCM), Associate Prof. Dr. Sujata Khobragade (Department of Community Medicine, MUCM) and Assistant Prof. Dr. Mila Nu Nu Htay (Department of Community Medicine, MUCM) for the continuous guidance and support given throughout our study. We also extend our appreciation to the Research Ethics Committee, Faculty of Medicine, Manipal University College Malaysia. Lastly, we would like to wholeheartedly thank Ms. Victoria C. Lucia, Foundational Medical Studies, Oakland University William Beaumont School of Medicine, for giving us permission to

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