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Factors Influencing Vaccination Decision among Parents in Malaysia

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Abstract

Vaccination is an important solution to a particular illness. In addition, vaccination is a treatment that makes the body more resistant to infection. Recently, vaccination awareness has been quite worrisome. Refusal of vaccination despite the availability of vaccines threatens the progress in avoiding vaccine-preventable diseases. Therefore, this study explored the most significant factor influencing vaccine hesitancy among Malaysian parents. A total of 203 Malaysian parents participated in this study. A logistic regression analysis was performed to show the influential factors. It is found that among educational level, living area, vaccination awareness and media exposure, only media exposure (p=0.000) was significant. It showed that media exposure is affecting parents' hesitancy in vaccinating their children. It is hoped that this study beneficial to raise awareness of vaccination among Malaysian citizens. This study can convince relevant organizations to launch an awareness campaign about the importance of vaccination. From here, the government can fulfil its responsibility to educate people about the importance and benefits of vaccination.

Keywords: Children, Vaccination, Logistic, Disease, Parents

Introduction

Vaccination is a treatment that makes the body more resistant to infection. Vaccinated weak antigens that cannot cause infection in the body are registered in the body, and the immune system still considers them as enemies and produces antibodies. After that, the antibody is broken down, but the memory cell remains in the body. Memory cells protect our body from illness when we encounter antigens again. Some people cannot be vaccinated due to their ages or their weak immune system in conjunction with the Disease Control and Prevention Centres. This unvaccinated person can be protected by people around them, known as herd

immunity. This happens when most of the people around an unvaccinated person are vaccinated and they are unlikely to encounter the disease.

Vaccination was introduced in Malaysia in the early 1950s and public health facilities are provided free of charge. Department of Statistics Malaysia has reported that 13.9% of deaths are due to ischemic heart disease and 12.7% are due to pneumonia. Vaccination is the process of strengthening the body's immune system. According to a study by Rumetta et al (2019), the immunization program is one of the greatest and most effective public health interventions in preventing morbidity and mortality caused by infectious diseases and second to clean water.

The Ministry of Health of Malaysia states that the number of measles cases has jumped from 195 in 2013 to 1934 in 2018. Of the total number of cases reported, the number of unvaccinated measles cases increased from 125 in 2013 to 1467 in 2018. It is recorded that six measles deaths and four of five cases of diphtheria deaths were caused by not receiving immunization in the year 2018 (TheStarOnline, 2018). The number of cases of measles in the world has risen due to resistance from the anti-vaccine campaigns to the denial of immunization due to the vaccination having contaminants that they believe could damage their children (Tobin, 2019).

Based on research by Rumetta et al (2019) 97-99% of Malaysia were eligible for free BCG and DTP vaccine vaccination in 2014. However, vaccine resistance increased rapidly. In the same article from the Ministry of Health of Malaysia, the number of cases of parental refusal to vaccinate increased from 470 in 2013 to 1541 in 2015. Certain factors cause parents to refuse vaccinations provided. For example, lack of confidence, drug company plots, religious restrictions, toxic or impure content.

Coronavirus disease or COVID 19 in 2019 is caused by the newly discovered coronavirus, SARSCoV2. The Malaysian government target to procure the COVID19 vaccine through multiple institutions and companies to vaccinate 80% of the population. One of the most a hotly debated topic in its use is the vaccination of children. The Ministry of Health (MOH) launched the COVID19 vaccine for children ages 5-12 in February 2022. The mRNA vaccine, Comirnaty® 10mcg Concentrate for Dispersion (Pfizer BioNTech) is used. The results of clinical studies of this vaccine have shown 90.7% efficacy and the ability to enhance a strong immune response against COVID 19 disease. However, only 38.5% of children take at least one dose, nearly two months after they hit the market. Health Minister Khairy Jamaluddin said the current challenge is to encourage children aged 5 to 11 years to be vaccinated because they do not have parental permission. A study done by Ng et al (2021) found that the common reasons given by parents who do not want to be vaccinated against COVID 19 are uncertainty about new vaccines (96.1%), concerns about vaccine content (93.2%), limited information about the vaccine from the doctors (82.3%), and believed the vaccine was unsafe (79.8%).

Media acts as one of the significant factors for raising awareness for the audience on the good and adverse effects of vaccination. A study in King County, Washington by Brunson (2013) did suggest that social networks play a key role in parents' vaccination decision-making. Francis et al (2019) researched to evaluate the routine vaccination coverage and factors associated with the immunization status of children that were living in rural Vellore. The researcher

found that UIP antigen coverage and proportion of fully vaccinated children in urban areas are higher than previously reported from rural Vellore. This research examination features the capability of improving parental familiarity with immunization plans and focusing on wellbeing instruction intercessions for pregnant ladies during antenatal visits to continue and improve routine vaccination inclusion.

The other potential factor was low awareness of vaccination among Malaysian parents (Joslyn, 2018). This was due to their wrong perception that these diseases were no longer in existence. However, knowledge of the benefits of immunization increased after the interviewing session was conducted. Therefore, the purpose of this study is to identify the most significant factors that influence parents' decision to vaccinate their children.

Methodology

Description of Data

This study used primary data and an internet survey was chosen as the data collection method. The internet survey questionnaire was used as the research instrument in this study. The questions in this questionnaire were adapted from various established research on vaccination among children Tefera et al (2018); HC (2006) The non-probability sampling technique which is convenience sampling was used since the sampling frame was not available. 203 Malaysian parents were selected as the sample for this research. Pedhazur (2019) stated that the minimum sample needed is 30 samples per independent variable. This research needs a minimum sample of 120 samples since there are four independent variables as suggested by (Pedhazur, 2019).

Research Framework

This study consists of one dependent variable which is Vaccine Hesitancy among Malaysian Parents and four independent variables. The research model for this study is shown in Figure 1. This model shows that Vaccine Hesitancy can be determined by variables of Education Level, Living Area, Media Exposure and Vaccination Awareness.

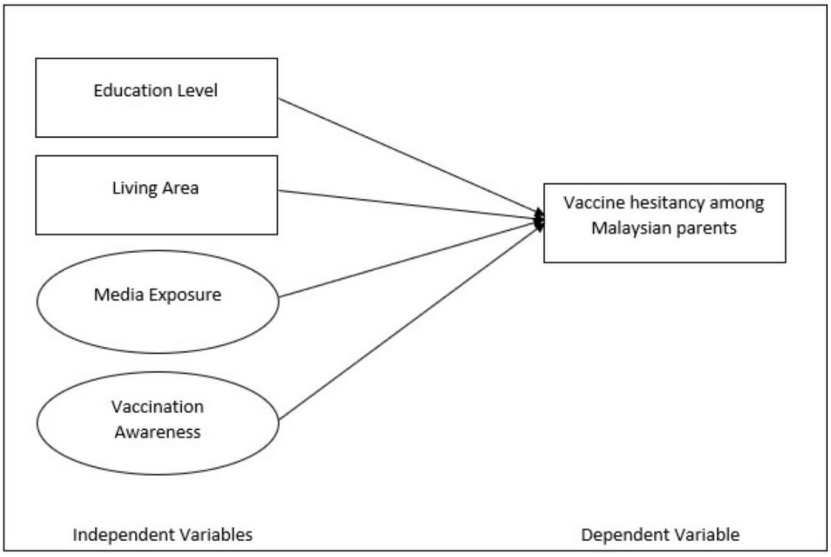

Figure 1: Research Framework

In this study, the researcher is interested in determining whether the education level of parents (SPM or lower, Diploma, Degree and Master) influences vaccine hesitancy among Malaysian parents. The researchers also decided to take the variable of Living Area such as Urban or Rural into consideration in this study because believed that the living area of the family affects the vaccine hesitancy. Besides, the variable of Media Exposure also is chosen as the independent variable in this study. It is important to study whether exposure to media will affect vaccine hesitancy among Malaysian parents. Moreover, the variable of Vaccination Awareness is one of the important independent variables that can be influenced vaccine hesitancy.

Logistic Regression Analysis

The logistic regression model is a process to identify the relationship between many independent variables and binary dependent variables. This study used a categorical factor that was well suited for logistic regression. The probability of the dependent variable in logistic regression will be 1 (probability of refuse, p) or 0 (probability of vaccine, 1 - p). In this study, parent refusal was noted as 1 and parent acceptance was noted as 0.

The general model for this this is:

$$\log\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

where

P_i : The probability for refusal of parents to vaccine their children
X_1 : Living area
X_2 : Media exposure
X_3 : Education level
X_4 : Vaccination awareness

In this study, there are four criteria to evaluate the logistic regression model. The omnibus test of model coefficient indicates the information from independent variables whether they give better prediction to the probability for refusal of parents to vaccine their children.

Moreover, the goodness-of-fit technique suggested by Hosmer and Lemeshow (2000) was used in this research. The Hosmer-Lemeshow tests the null hypothesis that predictions made by the model fit perfectly with observed group memberships. In addition, the classification table has been used in this study in predicting the efficiency of the model. The classification table compares the predicted value for the dependent variable (the outcome of parents' refusal to vaccine their children) based on the logistic regression model with the actual observed value in the data set.

In linear regression, R^2 is a very popular diagnostic for testing the goodness of fit. However, in logistic regression R^2 is not usually recommended because of its well-known disadvantage of possessing very low values. Hence, adjusted R^2 which is also known as Nagelkerke R^2 has been used in this study. This value provides an indication of the amount of variation in the response variable explained by the model.

Generally, in logistic regression, Wald statistic has been used in assessing the value of individual regressors when other regressors are in the model. The formula of Wald statistic is given by

$$Z = \frac{\hat{\beta}_i}{s(\hat{\beta}_i)}$$

All p-values are rounded by three decimal places and all statistical tests and confidence intervals were performed at a significance level of 0.05.

Results and Discussions

Model Evaluation

The Omnibus test is used to allow better prediction from the independent variable to the dependent variable. The Omnibus Test was used to check that the new model is an improvement over the baseline model. While Hosmer and Lemeshow tests were used to check that the model was a good fit for the data. From Table 1, the model is significantly better since the p-value of the Omnibus test is less than the α value, 0.05. The p-value of Hosmer and Lemeshow was 0.118 which is larger than the significance value, 0.05 indicates a good fit for the data.

Table 1
Model Evaluation

Model Evaluation	p-Value
Omnibus Test Model	0.000
Hosmer and Lemeshow	0.118

Cox Snell R^2 and Nagelkerke R^2 were used to calculate the total variation of the parent's decision of vaccinating their children. From Table 2, both R^2 values indicated that the total variation of parents' decision on vaccinating their children is between 18.9% and 25.2% related to all the independent variables included in the model.

Table 2
Model Summary

R^2	Value
Cox & Snell	0.189
Nagelkerke	0.252

Last but not least, is predictive efficiency criteria. Sensitivity measures the models' ability to predict the positive outcome correctly. As shown in Table 3, the findings found that the model could predict the parents' decision on not vaccinating their children correctly with a percentage of 68.0%. Contrarily, specification measure the models' ability to predict the negative outcome correctly whereby the model could predict the parents' decision on vaccinating their children correctly with a percentage of 77.0%. Meanwhile, the proportion of the total number of correct predictions measures the accuracy of the model. Overall, it indicates that the model in this study efficiently predicts people who are not vaccinate their children with an overall accuracy of 72.4%.

Table 3
Classification Table

Predictive Efficiency	Percentage
Sensitivity	68.0
Specificity	77.0
Overall	72.4

Wald Statistics

The significance of the independent variables was tested by using Wald statistics. This test is used to find the factors that influence parents' decisions on vaccinating their children. The coefficient, standard error, Wald statistics and p-value for each variable are shown in Table 4 with education SPM as the reference point.

Table 4
Wald Statistics

Variable	Estimated Coefficient	Standard Error	Wald Statistics	p-Value
Education Diploma	0.192	0.459	0.175	0.676
Education Degree	-0.018	0.431	0.002	0.968
Education Master	0.905	0.712	1.614	0.204
Living Area	-0.251	0.351	0.511	0.475
Media Exposure	-0.144	0.026	30.079	0.000
Awareness	0.043	0.028	2.394	0.122
Constant	1.411	0.711	5.801	0.016

There are four variables selected to find the significant factors that influence parents' hesitancy on vaccinating their children. Based on Table 4, only one variable was significant namely media exposure. The variable media exposure is significant because the p-value, 0.000, is less than the significance value, α, 0.05. It showed that media exposure is affecting parents' hesitancy on vaccinating their children. This result was in line with previous research done by (Wachob, 2019).

Following is the estimated logit model for the full model obtained:

Logit(Y=1) = 1.411 + 0.192 Education Diploma – 0.018 Education Degree + 0.905Education Master– 0.251 Living Area – 0.144 Media Exposure + 0.043 awareness

Odd Ratio

Since the Omnibus test is significant which showed that the independent variable can be used to have a better prediction of parents' hesitancy on vaccinating their children, the odds ratio was used to predict the probability of a parent not vaccinating their children. Only one variable was found as the significant variable, media exposure. For every increase in 1 score for media exposure, it can be concluded the odds of parents that not vaccinating their children decrease by 0.866.

Conclusion

In conclusion, this model satisfied all the criteria for logistic regression and all independent variables efficiently predict the parents who are not vaccinating their children. From all independent variables, media exposure gives a huge influence on the decision to vaccinate their children. Furthermore, the parents who reported having or planning to vaccinate their children based on the recommended schedule are less likely to use social media as a platform to gain information about vaccination. As a recommendation, the government and any related agencies are recommended to carry out awareness campaigns on the importance of vaccination, especially on social media. Using this practice, it would help to raise awareness of vaccination among Malaysian citizens and able to educate people on the importance and advantages of vaccination.

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