

## Factors Affecting Parents' Intention to Vaccinate Children against Influenza

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### ABSTRACT

*Globally, this influenza virus creates a year-round burden of disease, and vaccination is the most effective strategy in preventing influenza. A cross sectional study was carried out to examine parental intention to vaccinate their children against influenza. This study also aims to identify factors that influence the parental intention. A total of 167 parents were selected by stratified random sampling. An online self-reported questionnaire was distributed to the selected participants. The predictors were classified into three parts; demographic characteristics, Health Belief Model (perceived barriers, perceived benefits, perceived susceptibilities and perceived severity), knowledge of influenza. The dependent variable is parents' intention to vaccinate their children against influenza where it is categorized into dichotomous categories (0 and 1); 0 denoting that the parents will probably vaccinate their children (low likelihood) and 1 denoting that the parents will definitely vaccinate their children (high likelihood). Binary logistic regression was employed to obtain a predictive model and to identify the significant factors that affect parent's intention. The results found that 32.3% have a low likelihood to their children and 67.7% of the parents have a high likelihood. The binary logistic regression results suggested that gender, perceived benefits ("Influenza vaccines are safe for children."), perceived susceptibility ("My children have a high risk of influenza." and "My children get sick more easily than other children do."), perceived severity ("Influenza infection may cause serious health problems.") and knowledge about influenza were significantly associated to parents' intention to vaccinate their children.*

**Keywords:** influenza, influenza vaccine, vaccine intention, parents' intention

## 1 INTRODUCTION

Influenza is an infection produced by the influenza virus in the respiratory system where the virus mainly spread through respiratory droplets formed when an infected person coughing and sneezing [1]. Annual influenza epidemics occur in the northern hemisphere during winter, involving about 5 to 15 percent of the world population [2]. Globally, this virus creates a burden of illness throughout the year. Influenza is one of the health threats to the children [3]. In the year prior to Covid-19 pandemic, Malaysia was on alert on influenza outbreak where it has affected mostly school going

children. In 2020, Selangor was ranked as the largest number of influenza cases that affected school going children [4].

Influenza virus preventive vaccination is the primary tool for public safety as it the most effective way in preventing influenza. It has been shown that influenza vaccination has many benefits including a decrease in the incidence of flu infections and the incidence of influenza death in children [5]. Centre for Disease Control and Prevention (CDC) stated that the risk of flu vaccination reduces between 40% and 60% of the population over time when the majority of circulating influenza viruses are well associated with the flu vaccines [6]. The influenza vaccination uptake rates in Malaysia are only 0.9% despite it is considered as the most effective counter measure for influenza prevention to children [7]. This might be due to influenza vaccine are not mandatory in Malaysia and parents need to go to private hospital to vaccinate their children. Malaysia National Immunization Program (NIP) stated that Influenza vaccination is just an optional vaccination for children [8]. This is a worrying situation since lower vaccination rate would lead to increase in trend of influenza cases. Therefore, it is crucial to understand the factors that affect the parent's willingness to vaccinate their children since parents are primary decision-makers in families [9].

In recent years, numerous studies have been carried out in an attempt to determine factors that affect parents' intention to vaccinate their children against influenza. Most of parents agreed that vaccines had a good value when it come for free, but they refused when asked about their willingness to bear the cost of the vaccines [10]. Furthermore, some of the issues raised among Malaysian parents who refuse to vaccinate their children are due to religious belief, parents' knowledge, and parent's attitude on childhood immunization [10]. A number of studies investigating factors that influence parents' intention to have their children receive influenza vaccination [11-14] support the view that mothers are more likely to vaccinate their children. Previous research by Zeng et al. [13] and Lama et al. [3] have suggested that parents with higher knowledge regarding influenza and its vaccination are more likely to vaccinate their children. A large body of literature exists on the use of Health Belief Model (HBM) in studying health-related behavior. Several researchers [12-15] applied HBM model to investigate factors associated with parents' decision and willingness to vaccinate their children against influenza. They suggested that parents who indicated higher perceived benefits of influenza vaccination were more likely to have their children vaccinated. Previous studies also found perceived barriers were associated with the intention of vaccinating children against influenza [13-15]. Most researchers also agree that the other components of HBM such as perceived susceptibility and perceived severity were related to the parents' decision to vaccinate the children.

A recent study by Pengbin et al. [16] among parents in Nanhai District, China stated that a higher level of knowledge of influenza and having previous information on influenza were correlated with their willingness to vaccinate their children against influenza. On the other hand, the study revealed that considering their children are not susceptible to influenza, having concern that vaccine needs to be carefully administered, scared of the side effects of the vaccine, and having doubts of the new vaccine were significantly associated with a lower vaccination intention. In another recent study among Irish parents, Woon and Moylett [17] reported that parents who had receive influenza vaccination, having specific concern for influenza vaccine and parental influenza knowledge were found to be significantly related to the willingness to vaccinate their child. A more recent study was carried out by Goldman et al. [18] among caregivers who accompanied their children in 17 pediatric emergency departments in 6 countries (United States, Canada, Israel, Japan, Spain, and Switzerland during the outbreak of COVID-19 to determine the associated factors of parents' willingness to vaccinate children against influenza. Multivariable logistic regression analysis found that caregivers

with higher education level, whether the caregivers received flu vaccine last year, caregiver's concern that their child was infected by COVID-19 or caregiver's worry that they had COVID -19 were significantly associated to the willingness to vaccinate children against influenza. Additional work by Wang et al.[19] among have found that parents with higher income are more likely to accept influenza vaccine for their child.

Although parents' intention to have their children vaccinated against influenza has been widely studied, to date, few studies have investigated the problem among the parents in Kelantan's population. Thus, the goal of this study is to identify factors relating to the intention of parents to vaccinate children against the influenza among parents who are the educators in Universiti Teknologi MARA (UiTM) Cawangan Kelantan. It is anticipated that this study provides useful findings to the health authorities in order to increase the intake of influenza vaccination among children.

## **2 MATERIAL AND METHODS**

### **2.1 Study Design and Sample**

A cross-sectional study was conducted in UiTM Cawangan Kelantan from July to November 2020, among the lecturers who were eligible according to inclusion criteria. This study only focuses on the participants who have children regardless of their status. Thus, those who unmarried or married without kids were excluded from this study. Using stratified random sampling, a sample of 167 lecturers was selected. The population was stratified according to gender. The sample size was calculated using Sample Size Calculator by Raosoft by considering the following; 5% margin of error, 95% confidence level and 50% response distribution.

### **2.2 Ethical Consideration**

This study was approved by Universiti Teknologi MARA (UiTM) Research Ethics Committee. A consent was obtained from all participants before filling the questionnaire.

### **2.3 Questionnaire**

Data were collected using an online self-reported questionnaire. The questionnaire was developed in English and was translated into Bahasa Malaysia. There are 4 sections in the questionnaire. Data on socio-demographic and other children's information such as gender, age, marital status, education level, monthly income, health insurance coverage, residence, children chronic illness history, hospitalization history, influenza history, and children age were obtained in first section. Knowledge of influenza vaccination was assessed in the second section of the questionnaire. There were 6 statements that described the knowledge regarding influenza vaccination where the respondents were required to indicate whether the statement is "true" or false". Each correct answer given by the respondents will be scored one point. The third part of the questionnaire assessed the health beliefs of the participants based on HBM. Originally, the HBM was formulated to model the adoption of preventive health behavior in the United States where it composed of six constructs: risk susceptibility, risk severity, benefits to action, barriers to action, self-efficacy, and cues to action [20,21]. The HBM has been extensively applied and adapted to fit diverse contexts such as in studying factors related to vaccine acceptance or refusal among various target populations [22 - 25]. The validated questionnaire on HBM in the present study was extracted from Chen et al. [12] that consists

four components: perceived susceptibility (2 items), perceived severity (3 items), perceived benefits (3 items), and perceived barriers (6 items). A 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree) was used to assess all the 14 items in HBM. The final section of the questionnaire elicited the parents' intention to vaccinate their children.

## **2.4 Statistical Analysis**

Data were entered and analysed using IBM Statistical Package for the Social Sciences (SPSS) V23.0. For a preliminary analysis, descriptive analysis and normality test were done. The data were checked for any presence of outliers. Logistic regression analysis was applied to identify factors associated with parent's intention to vaccinate children against influenza. The dependent variable for this study is parent attention to vaccinate children. An alpha level of  $p < 0.05$  was employed to established statistical significance.

## **3 RESULTS AND DISCUSSION**

### **3.1 Descriptive Analysis**

The questionnaire was distributed to 167 respondents. Due to inability to reach the respondent and unwillingness of the respondents to involve in the study, there were 133 responses. Hence, the response rate reported for this study 80%. There were no missing values in the data. Table 1 shows the frequency analysis that presents frequency and percentage for each categorical variable in this study. Of the 133 respondents, most of the respondents (74.4%) are female and married (99.2%). A majority of respondents (79.7%) hold a master's degree and majority of them earned a monthly income of RM4001 and above (98.5%). One-hundred and eighteen respondents (88.7%) reported that they are covered by health insurance. With respect to children chronic disease, 100(75.2%) of children had no chronic disease, 15(11.3%) had skin or nasal allergy, 15(11.3%) had asthma, 2(1.5%) had two or more chronic disease, and 1(0.8%) had congenital heart disease. More than half of respondents (54.1%) indicated that their children had no history of hospitalization. When asked about the history of influenza vaccination, 84.2% of parents stated that their children had no history of influenza infection. Regarding their children's age, (32.7%) children of whom the parents participated in the study are aged between 4 years and 7 years while only 1.6% of the children were aged less than 6 months. With regards to parents' intention to vaccinate children against influenza, 67.7% indicated high likelihood (definitely) and 32.3% low likelihood (probably).

**Table 1** Frequency Analysis

<b>Variable</b>	<b>n</b>	<b>%</b>
Gender		
Male	34	25.6
Female	99	74.4
Marital Status		
Married	132	99.2
Divorced	1	0.8
Education		
Degree	3	2.3
Master	106	79.7
PhD	24	18.0
Monthly Income		
RM 2001 – RM 3000	1	0.8
RM 3001 – RM 4000	1	0.8
RM 4001 and above	131	98.5
Health Insurance Coverage		
Yes	118	88.7
No	15	11.3
Residence		
Rural	66	49.6
Urban	67	50.4
Children Chronic Illness History		
Asthma	15	11.3
Skin or nasal allergy	15	11.3
Congenital heart disease	1	0.8
Two or more chronic disease	2	1.5
None	100	75.2
Hospitalization History		
Yes	61	45.9
No	72	54.1
Influenza History		
Yes	14	10.5
No	112	84.2
Unknown	7	5.3
Children Age		
< 6 months	4	1.6
6 months – 3 years	55	22.2
4 years – 7 years	81	32.7
8 years – 10 years	57	23.0
> 10 years	51	20.6
Parents' intention to vaccinate children		
Yes, definitely	90	67.7
Yes, probably	43	32.3

Descriptive statistics for continuous variables are displayed in Table 2. The participants' mean age was 39.94(standard deviation, SD=6.14, range 32-59). The mean score for knowledge of influenza vaccination was 5.1(SD=0.86, range 3-6).

**Table 2** Descriptive Statistics

<b>Variable</b>	<b>Mean <math>\pm</math> Std. Deviation</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Median</b>
Age	39.94 $\pm$ 6.14	32.00	59.00	38.00
Influenza Vaccination Knowledge	5.10 $\pm$ 0.86	3.00	6.00	5.00

Table 3 presents the percentage of participants answering each question of HBM.

**Table 3** Health Belief Model

<b>Health Belief Model</b>	<b>Strongly Disagree n (%)</b>	<b>Disagree n (%)</b>	<b>Neutral n (%)</b>	<b>Agree n (%)</b>	<b>Strongly Agree n (%)</b>
<b>Perceived Barriers</b>					
1. I am generally opposed to vaccinations.	89(66.9)	35(26.3)	7(5.3)	1(0.8)	1(0.8)
2. Influenza vaccinations have unpleasant side effects.	47(35.3)	45(33.8)	32(24.1)	8(6.0)	1(0.8)
3. Influenza vaccinations weaken the natural immune system.	47(35.3)	59(44.4)	20(15.0)	6(4.5)	1(0.8)
4. Vaccinations are inconvenient.	56(42.1)	61(45.9)	9(6.8)	7(5.3)	0
5. Influenza vaccinations are expensive.	22(16.5)	41(30.8)	45(33.8)	23(17.3)	2(1.5)
6. I am influenced by negative news about influenza vaccines.	63(47.4)	50(37.6)	16(12.0)	4(3.0)	0
<b>Perceived Benefits</b>					
1. Influenza vaccinations can relieve influenza symptoms and complications.	0	1(0.8)	10(7.5)	90(67.7)	32(24.1)
2. Influenza vaccinations effectively protect against the flu.	0	3(2.3)	16(12.0)	85(63.9)	29(21.8)
3. Influenza vaccines are safe for children.	0	1(0.8)	15(11.3)	85(63.9)	32(24.1)
<b>Perceived Susceptibility</b>					

1. My children have a high risk of influenza.	21(15.8)	44(33.1)	42(31.6)	23(17.3)	3(2.3)
2. My children get sick more easily than other children do.	30(22.6)	74(55.6)	19(14.3)	10(7.5)	0
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Perceived Severity					
1. Influenza infection may cause serious health problems.	0	14(10.5)	11(8.3)	83(62.4)	25(18.8)
2. Influenza with complications is dangerous.	0	5(3.8)	10(7.5)	77(57.9)	41(30.8)
3. If any of my children contracted influenza, the disease could spread to other family members.	1(0.8)	6(4.5)	23(17.3)	76(57.1)	27(20.3)

In terms of perceived barriers, statements regarding “I am generally opposed to vaccinations” has the highest percentage where 66.9% of respondents strongly disagree toward the statement. This statement clearly shows that most of the respondents agree with vaccination. Referring to the table, 63 respondents do not agree with the statement “I am influenced by negative news about influenza vaccines”. Perceived benefits section recorded that 67.7% of respondents feel that can relieve influenza symptoms and complications. Furthermore, the majority of the respondents thought that influenza vaccination is safe for children. The next section of questionnaire concerned with perceived susceptibility. Only a minority of respondents agree with the statement “My children get sick more easily than other children do.” In the final part of HBM section, which is perceived severity, the respondents were asked if influenza infection may cause serious health problems and 62.4% of the respondents agree with this statement.

### 3.2 Binary Logistic Regression Analysis

Binary logistic regression analysis was used to determine the factors affecting parental vaccination intention. In order to facilitate and simplify analysis, all the items of Health Belief model (perceived barrier, perceived benefits, perceived susceptibility and perceived severity) were collapsed into two new categories: disagreement (between levels 1 and 2) or agreement (those between levels 3-5;) [26 - 27]. The reference category was disagreement. There are few variables with small sample size (less than 5) for its categories. The small sample size can cause inflated odds ratio. Hence, those variables with small sample size were excluded in building the predictive models. The excluded variables are shown in Table 4.

**Table 4** Excluded Variables

Section	Excluded Variable
Demographic	<ul style="list-style-type: none"> <li>• Monthly income</li> <li>• Marital Status</li> </ul>
Health Belief Model	<ul style="list-style-type: none"> <li>• PerceivedBarriers_opposevaccine I am generally opposed to vaccinations</li> <li>• PerceivedBarries_NegativeNews</li> </ul>

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I am influenced by negative news about influenza vaccines

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Table 5 summarizes the results of binary logistic regression analysis for three models resulted from three selection methods (enter, forward likelihood ratio, and backward likelihood ratio).

**Table 5** Binary Logistic Regression Analysis

Variable	Vaccination Intention		
	Model 1 ENTER OR(95%CI)	Model 2 FORWARD OR(95%CI)	Model 3 BACKWARD OR(95%CI)
Socio-demographic characteristics			
Age	0.979 (0.906– 1.058)		
Gender	0.330		0.320*
Male	(0.100–		(0.119–
Female*	1.081)		0.859)
Education	2.981	2.789*	
Degree and Master	(0.948–	(1.063–	
PhD*	9.380)	7.317)	
Resident	1.758		
Rural	(0.661–		
Urban*	4.675)		
Children chronic illness history	0.359		
No	(0.103–		
Yes*	1.254)		
Children Influenza History	1.021		
No	(0.16–		
Yes*	6.277)		
HBM			
Perceived Barriers			
PerceivedBarriers_unpleasantEffects	8.162		
Agree	(0.560–		
Disagree*	118.884)		
PerceivedBarriers_weakensImmune	0.279		
Agree	(0.010–		
Disagree*	7.981)		
PerceivedBarriers_inconvenient	0.453		
Agree	(0.023–		
Disagree*	9.097)		
PerceivedBarriers_expensive	0.489		0.405
Agree	(0.155–		(0.142–
Disagree*	1.543)		1.153)

Perceived Benefits			
PerceivedBenefits_relieveSymptoms	2.718		
Agree	(0.290–		
Disagree*	25.476)		
PerceivedBenefits_effectiveProtect	0.218		0.262
Agree	(0.03–		(0.057–
Disagree*	1.289)		1.195)
PerceivedBenefits_Safe	28.024***	15.151***	20.016***
Agree	(4.398–	(3.684–	(3.709–
Disagree*	178.559)	62.304)	108.027)
Perceived Susceptibility			
PerceivedSusceptibility_highRisk	106.399**	8.091**	35.771**
Agree	(4.231–	(1.717–	(2.881–
Disagree*	2675.625)	38.126)	444.104)
PerceivedSusceptibility_sickeasy	0.066		0.065*
Agree	(0.002–		(0.004–
Disagree*	1.832)		0.976)
Perceived Severity			
PerceivedSeverity_seriousHealth	2.063		3.144*
Agree	(0.419–		(1.024–
Disagree*	10.167)		9.660)
PerceivedSeverity_dangerous	1.421		
Agree	(0.216–		
Disagree*	9.330)		
PerceivedSeverity_spread	0.528		
Agree	(0.136–		
Disagree*	2.052)		
Knowledge score	2.298*		1.887*
	(1.137–		(1.068–
	4.645)		3.336)
Constant	-6.377	-2.721	-4.614

Table 6 summarizes the evaluation of model performance which includes accuracy, sensitivity and specificity values. Model 3 provides better accuracy which is 76.7%. Hence, the error rate of the model is 23.3%. The classification accuracy is considered “good” if the value is greater than 70%. Sensitivity is defined as the proportion of Y=1 (high likelihood to have their children receive influenza vaccination) that is correctly predicted as Y=1 while specificity value describes the proportion of Y=0 (low likelihood to have their children receive influenza vaccination) that is correctly predicted as Y=0. Model 3 with backward selection method was chosen as the best model of logistic regression given its highest accuracy rate. The model reported that 6 variables were found as significantly associated to parents’ intention to vaccinate their children against influenza.

**Table 6** Classification Table

<b>Model</b>	<b>Accuracy (%)</b>	<b>Sensitivity (%)</b>	<b>Specificity (%)</b>
Model 1(ENTER)	75.9	51.2	87.8
Model 2(FORWARD)	72.9	46.5	85.6
Model 3(BACKWARD)	76.7	48.8	90.0

Referring to Table 5, model 3 revealed that gender, perceived Benefits\_Safe("Influenza vaccines are safe for children"), perceived Susceptibilities\_HighRisk("My children have a high risk of influenza"), Perceived Susceptibilities\_SickEasy("My children get sick more easily than other children do"), Perceived Severity\_SeriousHealth("Influenza infection may cause serious health problems") and knowledge of influenza are significantly associated to parents' intention to vaccinate the kids. The results suggested that male respondents (fathers) are less likely to vaccinate their children against influenza compared to females (mothers). Parents who reported agree with the statement "Influenza vaccines are safe for children" are 20 times more likely to vaccinate their children against influenza and parents who agree with the statement "My children have a high risk of influenza" are 36 times more likely to vaccinate their children against influenza. It was also shown that parents who agree with the statement "Influenza infection may cause serious health problems" are 3 times more likely to vaccinate their children against influenza. Conversely, parents that agree with the statement "My children get sick more easily than other children do" are less likely to vaccinate their children against influenza.

### 3.3 Discussion

The purpose of this study was to determine the parents' intention to vaccinate their kids. Further, the study attempted to identify the factors that influence the intention. This was achieved by performing logistic regression analysis. In this study, gender was found to be significant in predicting parents' intention. The odds ratio explained that female respondents (mothers) were more likely to vaccinate their kids compared to male (fathers). This finding is in agreement with those of Boes et al. [11] and Zeng et al. [13] where the study found that women tend to vaccinate their children compared to men. In contrast to this finding, findings from previous study by Natan et al. [15] indicated that male respondents among Muslim Arab parents are more likely to vaccinate their kids rather than female.

The results from logistic regression analysis suggested that parents who agree with the statement "Influenza vaccines are safe for children." have a higher likelihood to vaccinate their kids. A possible explanation for this might be parents who have trust in influenza vaccine will not hesitate to let their children to be vaccinated. This finding appears to support the previous study by Henninger et al. [28] which reported that the pregnant women were more likely to vaccinate their children when they believed in influenza vaccines. However, another study by Chen et al. [12] among Taiwanese provided no evidence that the trust in the vaccine safety will affect the parents' intention.

In contrast to earlier finding by Chen et al. [12], the current study found that parents who agree with the statement that their children have high risk of influenza tend to have high likelihood to vaccinate their kids. Also, the predictive modelling analysis found that parents who agree with the one statement perceived severity "Influenza infection may cause serious health problem" were more likely to vaccinate their children against influenza. This finding corroborates the work done by Han

et al. [14], who found that parents who intended to vaccinate their children against influenza had substantially higher ratings for perceived severity. This result has not been described in previous studies by Zeng et al. [13] and Chen et al. [12] where those studies reported that perceived severity is not significant.

This study reported that influenza knowledge is significantly associated with parents' intention to vaccinate their children against influenza. Parents with a higher knowledge of influenza vaccine were more likely to have their children vaccinated. This finding supports the results from previous study by Lama et al. [3] that claimed 15.1% of unvaccinated parents with higher knowledge will be more likely to vaccinate their children compared to parents who have lower knowledge. Earlier study by Yang [29] indicated that knowledge was not significant to the vaccination intention since the existing knowledge does not lead to greater intention in getting a vaccine.

Although careful measures were taken to ensure a strong study, there were still some limitations arise in this study. One of the limitations of this research was the validity of responses by the respondents where they may not provide their actual decision to vaccinate their children against influenza. It was possible that the respondents may refer to some other sources to complete the questionnaire. Thus, in turn, might have led to occurrence of self-response bias. Another limitation in this study relates to the generalizability of the results. The results of this study might not be generalized to other populations since the sample of this was only drawn from the population of academic staffs in UiTM Cawangan Kelantan. This study was also limited by unwillingness of the respondents to participate in this study. However, despite these limitations, this study obtained an adequate response rate of 80%.

#### **4 CONCLUSION**

This study applied binary logistic regression to obtain a predictive model in predicting the parents' intention to vaccinate their children against influenza. Based on the preceding discussion of the results, the analysis revealed that gender, Perceived Benefits\_Safe("Influenza vaccines are safe for children"), perceived Susceptibilities\_HighRisk("My children have a high risk of influenza"), Perceived Susceptibilities\_SickEasy("My children get sick more easily than other children do"), Perceived Severity\_SeriousHealth("Influenza infection may cause serious health problems") and knowledge of influenza are significantly associated to parents' intention to vaccinate the kids. Also, it was found that 67.7% of the parents have a high likelihood to vaccinate their children and 32.3% of the parents have low likelihood vaccinate their children against influenza. The findings in the present study indicate the need in disseminating information about importance of influenza vaccination among parents in order to increase the vaccine uptake rate.

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