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A Cross Sectional Study: Knowledge, Attitude, Perception and Practice Towards Influenza Vaccine Among Undergraduate Students

Kieren Low Chitra Karan*, Jemima Thomas, Sonia Chitra Karan, Muhammad Hafiz bin Abd Rahim

Faculty of Medicine, Melaka-Manipal Medical College, Manipal Academy of Higher Education (MAHE), Melaka, Malaysia

Abstract

Annual influenza epidemics are estimated to result in about 3 to 5 million cases of severe respiratory illness and about 290,000 to 650,000 respiratory deaths. These burden of illness causes considerably high morbidity and mortality worldwide. With that being said, vaccines have undoubtedly become the best preventive measure for various diseases, more so for the influenza. This study was conducted to understand the knowledge, perception, attitude and practice of undergraduate students towards the influenza vaccine. This cross-sectional study had been conducted from November 2020 to December 2020 with the help of a questionnaire. This questionnaire consisted of 5 sections which included: Sociodemographic information, knowledge of flu vaccines overall, attitude towards flu vaccinations, risk perception, and attitude towards the influenza vaccination which had all been completed by 280 students. Statistical tests (Unpaired T-test, ANOVA, Chi square, logistic regression) had been done using Epi info V7.2.4. From the knowledge section of the questionnaire, the participants can be divided into 3 categories for knowledge: high, low and moderate where at which, 3.57% of the participants had been in the high category, 71.07% for low and 25.36% had been in moderate. Attitude of the students towards influenza vaccination, along with perception and knowledge had no significant association with age, gender, ethnicity, previous history of influenza vaccination, smoking status, history of chronic illness or living with susceptible individuals. However, there had been a positive association between smoking status and influenza vaccination uptake, with smokers more likely to be vaccinated compared to non-smokers. In addition to this, Indian and Malay populations were more likely to be vaccinated compared to that of Chinese populations.

Keywords

Knowledge, Attitude, Perception, Practice, Undergraduate Students, Influenza Vaccination, Cross-sectional Study, Malaysia

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1. Introduction

Influenza is an extremely contagious, acute respiratory infection caused by the influenza viruses. This is usually by the Influenza A or B subtypes. The severity of it ranges from mild to severe illness. The virus also predisposes individuals to exacerbations of underlying disease or development of secondary bacterial infections. Certain groups of individuals are at a risk for serious complications of influenza, such as pregnant women, older and younger age groups and individuals with certain chronic health conditions.[1] With that being said, when looking into season and pandemic influenza, these burden of the illness causes considerably high morbidity and mortality worldwide. These annual epidemics are estimated to result in about 3 to 5 million cases of severe respiratory illness, and about 290 000 to 650 000 respiratory deaths. [2, 3]

Over the years, vaccines have undoubtedly become the best

* Corresponding author
E-mail address: kieren10000@yahoo.com (K. L. C. Karan)

preventive measure for various diseases. A study analysis done in 2009 showed that routine childhood immunization will prevent up to 42000 early deaths and 20 million cases of diseases [4]. Apart from that, vaccination can provide herd immunity for populations with high risk for complications [5, 6]. A study done in US regarding vaccination has also noted that vaccination can prevent the development of resistant strains for particular diseases, extend life expectancy, ensuring safe travel and mobility and other public health benefits including women empowerment, promoting economic growth and equity and providing protection against bioterrorism [7].

However, vaccination coverage among people at high risk such like those with chronic diseases, old age and health-care workers is lower than 40% in most countries [8]. This is seen in many countries including Norway with 38.2%, Germany with 34.8%, Czech Republic with 21.5% of influenza vaccination coverage for people aged 65 years and above. There are even some countries with coverage of less than 20% such as Lithuania, Latvia and Turkey to name a few. On the other hand, a gap can be obviously seen in countries like Korea which having the most coverage with 85.1% followed by UK with 72% and US with 68.7% [9]. In the US, 63.8% of children 6 months through 17 years receive ≥1 dose of flu vaccine during the 2019–20 season while adults of ≥18 years, flu vaccination coverage was 48.4% [10].

There are numerous factors affecting vaccine coverage in various countries that have been identified in a report published in *Communicable Disease Intelligence* [11], some of which include risk perception and the decision-making power of parents. The belief of parents plays a huge role in the vaccination of their children. In the study mentioned in the report, they had observed that there had been a wide range of reasons, from being fearful of unknown/long term side effects, not having trust in health care providers and also the belief that vaccinations were social experiments [12]. In addition to this, obtaining consent from families that were divided had been said to be difficult, as well as gaining consent from adolescents who have poor perception of risk [13]. Influence of healthcare providers had also been observed to be a factor according to a western Sydney study in the report.

In an influenza vaccination study done among Malaysian healthcare workers [14], out of the 527 HCWs that had participated, 271 (51.4%) of the participants were vaccinated. Most of them had an age range of 20-30 years, followed by 31-40 at 37%, 41-50 at 7% and 51-60 at 4%. The participants that had not been vaccinated had a majority age range from 41-50 with 61.3%. The study had also categorized the vaccinated and unvaccinated participants based on their department, with the Pharmacy department having the highest rate of unvaccinated with 70.59%. Moreover, a cross-sectional study [15] regarding the complete immunization coverage of children in Malaysia had reported that the overall complete immunization coverage among the children which were verified by cards, to be 86.4%. These children were 12-23 months of age. While in another study based on hospitalized infants [16], out of 100 infants, 22 had been incompletely immunized, thus resulting to an immunization rate of 78% for the study population.

CDC estimates influenza has resulted in in between 9 million - 45 million illnesses, between 140,000 – 810,000 hospitalizations and between 12,000 – 61,000 deaths annually since 2010 in the United states alone [17]. In the tropics of Kuala Lumpur in Malaysia however, there is year-round influenza activity and biannual epidemics that occur from May to July and from November to January [18]. A retrospective epidemiological study of hospitalized children was done in Kuala Lumpur from 1982 to 2008 and showed that 297 of 2,708 (11%) of patients with confirmed virus infection (RTI) were positive for influenza virus. This makes it the third most common respiratory virus that is affecting children aged <5 years, with rates that are higher in children aged 1 to 5 years than in children under 12 months old. Epidemiological research in Malaysia is without a doubt well documented [18-21], but not many studies have been conducted on the factors contributing to influenza vaccination uptake among population groups.

Healthcare workers and medical students are considered to be a reservoir for hospital transmission since they are at a high risk of exposure towards Influenza since they care for vulnerable patients who are unable to produce the same level of protection from the Influenza vaccine. Getting them vaccinated allows to reduce the transmission of nosocomial infections to the community and in health care settings. [22] The CDC as well as Malaysian Ministry of Health believe that vaccinating healthcare workers reduces the frequency of hospital acquired infections, minimizing absenteeism, morbidity and mortality of patients. This also applies to medical students since they are in close proximity with patients, materials infected with virus while clerking cases and practice. Studies show that in Malaysia, the educational level and occupation impact the knowledge and attitude of the participants on influenza vaccine. Majority of them had good knowledge about the virus and believe that Influenza has life threatening sequels to their health and community. [14, 23] Healthcare workers and medical students must be educated upon the knowledge and uptake of Influenza vaccination since public will be more encouraged to be vaccinated. Many studies show that public gets influenced by family and friends from the public health sectors to practice immunization. [32]

In Malaysia however the burden of the disease is very much understudied. Before considering the interventions such as vaccines in the control of influenza, it is of the upmost

importance to determine the knowledge, attitude, perception and current practice of individuals towards influenza vaccination.

A study done in England across 2011-2016 shows that people of age 18-25 has the least vaccine uptake which is only 12.6% when compared to the elderly age group of more than 65 years which is 74% [24] despite it being safe and mostly well-tolerated [25-27]. This is likely to be attributed to the fact that elderly is more susceptible to influenza and its complications [28, 29]. Similar study done in Malaysia amongst medical students shows there was no significant difference in gender and smoke exposure between vaccinated and unvaccinated participants. As for previous history of influenza vaccination, 23.1% of vaccinated participants reported of having their vaccination within one year ago, 76.9% had it more than one year ago and 56% took the vaccine more than three years ago. However, the vaccinated participants scored higher in knowledge about influenza when compared to the unvaccinated ones [30]. Additionally, a study in Serbia suggested that medical students scored higher in knowledge section when compared to law and engineering students, and there was a difference in mean scores between the students in different years of the course [31].

Many studies have explained how healthcare workers are vulnerable when it comes to risk of being exposed to the influenza virus [32]. There have been studies done on Malaysian Health care workers, illustrating their Influenza vaccination coverage and attitude. However, it showed poor uptake of the vaccination despite wide availability mainly due to the uncertainty of the efficacy and safety of the vaccination [14]. Undergraduate student in medical field are seen as the future generation of health care work force and studies have exhibited that, there are some factors determining the attitude as well as their hindrances towards Influenza vaccination. One of the main reasons why the students opted to be vaccinated was to protect themselves and others, especially susceptible population such as infants, elderly and immunocompromised patients from the viral flu. Others, who showed a positive apprehension to be vaccinated were under the influence of their parents, friends or medical practitioner's advice [33]. Studies also explains that individuals with underlying chronic diseases such Asthma, COPD, Heart diseases, Diabetes Mellitus, cancer etc. are the core target of influenza vaccination [34]. In European countries, it is recommended that individuals more than 6 months of age with at least 1 chronic disease which accounts for a risk factor for influenza or their complication must be immunized [35]. It has been exhibited that a student's previous history of contacting influenza also weighs in a huge factor toward their attitude and practice towards the vaccine with a majority of them with positive attitude [33].

Although several studies have been done worldwide regarding the knowledge, attitude and practice of Influenza vaccination, there is a dearth of research in understanding the same from undergraduates' students in Malaysia. Widely well known for their health care tourism, the undergraduates being the future representatives of the health care sector must be well aware about the knowledge and importance of vaccinations. In order to fill in this gap, this research assesses the knowledge, attitude and practice of undergraduate students and determining the factors that affect the uptake. We aim to understand the knowledge, perception, attitude and practice towards the influenza vaccine among undergraduate students. Further find out the rate of immunization towards the flu vaccine amongst the students.

2. Methodology

2.1. Study Design, Population, Time and Place

A cross sectional study was on conducted from November 2020 to December 2020 among undergraduate students of a private medical college, Melaka Manipal Medical College (MMMC). The university is located in Malaysia, consisting of 2 campuses, one based in Muar, Johor and the other in Malacca. There are 3 courses offered by the university: Foundation in Science (FIS), Bachelor of Dental Surgery (BDS) and Bachelor of Medicine and Bachelor of Surgery (MBBS). This study involved all the students in the FIS, BDS and MBBS courses with an estimated total population of 1500, with the aim of determining their knowledge, attitude, perception and practice towards the influenza vaccine.

2.2. Sample Size

Based on previous research done in Malaysia [14], 51.4% of all participants had taken the Influenza vaccination.

With the formula application software "Epi Info" version 7.2.4.0, the sample size (n) is calculated as below:

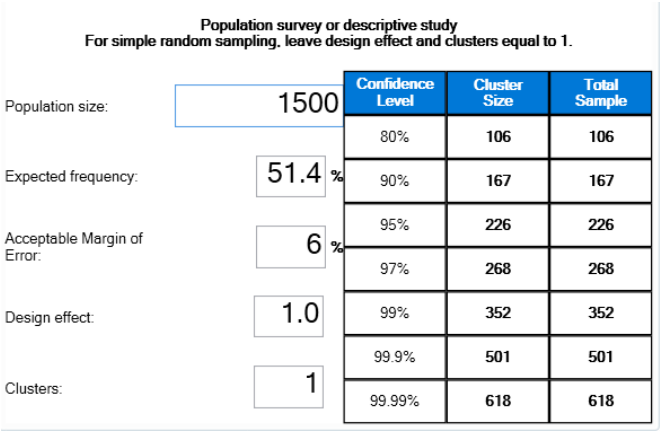

Figure 1. Sample Size Calculation using Epi Info.

The minimum sample size required was 226.

Upon further calculation of sample size (n) using the formula application software Epi Info version 7.2.4.0, we then chose to allow a non-response of 20% and the calculation is as below:

$$\text{n(final)} = \frac{n(calculated)}{1-(non-response)} = \frac{226}{1-0.2} = 283$$

The final sample size obtained for this study was 283.

2.3. Sampling

The sampling method is purposive sampling. The inclusion criteria included Malaysian and International students of MMMC (MBBS, BDS, FIS) who provide informed consent to participate in this study. For those who did not consent or fail to complete all the questions or provide irrelevant response to the questions asked were excluded.

2.4. Data Collection

The data was collected after distributing the questionnaires via Google form to all the undergraduate students of Melaka Manipal Medical College.

The independent variables of this study are age, ethnicity, program attended, previous history of vaccination,-any existing chronic diseases and smoking status. Dependent variables are knowledge, attitude perception and practice towards flu vaccines which included personal beliefs and source of encouragement. The survey components were formulated based on previous preprints of Florida and Italy. [33, 36]

The questionnaire was divided into 4 parts, namely 1) informed consent and socio demographic information, 2) knowledge of flu vaccine overall, 3) attitude towards flu vaccination, and 4) practice towards influenza vaccination.

Socio-demographic profile comprised of age, gender, ethnicity, nationality- Malaysian/international and program attended i.e., Foundation in Science/ Dentistry/MBBS. Personal history included existing chronic illnesses such as asthma, diabetes, smoking status and living with susceptible individuals (e.g., newborn, elderly, pregnant women, immunocompromised individuals etc.) were designed as close ended questions within the same section.

The knowledge section of the questionnaire consisted of 14 statements, for example, “According to the CPG guidelines from Ministry of Health Malaysia, all persons 6 months and older gets influenza vaccine annually”. For each statement, the participants can either choose “Yes”, “No” or “Do not know” and were scored according to the correct answer chosen. Every correct answer was given a score of “1”, whereas every wrong and “Do not know” was given a score of “0” respectively.

In next section, the questions were targeted towards the participant’s attitude towards the Influenza vaccination. A set of 3 questions using Likert Scale containing 7 options, ranging from 1 (almost zero) to 7 (very high) was used to assess various aspects of the participant’s attitude and perception towards the flu vaccination.

The last section evaluated the participants practice towards influenza vaccination. This part had 7 sets of questions, namely enquiring about 1) their past Influenza immunization history, 2) reasons to be vaccinated against Influenza, 3) how often did they get vaccinated 4) Reasons not to be vaccinated against influenza, 5) family influence and practices towards flu vaccination, 6) sources of information regarding the flu vaccine and 7) preferences on how they would like to receive information about the flu vaccine. Question 1-5 were set as close ended questions. Question 6&7, i.e., Sources of information regarding the flu vaccine and preferences of the same were designed as checkbox questions (choose more than one answer option), such as campus wide educational event, healthcare provider, online resources, media news etc.

2.5. Data Analysis and Data Processing

Descriptive statistics (frequencies, percentages) was used for demographics and key outcomes; analyses were conducted using Epi info V7.2.4. Data was fed into Microsoft Excel and compiled. Independent variables that we used in this cross-sectional study were age, gender, program, history of vaccination, smoking status, history of chronic illness, living with susceptible individuals, previous history of influenza and history of any side effects due to vaccination. The dependent variables include their knowledge towards flu vaccination; Practice towards flu vaccination; and attitude towards the flu vaccination. The statistical tests used to find out the association between the independent variables and dependent variables will be shown in a table.

For quantitative data (e.g., age), the frequency as well as percentage were recorded. Other quantitative data such as knowledge scores included mean calculations along with standard deviation. As for qualitative data (gender, ethnicity, history of chronic illness, living with susceptible individuals and smoking status), the frequency and percentage were calculated. For the questions to knowledge, each correct answer was given a score of 1 and 0 for every incorrect response including the option, “Don’t know”. The score was converted into a percentage. If the knowledge percentage was ≥81, then the level of knowledge will be categorized as high; moderate if the knowledge percentage is between 61 and 80, and low if the knowledge score is ≤61. The minimum possible score is 0 (0%) and the maximum possible score is considered as 14 (100%). The associations between the socio-demographic to the extent of knowledge were assessed

by using unpaired T-test. Following statistical test was used in our study: (Table 1)

Table 1. Independent and dependent variables with their statistical tests.

Independent variable	Dependent variable	Statistical test
Age	Knowledge towards the flu vaccine Attitude towards flu vaccination	Unpaired T-test
Gender		Unpaired T-test
Ethnicity		ANOVA
Previous history of vaccination	Perception towards vaccination	Unpaired T-test
Smoking status		Unpaired T-test
History of chronic illness		ANOVA
Living with susceptible individuals		Unpaired T-test
Previous history of influenza		Unpaired T-test
Age	Practice towards flu vaccination	Chi-square
Gender		
Ethnicity		
Smoking status		
History of chronic illness		
Living with susceptible individuals		
Knowledge towards the flu vaccine	Practice towards flu vaccination	Logistic regression
Attitude towards flu vaccination	Practice towards flu vaccination	Logistic regression
Perception towards flu vaccination	Practice towards flu vaccination	Logistic regression

2.6. Ethical Consideration

An informed consent form with all the important and relevant details of the study was given to the participants. The participants were given the option to participate in this study, and none were forced into participation. The participants' information was kept confidential and used only for the purpose of a particular research. Their anonymity and privacy were well maintained. This research was conducted ethically by obtaining approval by the Research Ethics Committee, Faculty of Medicine, Melaka Manipal Medical College, Melaka, Malaysia

3. Results

Table 2. Socio-demographic of the medical students that participated in the study.

Variable		Frequency (n)	Percentage (%)
Age	≤21	144	51.43
	>21	136	48.57
	Mean (SD)	21.17 (1.6459)	
	Min-Max	18-26	
Gender	Female	196	70.00
	Male	84	30.00
Ethnicity	Malay	24	8.57
	Chinese	72	25.71
	Indian	147	52.50
	Others	37	13.22
History of Chronic Illness [a]	Asthma	13	4.6
	Hypertension	2	0.7
	Diabetes	0	0
	Epilepsy	0	0
	Others	5	1.8
Living with susceptible individuals [a]	None	262	93.6
	Newborn/infants	24	8.6
	Elderly	128	45.7
	Immunocompromised	30	10.7
	Pregnant woman	8	2.9
	Chronic Smokers	17	6.1
	None	121	43.2
	Others	7	2.6
Smoking status	Yes	7	2.5
	No	273	97.5

[a] Multiple response questions

Of those who responded, the 144 from the total participants were in the age group of ≤21 which gives rise to a mean of 21 years of age in our sample size. Besides that, most of the responses were noted to be females (70%), leaving a total of 84 responses to be that of males (30%). When it comes to ethnicity, the highest response came from that of the Indian community (52.50%). The Chinese community (25.71%) was the second highest ethnicity that responded in the study, followed up by the other categories (13.22%) and finally the Malay community (8.57%). When it came to the questions involving individuals with history of chronic illness, majority of the individuals responded that they have no chronic illnesses (93.6%). The second highest were those who had asthma (4.6%) with others being third (1.8%) and hypertension at 2 responses (0.7%). There were no responses that recorded individuals with epilepsy and diabetes. We saw a good response with the number of responses with the question asking the individuals if they lived with any susceptible individuals. The huge proportion of individuals lived with elderly which was 128 (45.7%) of the responses. In contrast to this, 121 (43.2%) students were not staying with any susceptible individuals. The next highest responses were individuals living with immunocompromised (10.7%) followed up by newborns with 24 (8.6%) and chronic smokers being 17 (6.1%). Finally only 8 (2.9%) students lived with pregnant woman. About smoking status, 7 (2.5%) students responded to being smokers and 273 (97.5%) students responded with "no" indicating that they were not smokers.

Table 3. Knowledge category amongst undergraduate students.

Knowledge Category	Frequency (n)	Percentage (n%)
High	10	3.57%
Low	199	71.07%
moderate	71	25.36%

Table 3 shows us that among our participants, only 3.57% had high knowledge towards Influenza and its vaccine overall. Majority of them (71.07%) had low knowledge score about the flu and the vaccine in general. Especially with regards to statements that were related to the indication, side effects of Influenza vaccination.

Table 4. Knowledge of the Flu Vaccine overall.

Statements on Knowledge of Influenza Vaccination	Frequency of Correct Response (n)	Percentage of Correct response (%)
According to the CPG from Ministry of Health Malaysia, all person 6 months and older get influenza vaccine annually	126	(45)
You can get 'the flu' from an influenza vaccine	132	(47.14)
Influenza illness complication can be severe, leading to extended time away from school to hospitalization and even death	211	(75.36)
Getting an influenza vaccine helps protect others that I may come into contact with from influenza	232	(82.86)
Getting an Influenza vaccine reduces the severity and duration of Influenza if I do catch the strain not covered in the vaccine	170	(60.71)
Young and healthy people can die from Influenza	169	(60.36)
By receiving Influenza vaccine, myself, I am helping limit transmission throughout the community even to population consisting of infants and immune-compromised patients	260	(92.86)
The efficacy of the Influenza vaccine is minimal, thus not necessary if you are young and healthy	155	(55.36)
If you have contacted the flu there is no need to get vaccinated against Influenza as you already developed the antibodies against it	136	(48.92)
The intramuscular influenza vaccine contains live attenuated virus	52	(18.57)
Influenza vaccination is important among diabetics and should be taken yearly	83	(29.64)
The Influenza vaccine has been identified as causative agent of lethargic encephalitis	38	(13.57)
Influenza vaccination increases the risk for allergic disorders	95	(33.93)
Common cold and Influenza "flu" is the same	189	(67.50)

Overall the student population had low knowledge about influenza vaccination (71.07%). Only 3.57% of the students had high knowledge about influenza disease and its vaccination. Majority (92.86%) of them knew that by receiving vaccination they could limit the transmission to the community especially including the immunocompromised patients and infants, getting immunized against influenza help to protect others from themselves when in contact influenza (82.86%) and that influenza illness has potential severe complication that might take time away from school to be hospitalized or eventually death (75.36).

However there seems to be a knowledge gap regarding the statement, "Influenza vaccine has been identified as causative agent of lethargic encephalitis" which has been answered correctly by 13.57% of the students. Surprisingly, very few students are aware about the composition of influenza vaccination given intramuscularly that contained inactivated virus (18.57%), the significance of diabetic patients to be vaccinated against influenza annually (29.64%) and they require a vaccine after contacting influenza (48.92%). Common misconceptions such as influenza vaccination does increase the risk of allergic disorders and possibilities of getting the "flu" from the vaccine seemed to be predominantly present in this population.

Only 45% of the students were aware of the latest CPG guidelines recommended by The Malaysian authorities regarding the influenza vaccination schedule.

Table 5. Attitudes towards influenza vaccination and vaccines (in general).

	Almost zero (n)	Low (n)	Rather low (n)	Moderate (n)	Rather high (n)	High (n)	Very high (n)
Attitude towards influenza vaccine	0 (0%)	4 (1.43%)	1 (0.36%)	19 (6.79%)	44 (15.71%)	57 (20.36%)	155 (55.36%)
Attitude towards vaccinations (in general)	2 (0.71%)	1 (0.36%)	3 (1.07%)	10 (3.57%)	39 (13.93%)	57 (20.36%)	168 (60.00%)

The mean of the attitudes of the participants towards vaccinations in general was 6.3+/-1.06 with an actual range of 1-7, while for their attitude towards influenza vaccine, there was a mean of 6.19+/-1.1 with an actual range of 2.7

Table 6. Components of risk perception score.

	Almost zero (n)	Low (n)	Rather Low (n)	Moderate (n)	Rather High (n)	High (n)	Very High (n)
Perception of the probability of adverse effects after influenza vaccination	24 (8.57%)	103 (36.7%)	71 (25.36%)	66 (23.57%)	7 (2.5%)	8 (2.86%)	1 (0.36%)
Perception of the probability for influenza natural infection in undergraduate students	12 (4.29%)	69 (24.64%)	61 (21.79%)	101 (36.07%)	15 (5.36%)	13 (4.64%)	9 (3.21%)
Perception of the severity of adverse effects after influenza vaccination	27 (9.64%)	104 (37.14%)	64 (22.86%)	66 (23.57%)	11 (3.93%)	8 (2.86%)	0 (0%)
Perception of the severity of the influenza natural infection in undergraduate students	22 (7.86%)	65 (23.21%)	66 (23.57%)	92 (32.86%)	24 (8.57%)	8 (2.86%)	3 (1.07%)

8.57% of participants had an almost zero perception of the probability of adverse effects after influenza vaccination, while 36.7% were low, 25.36% were rather low, 23.57% were moderate, 2.5% were rather high, 2.86% were high and 0.36% were rather high. Moreover, 4.29% of participants perceive the probability for influenza natural infection in undergraduate students to be almost zero, 24.64% as low, 21.79% as rather low, 36.07% as moderate, 5.36% as rather high, 4.64% as high, and 3.21% as rather high. In addition to that, 9.64% of participants had perceived the severity of adverse effects after influenza vaccination to be almost zero, 37.14% as low, 22.86% as rather low, 23.57% as moderate, 3.93% as rather high, 2.86% as high, and 0% as very high. Lastly, 7.86% had perceived the severity of the influenza natural infection in undergraduate students as almost zero, 23.21% as low, 23.57% as rather low, 32.86% as moderate, 8.57% as rather high, 2.86% as high, and 1.07% as very high.

Table 7. Means of risk perception scores.

	Mean (SD)
Perception of the probability of adverse effects after influenza vaccination	2.846 (1.158)
Perception of the probability for influenza natural infection in undergraduate students	3.404 (1.330)
Perception of the severity of adverse effects after influenza vaccination	2.836 (1.177)
Perception of the severity of the influenza natural infection in undergraduate students	3.239 (1.263)

The mean of the perception of the probability of adverse effects after influenza vaccination had been 2.846 compared to that of the perception of the severity of the adverse effects which was different by a small margin at 2.836. These results had still been less than that of the perception of the probability for influenza natural infection and the severity of the influenza vaccination which had been 3.404 and 3.239 respectively.

Table 8. Practice towards flu vaccination.

	Frequency (n)	Percentage (%)
Vaccinated against influenza previously (n=280)		
Yes	149	53.21%
No	131	46.79%
Reasons for vaccinated students to get vaccinated[a] (n=149)		
I believe the vaccines is the best way to protect myself and others	124	83.22%
I was required to get a flu vaccine (for any reason)	88	59.06%
If the vaccination was NOT required, would NOT have gotten it	53	35.57%
Someone I know had the flu recently, and I want to protect myself	45	30.20%
I saw a news report on the importance of influenza vaccines	60	40.27%
It was recommended by a health professional	115	77.18%
A parent or relative encouraged me	94	63.09%
Reasons for unvaccinated students to not get vaccinated[a] (n=131)		

	Frequency (n)	Percentage (%)
I am already immunized by previous vaccination campaigns	24	18.32%
I use alternative countermeasures	15	11.45%
I am not convinced that influenza vaccine is useful	22	16.79%
I have fear of injections	25	19.08%
I have fear of side effects	23	17.56%
The influenza vaccine is useless because influenza is a mild disease	25	19.08%
The influenza vaccine is useless because lifestyles are more efficient measures	21	16.03%
Influenza vaccination practice and influence in family (n=280) Did your parents receive influenza vaccines regularly growing up?		
Yes	93	33.21%
No	187	66.78%
Has the experience of having received (or not) influenza vaccines growing up influenced your decision regarding whether to get a vaccine now?		
Yes	129	46.07%
No	151	53.93%
Do you intend to get a vaccination for next flu season?		
Yes	185	66.07%
No	95	33.93%
How have you been receiving information about influenza[a] (n=280) Campus-wide educational event	90	32.1%
Media news	118	32.1%
Online resources	159	56.8%
Physician and healthcare provider	132	47.1%
I have not been receiving any information on influenza vaccinations previously	62	22.1%
Where/How would you like to receive information about influenza vaccination in the future[a] (n=280)		
Campus-wide educational event	176	62.9%
Media news	188	67.1%
Online resources	199	71.1%
Physician and healthcare provider	172	61.4%
I do not wish to receive any information on influenza vaccinations	7	2.5%

[a] Multiple response questions

Practice

Over half the students (53.21%) has been vaccinated against influenza previously. As shown in Table 8, majority of vaccinated students (83.22%) believe that the vaccination is the best way to protect themselves and others. Other common reasons for vaccination are recommendation from health professionals (77.18%), encouragement from parents or relatives (63.09%) and students that were required to take vaccine for any reason (59.06%). However, 35.57% of them answered that they would not have gotten the vaccination if it was not required.

In Table 8, for unvaccinated students which accounts up to 46.79% of total sample size, the reasons of not getting a vaccination are the fear of injections (19.08%) and they believe that influenza is a mild disease that taking a vaccine is pointless (19.08%). 17.56% of unvaccinated students are afraid of the side effects of the vaccine and 16.03% believe that lifestyles are more efficient measures compared to vaccination.

From the total of 280 students in this study, only 93 students (33.21%) having their parents receiving influenza vaccines regularly growing up. 46.07% students believe that their decision to get a vaccine now is influenced by their past vaccination history. On the other hand, 66.07% of students intend to get a vaccination for the next flu season.

Education material

Online resources have been the most common source for receiving information about influenza vaccines among the students (56.8%) followed by physician and healthcare provider (47.1%), media news (32.1%) and campus-wide educational event (32.1%). However, over one-fifths of students (22.1%) have not been receiving any information on influenza vaccinations previously.

Online resources are the preferred source (34.6%) to receive information about influenza vaccination in the future followed by media news (67.1%), campus-wide educational event (62.9%) and physician and healthcare provider (61.4%). There is still 2.5% who do not wish to receive any additional information about influenza vaccination.

Table 9. Association between Independent variables (age, gender, previous history of vaccination & smoking status) and Knowledge of influenza vaccination.

Independent variables	Knowledge Percentage Mean (SD)	Mean difference (95% CI)	T- test	P value
Age				
≤21	53.0 (16.5)	-1.51 (-5.61, 2.59)	-0.720	0.471
>21	51.5 (18.2)			
Gender				

Independent variables	Knowledge Percentage Mean (SD)	Mean difference (95% CI)	T- test	P value
Male	53.48 (15.9)	-1.80 (-6.2, 2.7)	-0.780	0.440
Female	51.71 (18.0)			
Previous History Of influenza vaccination				
Yes	53.9 (17.8)	-3.61 (-7.69, 0.485)	-1.74	0.084
No	50.3 (16.8)			
Smoking Status				
Yes	53.1 (12.9)	-0.82 (-13.9, 12.3)	-0.130	0.90
No	52.2 (17.5)			
History of chronic illness				
Yes	49.2 (21.7)	3.21 (-4.93, 11.4)	0.780	0.440
No	52.5 (17.1)			
Living with susceptible individuals				
Yes	52.8 (18.0)	-1.28 (-5.41, 2.85)	-0.610	0.540
No	51.5 (16.7)			

Objective 1: Association between Age and knowledge percentage towards Influenza vaccination

When looking at the association between age and the knowledge scores of the students, it was observable that those below or equal to 21 years of age had a mean knowledge percentage of 53% and slightly lower in those above 21 years being 51.5%. The mean difference is -1.51 with 95% CI range from -5.61 to 2.59. The p-value is 0.471 thus showing that there is no significant association between age and knowledge of undergraduates towards influenza vaccination.

Objective 2: Association between Gender and Knowledge Percentage towards Influenza vaccination

This shows us that males are having 53.5% knowledge score and females have a slightly lower score of 50.3% as their mean knowledge towards influenza vaccination. The mean difference is -0.8 with 95% confidence interval range from -13.9 to 12.3. There is no significant difference gender and knowledge percentage towards influenza vaccination as P value is 0.435 which is more than 0.05 (level of significance).

Objective 3: Association between Previous history of influenza vaccination and knowledge percentage towards influenza vaccination.

When looking at the association between the previous history of influenza vaccination and knowledge scores among students, it was observable that students who were vaccinated against influenza had a mean knowledge score percentage of 54% and unvaccinated students scored a mean knowledge score of 50.3%. Their mean difference was -3.6 with a 95% confidence interval range from -7.7 to 0.48. There is no significant difference between Previous history of influenza vaccination and knowledge percentage towards influenza vaccination as P value is 0.13 which is more than 0.05 (level of significance).

Objective 4: Association between smoking status and knowledge percentage towards influenza vaccination.

This shows us that students with a significant smoking history had 53.1% mean knowledge score and students who were non-smokers had 52.2% mean knowledge score about influenza vaccination. Their mean difference was -0.8, with a 95% confidence interval range from -13.9 to 12.3. There is no significant difference between smoking status and knowledge percentage towards influenza vaccination as P value is 0.9 which is more than 0.05 (level of significance).

Objective 5: Association between those who had chronic illnesses and knowledge percentage towards influenza vaccination

Students who had chronic illnesses had a mean score of 49.2% and those who didn't had a mean knowledge score of 52.5%. Their mean difference was -1.28 with a 95% confidence interval range from -4.93 to 11.3. The p value is 0.540 and therefor there is no significant different between individuals who had chronic illnesses and knowledge percentage.

Objective 6: Association between those who live with susceptible individuals and knowledge percentage towards influenza vaccination

A good number of students lived with susceptible individuals, those who did scored a mean knowledge score of 52.8% and those who didn't scored a higher mean score of 51.5%. The mean difference is -1.28 with 95% CI range from -5.41 to 2.85. The p-value is 0.543 that shows that there is no significant association between those who live with susceptible individuals and knowledge towards influenza vaccination.

Table 10. Associations between independent variables: gender, age, race, smoking status, history of chronic illness, living with susceptible individuals and the total risk perception score.

Independent variables	Mean (SD)	Mean Difference (95% CL)	P value
Gender			
Male	12.95 (3.68)	-0.896 (-1.902, 0.110)	0.0805
Female	12.06 (4.01)		

Independent variables	Mean (SD)	Mean Difference (95% CL)	P value
Age			
≤21	12.55 (4.07)	-0.460 (-1.386, 0.465)	0.329
>21	12.09 (3.79)		
Race			
Chinese	11.75 (4.34)	-	0.394
Indian	12.45 (3.79)		
Malay	12.17 (3.78)		
Others	13.05 (3.75)		
Smoking Status			
Yes	13.43 (2.30)	-1.132 (-4.098, 1.834)	0.453
No	12.30 (3.96)		
History of Chronic illness			
Yes	13.26 (4.85)	-1.007 (-2.846, 0.832)	0.282
No	12.26 (3.86)		
Living with susceptible individuals			
Yes	12.20 (3.93)	0.281 (-0.653, 1.215)	0.554
No	12.48 (3.95)		

Table 10 shows the associations between independent variables: gender, age, race, smoking status, history of chronic illness, living with susceptible individuals and the total risk perception score. As can be seen, males have a slightly higher perception (12.95) towards the subject of flu vaccinations compared to females with a mean score of 12.06. There was also only a slight difference in scoring regarding >21 (12.09) and ≤21 (12.55) age groups and their total perception score. This can be compared to a slightly bigger difference between the races where at which Other races had the highest mean perception score (13.05) compared to Indians (12.45), the Malays (12.17) and the Chinese (11.75). Participants that were smoking (13.43) and participants that had history of chronic illnesses (13.26) both individually had higher mean perception scores compared to those that did not. There had been no significant association between any of the independent variables and the total perception score of the participants.

Table 11. Association between independent variables: age, race, smoking status, history of chronic illness, living with susceptible individuals and the total score for participants attitude towards flu vaccination.

Independent variables	Mean (SD)	Mean Difference (95% CL)	P value
Gender			
Male	12.26 (2.25)	0.340 (-0.182, 0.863)	0.201
Female	12.60 (1.93)		
Age			
≤21	12.38 (2.04)	0.257 (-0.222, 0.737)	0.292
>21	12.63 (2.03)		
Race			
Chinese	12.13 (2.18)	-	0.258
Indian	12.56 (2.11)		
Malay	12.96 (1.60)		
Others	12.68 (1.62)		
Smoking Status			
Yes	13.43 (0.79)	-0.952 (-2.486, 0.581)	0.223
No	12.48 (2.05)		
History of Chronic illness			
Yes	12.63 (1.89)	-0.141 (-1.096, 0.813)	0.771
No	12.49 (2.05)		
Living with susceptible individuals			
Yes	12.42 (2.08)	0.174 (-0.310, 0.660)	0.479
No	12.60 (1.99)		

Table 11 shows the association between independent variables: age, race, smoking status, history of chronic illness, living with susceptible individuals and the total score for participants attitude of the participants towards flu vaccination. As with the results from the association of the independent variables with total perception scores, the results for this had almost been similar with variables such as gender, age, race, history of chronic illness and participants living with susceptible individuals all have very minimal differences in mean score. With smoking status however, there was a mean score of 13.43 with individuals that smoked compared to individuals that did not (12.48). All the variables had no significant association with the total score for participants towards flu vaccinations.

Table 12. Chi square of association between gender, age, races, smoking status, history of chronic illness, living with susceptible individuals and influenza vaccination.

Independent variables	Vaccination status		OR (95% CI)	Chi-square	P value
	Yes n (%)	No N (%)			
Gender					
Male	44 (52.4%)	40 (47.6%)	Reference		
Female	105 (53.6%)	91 (46.4%)	0.95 (0.6, 1.6)	0.034	0.855
Age					
≤21	77 (53.5%)	67 (46.5%)	1.02 (0.6, 1.6)	0.008	0.929
>21	72 (52.9%)	64 (47.1%)	Reference		
Race					
Chinese	29 (40.3%)	43 (59.7%)	Reference		
Indian	85 (57.8%)	62 (42.2%)	2.03 (1.1, 3.6)	5.961	0.015
Malay	16 (66.7%)	8 (33.3%)	2.97 (1.12, 7.83)	5.034	0.025
Others	19 (51.4%)	18 (48.7%)	1.57 (0.7, 3.5)	1.216	0.270
Smoking status					
Yes	7 (100.0%)	0 (0%)	-	-	0.012
No	142 (52.0%)	131 (48.0%)	Reference		
History of chronic illness					
Yes	12 (63.2%)	7 (36.8%)	1.55 (0.6, 4.1)	0.810	0.368
No	137 (52.5%)	124 (47.5%)	Reference		
Living with susceptible individuals					
Yes	85 (53.8%)	73 (46.2%)	1.06 (0.7, 1.7)	0.050	0.824
No	64 (52.5%)	58 (47.5%)	Reference		

Table 12 shows association between gender, age, races, smoking status, history of chronic illness, living with susceptible individuals and influenza vaccination. Indian population are 2.03 times more likely to get vaccinated against influenza compared to Chinese population (95% CI for OR 1.1 to 3.6; P-value 0.015) while Malay population are 2.97 times more likely to get vaccinated against influenza compared to Chinese population (95% CI for OR 1.12 to 7.83; P-value 0.025). However, there is no significant difference for influenza vaccination among other races compared to Chinese population (p-value: 0.270). There is a significant positive association between smokers and influenza vaccination uptake. (p-value: 0.012). The other variables were found to be insignificant. Female students are 0.95 less likely to get vaccinated compared to male students (95% CI for OR 0.6 to 1.6; P-value 0.855). Students aged 21 or less are 1.02 times more likely to be vaccinated compared to students aged more than 21 (95% CI for OR 0.6 to 1.6; P-value 0.929). Students with history of chronic illness are 1.55 times more likely to be vaccinated than those without history of chronic illness (95% CI for OR 0.6 to 4.1; P-value 0.368). Students who are living with susceptible individual are 1.06 times more likely to be vaccinated compared to students who are not living with susceptible individuals (95% CI for OR 0.7 to 1.7; P-value 0.824).

Table 13. Logistic regression of association between knowledge, attitude, perception, and influenza vaccination.

Variable	OR (95% CI)	P-value
Knowledge towards influenza vaccination	1.0034 (0.99, 1.01)	0.118
Attitude towards general vaccination	1.0280 (0.99, 1.07)	0.142
Attitude towards influenza vaccination	1.0347 (0.99, 1.07)	0.075
Perception towards influenza vaccination	1.0100 (0.99, 1.03)	0.283

Table 13 shows the data for logistic regression of association between knowledge, attitude, perception, and influenza vaccination. Based on the study, there is no significant association between all the variables; knowledge, attitude towards general and influenza vaccination and perception towards influenza vaccination among undergraduate students of MMMC. Students with higher knowledge of influenza vaccination are 1.0034 times more likely to be vaccinated compared to those with less knowledge of influenza vaccination (95% CI for OR 0.99 to 1.01; P-value: 0.118). Students who scored higher in attitude towards general influenza and influenza vaccination are 1.028 (95% CI for OR 0.99 to 1.07; P-value: 0.142) and 1.0347 (95% CI for OR 0.99 to 1.07; P-value: 0.075) times respectively, are more likely to be vaccinated when compared to students who scored lower in attitude towards general influenza and influenza vaccination. Lastly, students with higher score in perception towards influenza vaccination are 1.01 times more likely to be vaccinated compared to those with lower score in perception towards influenza vaccination (95% CI for OR 0.99 to 1.03; P-value: 0.283).

4. Discussion

This cross-sectional study was conducted to observe the knowledge, attitude, perception and practice towards influenza vaccine among undergraduate students in MMMC. Among 280 participants in this study, 53.2% students have received vaccination against influenza previously. Majority of them believe that the vaccination is the best way to protect themselves and the people around them. Other common reasons for vaccination are recommendation from health professionals, encouragement from parents or relatives and requirement for any reason of which 35.6% would not have received the vaccination if it was not required. The rest of 46.8% students in this study have not received influenza vaccination before. However, the reasons of not getting the vaccination were not clearly depicted from this study. A study done previously in Malaysia recorded lesser percentage of subjects taking influenza vaccination which was 28.9% [30]. It was also seen in similar study that being healthy or having no risk is the main reason for vaccine refusal amongst the participants, followed by time constraint and financial problems [37, 38]. Previous study done in Malaysia amongst healthcare worker suggested the main reasons for the same is that influenza vaccination is not a requirement for any reason, followed by side effects and doubts about its efficacy [14, 39].

From the study, there is a positive association between smoking status and influenza vaccination uptake; smokers are more likely to be vaccinated compared to non-smokers. However, a previous study in Korea observed that smokers are less likely to be vaccinated against influenza [40]. Another study in Saudi Arabia showed no association between smoking status and influenza vaccination uptake [37]. Furthermore, in our study it was noted that Indian and Malay populations are seen more likely to be vaccinated against influenza compared to Chinese population. When comparing the students' knowledge, attitude and perception towards practice of influenza vaccination, positive association were seen in which higher knowledge, attitude and perception increases the likelihood of the students to be vaccinated. Although these association were not significant in this particular study. From previous studies in Malaysia and US, there is a significant positive association between higher knowledge, perception and attitude towards getting influenza vaccination [30, 41]. However, a study of influenza vaccination uptake among healthcare workers in Dubai concluded that there was no association between knowledge, perception and attitude towards influenza vaccination uptake [42].

In this study we observed that amongst our participants, only 3.57% had high knowledge towards Influenza and its vaccine overall. Majority of them (71.07%) had low knowledge score about the flu and the vaccine in general. Especially statements related to the indication, side effects and components of the Influenza vaccination were answered incorrectly by nearly 80% of the student's population. There was a knowledge gap about one of the commonest misconceptions about the Influenza vaccine, "You can get 'the flu' from an influenza vaccine "that was answered incorrectly (53%)

Previous studies from Italy and Florida conducted on occupational physicians and university students respectively shows us that their participants overall were knowledgeable about Influenza, its vaccine properties and were aware of some the misconception behind them such as the efficacy of the vaccine and how often one should get vaccinated against Influenza. However, some of their participants had shared false beliefs regarding the relation between vaccine and disorders such as lethargic encephalitis and diabetes and believed that they can get "the flu" from the vaccine [33, 36].

We found no significant association between age, gender, previous history of Influenza vaccination, smoking status, history of chronic illness, living with susceptible individuals and Knowledge towards influenza vaccine overall.

A study in Dubai have shown to have a positive association between age and knowledge towards influenza vaccine overall [42]. This was however due to the research done amongst general population in public health care centres.

In our study, there were very high positive attitudes for vaccinations in general (60.00%) and the influenza vaccine (55.36%). Both of which had the same percentage of 20.36% for high, and 15.71% and 13.93% for rather high towards influenza vaccine and the vaccinations in general respectively. However, we have observed there had been no significant associations between the total attitude score and the demographic variables. In a study done in Italy [36], 95.6% of the participants had been favourable towards vaccinations compared to 68.5% that were favourable towards influenza vaccinations. This particular study had also not found any significant association between their demographic variables (which included country of origin) and the participants personal attitude towards influenza vaccinations. In another study [43] done in Bulgaria, 40% of its participants had a general positive attitude while 37.5% had a negative and 22.5% had an unclear attitude.

With regards to the total risk perception score, majority of the scores (13.21%) had been for a total perception score of 8 and 12, while the lowest score had been 25 at 0.36% (out of the maximum total possible risk perception score of 28). This shows that majority of the participants show little to no negative perception towards the subject of adverse effects

(severity and probability) and the natural infection of influenza vaccinations (severity and probability). In addition to this, the mean value for the perception score for the probability of adverse effects after the influenza vaccination was 2.846 and 2.836 for the perception of the participants severity of the adverse effects. For the probability of influenza natural infection and its severity on the other hand, it was 3.404 and 3.239 respectively, thus being slightly higher than that of the adverse effects of the influenza vaccinations There had also been no significant association between the demographic variables in our study with the total risk perception score. As mentioned previously, the study done in Italy [36] had 59.8% of its participants perceive the severity of natural infection of influenza as "almost zero" to "rather low" whereas the probability of influenza natural infection had a percentage of 26.1% for "almost zero" and "rather low" with 30.4% acknowledging a "moderate" probability.

Limitations of this study should also be mentioned. Firstly, students had anonymously self-report their vaccination status. No verification by health records were needed. Besides that, although the research looked into how many undergraduate students had taken the vaccine, no questions were asked that further looked into the willingness of the individuals when they took the vaccine. The sample size assessed was relatively small, fathered through convenience sampling. With that being said, our sample may therefore not represent the whole undergraduate populations around Malaysia. This study looked at students from different undergraduate degrees (e.g., dentistry, medicine, foundation in science; as such it may not accurately reflect practices among their individual centres. The responses were also self-reported, therefore, it is possible that social desirability might constitute a bias that could not be independently verified in this study. The results were also predominantly skewed towards females answering. Gender bias can be excluded from this as a convenience type of sampling method was used. Results may not be generalizable to all university student populations.

This study had only included undergraduate students in one private college, we would like to recommend future researchers to include graduate students, generally physicians, nurses and patients in their study. Since this research had not included willingness of undergraduate students that had taken the vaccine, future studies should be conducted in a qualitative manner to further answer these questions. Undergraduate students overall had a low knowledge score (71.1%). With that being said, recommendations should also be made to improve knowledge of the general population. Information about influenza vaccination should be given more through online resources (articles, e-posters) as well as through the media.

5. Conclusion

In summary, our study shows that 53.2% of the students in MMMC have received Influenza vaccine previously as they believe that it is the best way to protect themselves and their community. It was observed that Indian and Malay students were more likely to be vaccinated compared to Chinese population. Furthermore, students who smoked also were more likely to be vaccinated against Influenza. Overall, the students had a positive attitude towards the uptake of Influenza vaccine and immunization in general. These students intended to be vaccinated for the next flu season. However, 71% of students had poor knowledge score regarding the flu and vaccination in general. Common misconceptions regarding Influenza and its vaccine properties remained to be highly prevalent amongst them. Most of the information related to the vaccine was received from online resources and their health care providers. Besides, only 30% of the student's parents practiced the uptake of Influenza vaccine previously.

Information related to Influenza are not advertised sufficiently in media, newsletters and medical awareness campaign within campus thus knowledge towards flu and its vaccination needs to be addressed to medical students as the future standard and care of medicine are solely in their hands.

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