ORIGINAL ARTICLE

DRIVING FACTORS OF PARENTAL VACCINE HESITANCY TOWARDS COVID-19 VACCINES FOR CHILDREN IN PETALING DISTRICT, MALAYSIA

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ABSTRACT

Parental vaccine hesitancy (PVH) is a crucial barrier towards effective public health intervention, which refers to a delay in accepting or refusing vaccines despite its availability. This research seeks to determine the prevalence and driving factors of PVH against the COVID-19 vaccination for children in the Petaling district, guided by the the Health Belief Model and Theory of Planned Behavior. Parents of pre-school children in the Petaling district were recruited using a stratified proportionate-to-size random sampling method. A validated and reliable self-administered questionnaire was used, and three-level data analysis was done using SPSS Version 27.0. A PVH prevalence of 64.4% was obtained, in which 34.1% delayed and 30.3% refused vaccination. Parents with a high perceived barrier to taking the COVID-19 vaccination were 3.26 times more likely to be vaccine-hesitant (aOR=3.259, 95% CI: 1.994,5.324). Inversely, parents who have high perceived susceptibility, high subjective norms, and high cues to action had lower odds of being vaccine-hesitant respectively (aOR=0.286, 95% CI: 0.160,0.509, p<0.001; aOR=0.391, 95% CI: 0.211,0.723, p=0.003; aOR=0.331, 95% CI: 0.181,0.607, p<0.001). Also, parents aged more than 35 years old have 0.4 lesser odds of being vaccine-hesitant than parents aged less than 30 years old of age (aOR=0.419, 95% CI: 0.186,0.943, p=0.035). The high prevalence of parental vaccine hesitancy necessitating a nuanced strategy that considers each parent's specific concerns and beliefs related to the vaccination program.

Keywords: *Parental vaccine hesitancy, COVID-19 vaccination, driving factors.*

INTRODUCTION

Vaccination has been hailed as one of the greatest public health accomplishments of the twentieth century, contributing greatly to the reduction and elimination of many infectious diseases(1). Despite the obvious benefits of vaccines, vaccine hesitancy has surfaced as a major challenge in many parts of the world, and the World Health Organization has named it one of the top ten global health threats (2).

Vaccine hesitancy is described as a delay in accepting or refusing vaccines despite the availability of vaccine services. It is influenced by a complex interplay of multiple variables such as individual beliefs, cultural and religious beliefs, socioeconomic status, as well as trust in health institutions and authorities (3). Vaccine hesitancy is not a novel phenomenon, but it has received renewed focus in recent years as the number of outbreaks of vaccine-preventable diseases has increased, as has the rise of anti-vaccine movements and misinformation on social media (4,5).

Since the emergence of the COVID-19 pandemic, vaccination has been regarded as one of the most effective means of mitigating the virus's spread and devastation to global health. The development of COVID-19 vaccines was an important breakthrough in the struggle against the pandemic(6). Nevertheless, despite the demonstrated safety and efficacy of COVID-19 vaccines, vaccine hesitancy has emerged as a significant problem in many regions of the globe (7,8).

In Malaysia, The National COVID-19 Immunisation Programme or "Program Imunisasi COVID-19 Kebangsaan" in Malay language, abbreviated as NIP or PICK, was started on 24th of February 2021. The COVID-19 vaccination was fully funded by the government and made available to everyone who qualified for the shots. Until 8th of February 2022, 98% of the adult population have been vaccinated. The programme has expanded not only for adults but also for adolescents aged 12 to 17 years old and children aged 5 to 11 years old (9).

Even though children have a significantly lower risk of developing severe symptoms when infected (10), COVID-19 vaccines for children can protect children from developing long covid or Multisystem Inflammatory Syndrome in Children (MIS-C) post-COVID-19 infection(11). Furthermore, the COVID-19 pandemic has indirect effects on children (12), including school closures, movement restrictions, and healthcare service disruptions. Additionally, COVID-19 vaccination for children will protect not only the children but also those around them, particularly those who are not eligible for COVID-19 vaccination. Children are more likely to get a milder infection,

resulting in no or mild symptoms. However, a recent study found that the amount of virus found in children, known as their viral load, was unrelated to the severity of their symptoms. As a result, a child with mild or no symptoms may have the same number of virus particles in their nose and mouth as a child with severe symptoms and may be able to transmit the virus to others (12).

With the introduction of the COVID-19 vaccine for children under 12 years old, parental vaccine hesitancy was triggered. In childhood immunization, parents act as a proxy decision-makers for their children who are unable to make decisions for themselves, making parental vaccine hesitancy a more complex issue (13). As shown in primary immunization programmes, parental vaccine hesitancy for their children poses a threat to COVID-19 vaccination for children.

In Malaysia, little is known about the prevalence and factors influencing parental vaccine hesitancy against COVID-19 vaccination. Thus, this research seeks to determine the prevalence and driving factors of parental vaccine hesitancy against the COVID-19 vaccination for children in the Petaling district, Malaysia, using the i-PEACH Framework, a framework created by integrating the Health Belief Model and Theory of Planned Behavior.

METHODS

A cross-sectional research design was conducted from June 2022 to October 2022, with a pretest taking place in June 2022. The sampling population consisted of parents of children aged 4 to 6 years old who attended the registered pre-schools with The Community Development Department (KEMAS) in Petaling district, Selangor. The study's inclusion criteria were Malaysian citizens with children aged 4 to 6 years old, either mother or father with whom the child resided, and the ability to comprehend and communicate in Malay or English. The sample size was pre-determined using the two-proportions formula(14). The least sample size was 116, and the optimum sample size was 580 participants. This research employed stratified proportionate-to-size random sampling based on subdistricts. This sampling method is appropriate for ensuring that each stratum is proportionately represented. First, a list of all KEMAS pre-school pupils in all subdistricts is obtained from the KEMAS Petaling district office. Following that, the strata were based on the six subdistricts, and the number of samples needed from each stratum was collected proportionally.

A framework was developed integrating the Health Belief Model and the Theory of Planned Behaviour to guide the study. Both are behavioural change theory/ model that have been used widely and proven to have the predictive ability in studying vaccination behaviour. The dependent variable in this study is vaccine hesitancy, and the independent variables are socio-demographic factors (age, gender, ethnicity, education level, religion, household income, occupation), parental covid-19 vaccination status, and the constructs of the integrated framework (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, subjective norms towards vaccination, perceived behavioural control towards vaccination and cues to action of vaccination).

Data was collected using a self-administered questionnaire adapted from several validated and reliable questionnaires (15,16). The questionnaire comprised of six sections; Section A: Sociodemographic Factors, characteristics of sociodemographic factors were asked, including age, gender, ethnicity, education level, religion, household income, occupational status and COVID-19 vaccination status of the respondents; Section B: Attitude on constructs of perceived severity, perceived susceptibility, perceived benefits, perceived barriers; Section C: Cues to action; Section D: Subjective Norms; Section E: Perceived Behavioural Control; and Section F on Vaccine Hesitancy. Parental vaccine hesitancy was measured by a question on parental intention to vaccinate their children against COVID-19, defined as parents who delay in acceptance, reluctance, or refusal of COVID-19 vaccination despite the availability of COVID-19 vaccination services. The outcome corresponds to the question regarding the intention of the participant to take the COVID-19 vaccine by the question, "Have you received, or will you receive, COVID-19 vaccination for your child?" The outcome was "Yes", "Yes, but I will wait some time", and "No". The outcome was further categorized into two categories: "Yes" was categorized into "Not vaccine hesitant", while "Yes, but I will wait some time", and "No" was categorized as "Vaccine hesitant" (17) The questions were constructed in back-to-back translation manner comprising of English and Malay languages. Face and content validity and were performed to ensure the validity of the questionnaire used, and an internal consistency test was done to ensure reliability, with the value of Cronbach's alpha ranged from 0.766 to 0.951 were obtained.

The IBM Statistical Analysis of Social Sciences System (SPSS) Version 27.0 was used for the data analysis. Three levels of analysis were done: descriptive statistics, bivariate analysis using the Chi-square test to measure associations between two categorical variables, and multivariable analysis using multiple binary logistic regression to determine predictors of complete immunization uptake. The bivariate independent variables with $p<0.25$ were selected to be analyzed in the multivariable logistic regression. In all analyses, a significance level of 0.05 with a confidence interval of 95% was used.

Institutional approval has been obtained from the Community Development Department of Selangor, as well as the ethical approval from the UPM Ethical Committee on Research involving Humans (JKEUPM) was obtained to carry out this research. All data collected were kept confidential and used solely for this research and publication.

RESULTS

The response rate was 87.5%, with only 508 questionnaires were completed from a total of 580 distributed. The distribution of respondents' sociodemographic factors is depicted in Table 1. The respondents' median is 35 years old, with an interquartile range of 6. The majority of respondents were female, accounting for 81.7% of all respondents. The majority of respondents (92.3%) were Malay in race and Muslim in religion (96.3%). The respondents' occupational status was primarily working (64.8%), and their educational level was fairly divided into two categories, with low level education (secondary school and below) accounting for 52.2% and high education (diploma level and above) accounting for the remaining 47.8%. The respondents' median household income was RM3000, with an interquartile range of RM2000.
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Table 1: Distribution of respondents' sociodemographic factors

Characteristics	Median (IQR)	n	Percentages %
Overall		508	100
Age	35(6)		
Sex			
Male		93	18.3
Female		415	81.7
Ethnicity			
Malay		469	92.3
Non-Malay		39	7.7
Religion			
Muslim		489	96.3
Non-Muslim		19	3.7
Occupational status			
Working		329	64.8
Not working		179	35.2
Education level			
Low education		265	52.2
High education		243	47.8
Household income	3000 (2000)		

As for parental COVID-19 vaccination status, the majority of the respondents had completed their COVID 19 vaccinations (97.4%) as depicted in Table 2. The prevalence of parental vaccine hesitancy towards COVID-19 vaccines for children among the respondents was 64.4% which accounted for 327 respondents, with 154 of them refused vaccination (30.3%) and another 173 of delayed vaccination (34.1%). The result is depicted in Table 3.

Table 2: Distribution of respondents' COVID-19 vaccination status

Characteristics	n	Percentages %
Overall	508	100
COVID-19 Vaccination status		
Complete	495	97.4
Not vaccinated	13	2.6

Table 3: Prevalence of parental vaccine hesitancy towards COVID-19 vaccines for children among respondents

Vaccine hesitancy	N	%
Yes	327	64.4
Refused vaccination	154	30.3
Delayed vaccination	173	34.1
No	181	35.6

Bivariate analysis in Table 4-6 showed 9 factors significantly associated with parental vaccine hesitancy including 2 sociodemographic factors; parental age (p<0.001) and household income (p=0.044), and all the constructs of the integrated framework; perceived susceptibility (p<0.001), perceived severity (p<0.001), perceived threats (p<0.001), perceived benefits (p<0.001), subjective norms (p<0.001), perceived behavioural control (p<0.001), and cues to actions (p<0.001). Those independent variables with p<0.25 from bivariate analysis were chosen to be analyzed further using multivariable logistic regression to analyze the predictors of parental vaccine hesitancy.

Table 4: Association between sociodemographic factors and parental vaccine hesitancy

Variables	Vaccine hesitancy			
	No n(%)	Yes n(%)	χ^2 (df)	p-value
Age				
<30 years old	13	45	14.072 (1)	<0.001*
30-35 years old	54	131		
>35 years old	114	151		
Gender			0.982(1)	0.322
Male	29(31.2)	64(68.8)		
Female	152(36.6)	263(63.4)		
Ethnicity			2.040(1)	0.153
Malay	163(34.8)	306(65.2)		
Non-Malay	18(46.2)	21(53.8)		
Religion			0.361(1)	0.548
Muslim	173(35.4)	316(64.6)		
Non-Muslim	8(42.1)	11(57.9)		
Household income				
<RM2000	60(32.8)	123(67.2)	6.258(2)	0.044*
RM2000-4000	66(32.5)	137(67.5)		
>RM4000	55 (45.0)	67(55.0)		

Note: (*)significant p<0.05

Table 5: Association between parental COVID-19 vaccination status and parental vaccine hesitancy

Variables	Vaccine hesitancy			
	No n(%)	Yes n(%)	χ^2 (df)	p-value
COVID-19 Vaccination status			2.384(1)	0.123
Complete	179(36.2)	316(63.8)		
Incomplete	2(15.4)	11(84.6)		

Note: (*)significant p<0.05

Table 6 Association between constructs of the integrated framework and parental vaccine hesitancy

Variables	Vaccine Hesistancy (Yes versus No)			p-value
Perceived susceptibility			1122.820(1)	<0.001**
High	143(61.1)	91(38.9)		
Low	38(13.9)	236(86.1)		
Perceived severity			92.602(1)	<0.001**
High	137(57.3)	102(42.7)		
Low	44(16.4)	225(83.6)		
Perceived benefits			106.336(1)	<0.001**
High	144(58.1)	104(41.9)		
Low	37(14.2)	223(85.8)		
Perceived barriers			26.218(1)	<0.001**
High	51(23.2)	169(76.8)		
Low	130(45.1)	158(54.9)		
Subjective norms			116.323(1)	<0.001**
High	144(59.8)	97(40.2)		
Low	37(13.9)	230(86.1)		
Perceived behavioural control			72.458(1)	<0.001**
High	122(56.7)	93 (43.3)		
Low	59(20.1)	234(79.9)		
Cues to action			120.803(1)	<0.001**
High	144(60.5)	94(39.5)		
Low	37(13.7)	233(86.3)		

Note: (*) significant p<0.05; (**) significant p<0.001

For the multivariable logistic regression, all variables that were chosen based on the bivariate analysis undergone 'Forward-LR', or 'Backward-LR' methods. The best final model using 'Backward-LR' yielded six significant factors as shown in Table 7. There was no multicollinearity and interaction between the independent variables detected from the analysis. Hosmer and Lemeshow goodness of fit test (x2=5.014, df=7, p=0.658, p>0.05) showed that the model had good model fit. The overall classification accuracy based on the model was 64.4%, and Negelkerke's

R square showed that 46% of the variation of parental vaccine hesitancy is explained by the final model. Area under the curve for ROC curve is 0.860, which can accurately discriminate 85.6% of the cases (p<0.001, 95%CI 0.823-0.8888). Thus, good model fit to the data.

The final model shows that there were 1 variable positively associated with parental vaccine hesitancy and 4 variables inversely associated with parental vaccine hesitancy. The variables that were positively associated with parental vaccine hesitancy were perceived barrier in which parents who have high perceived barrier towards taking the COVID-19 vaccination are 3.26 times more likely to be vaccine-hesitant respectively (aOR=3.259, 95% CI: 1.994,5.324, p<0.001).

There are four variables that were found to be inversely associated with parental vaccine hesitancy which are perceived susceptibility, subjective norms, cues to action, and age of parents. Parents who have high perceived susceptibility towards COVID-19 for their children have lower odds of being vaccine hesitant compared to those who have low perceived susceptibility susceptibility (aOR=0.286, 95% CI: 0.160,0.509, p<0.001). Next is the subjective norms, in which parents with high subjective norms towards taking the COVID-19 vaccine have lower odds of being vaccine hesitant than parents with low subjective norms towards taking the COVID-19 vaccine (aOR=0.391, 95% CI: 0.211,0.723, p=0.003). The next significant predictor is cues to action in which parents with high cues to take the COVID-19 vaccine have lower odds of being vaccine hesitant (aOR=0.331, 95% CI: 0.181,0.607, p<0.001). Also, one sociodemographic factor was found to be a negative predictor which is parental age, where parents aged more than 35 years old has 0.37 lesser odds of being vaccine hesitant than parents aged less than 30 years old of age (aOR=0.419, 95% CI: 0.186,0.943, p=0.035).

Table 7: Predictors for parental vaccine hesitancy

Variable	Adjusted Coefficient	Standard error	Adjusted Odd ratio	95% CI for Odd ratio		p-value
				Lower bound	Upper bound	
Intercept	2.394	0.443				
Perceived susceptibility	-1.253	0.295	0.286	0.160	0.509	<0.001**
Perceived barrier	1.181	0.250	3.259	1.994	5.324	<0.001**
Subjective norms	-0.939	0.314	0.391	0.211	0.723	0.003*
Cues to action	-1.106	0.309	0.331	0.181	0.607	<0.001**
Age						
<30 years old	Ref					
30-35 years old	0.058	0.435	1.060	0.452	2.848	0.894
>35 years old	-0.870	0.413	0.419	0.186	0.943	0.035*

Note: (*) significant p<0.05; (**) significant p<0.001

DISCUSSION

The prevalence of parental vaccine hesitancy towards the COVID-19 vaccination for children in this study was 64.4% in which 30.3% refused vaccination and 34.1% delayed vaccination for their children. These findings differ than the only local study done on parental willingness to vaccinate their children with COVID-19 vaccination in Malaysia, in which the study found majority of the parents were willing to vaccinate their children with COVID-'19 vaccination (73.6%) (18). The differing results were most probably because of difference in sampling and specific location of the study. The study mentioned utilized the whole Malaysia as sampling location but snowball sampling, which is a non-probability sampling was used, whilst in this study, a probability sampling using the stratified proportionate to size sampling was conducted, but only confined to the Petaling district. The prevalence in this study was more comparable to the current available data of COVID-19 vaccination for children in Malaysia in which 43.5% of the children population in Malaysia were completely vaccinated with 2 dose of a two-dose vaccine or 1 dose of a one-dose vaccination, as of 20th March 2023.

There were 5 variables that became predictors of parental vaccine hesitancy in this study, namely perceived susceptibility, perceived barrier, subjective norms, cues to action, and parental age. Parents who have high perceived susceptibility having a lower odd of being vaccine

hesitant compared to those who have low perceived susceptibility. Studies have shown similar results that perceived susceptibility plays a significant role in parental vaccine hesitancy against COVID-19 vaccination for children in which parents who perceived their children to be at a lower risk of contracting COVID-19 were more likely to be hesitant about vaccinating their children (19,20). This demonstrates that the perception of vaccination benefits in terms of disease susceptibility is an important factor in increasing vaccine acceptance (21). Furthermore, parents who had a high perceived barrier to receiving the COVID-19 vaccination have 3.22 times more likely to be vaccine hesitant. Findings were comparable to research that identified perceived barriers significantly associated to parental vaccine hesitancy (22). Also, in a systematic review of studies applying Health Belief Model for COVID-19 vaccine hesitancy, perceived barrier was one of the most common HBM constructs that were significantly associated with parental vaccine hesitancy (23). In multiple studies, concerns about vaccination side effects have been shown to be one of the most common barriers on why parents declined to vaccinate their children with the COVID-19 vaccine (24–26).

Next, parents with high subjective norms towards taking the COVID-19 vaccine have lower odds of being vaccine hesitant than parents with low subjective norms towards taking the COVID-19 vaccine. The finding is consistent with other studies that reported a perceived subjective norm linked to children's COVID-19 vaccination was correlated with lower vaccine hesitancy (27). Lack of support for COVID-19 vaccination for children from other parents, family members, clergy, and others in one's community has been a major barrier to parental vaccine acceptance (28).

Other than that, it was identified that parents with high cues to take the COVID-19 vaccine were less likely to be hesitant. This result was consistent with the findings of other studies, which found that cues of action towards getting the COVID-19 vaccination for their children are negatively linked with vaccination refusal (29), while no cues of action are positively associated with parental vaccine hesitancy (30). This shows cues to action may be particularly important given the novelty of the vaccine and the potential concerns or hesitancy among parents. By providing clear and consistent messages about the importance and safety of COVID-19 vaccination for children, and by providing reminders and prompts to get vaccinated, it is potential to reduce vaccine hesitancy among parents.

On the other hand, parents aged more than 35 years old had lesser odds of being vaccine hesitant than parents aged less than 30 years old of age. Similar findings were found in other studies studying parental vaccine hesitancy towards COVID-19 vaccination in which younger parents were more likely to be vaccine hesitant (31,32). One possible explanation for this problem is that younger parents are more likely to get vaccine information from online sources. Social media can be a valuable source of vaccine information for younger parents, and this information may influence their decision to vaccinate their children. According to a study on the impact of internet media on parents' attitudes towards child vaccination, younger parents are especially vulnerable to the influence of online media on vaccine attitudes (33). As not all content on social media is accurate or reliable, this vulnerability of the younger parents exposes them to misinformation that can lead to vaccine hesitancy (34).

This study is without limitations. The use of a cross-sectional study design which is an observational type of study only analyses data from a population at a single moment in time. As a result, the weakness of this research design is the inability to make a causal inference because a temporal relationship cannot be established. Furthermore, even though Petaling district has the highest population density in Malaysia, using a district as a study location limits the results to the present study population rather than the entire population of Malaysia.

CONCLUSIONS

The prevalence of parental vaccine hesitancy was high, as reflected by the low uptake of the COVID-19 vaccination for children in Malaysia. This study uncovered several important findings that can be used to develop interventions and plans for addressing COVID-19 parental vaccine hesitancy and increasing vaccination acceptance.

Subjective norms have been found to be highly significant. Hence, it is critical to promote positive messages about vaccination for children across all levels of the community in order to help change subjective norms in favour of vaccination. Engaging with key referents, such as family members or community leaders, can also have a significant impact on the formation of subjective norms. Creating positive and informative posts about the benefits of vaccination, as well as sharing stories of people who have been vaccinated, can help to change attitudes and beliefs about vaccination. There are many narratives about negative experiences that have led to perceived barriers in vaccine hesitancy; therefore, we should concentrate on developing a platform for sharing positive personal experiences with COVID-19 vaccination to help build trust and confidence in the vaccine. Aside from that, perceived susceptibility is a factor in parental vaccine hesitancy, so providing accurate information about the risks of COVID-19 for children who have and have not had the COVID-19

vaccination should be emphasized. This can include data on COVID-19 cases and their vaccination status, as well as the risk of transmission, long-term health consequences, and the risk of severe illness or death. Other than that, cues to action for vaccination have been shown in this study to operate both ways, in favour of or against vaccination. As a result, it is critical to manage all the cues that lead to vaccine hesitancy, such as aggressively addressing and correcting misinformation about the COVID-19 vaccine. The use of social media can be a potent tool for influencing people, particularly young parents, who were found to be more likely to be hesitant in this study, to accept vaccinations. Specific interventions must be tailored to the young generation's needs, concerns, and manner.

As the integrated framework was able to predict parental vaccine hesitancy in this research, creating a theory-based intervention based on this comprehensive framework has a high chance of success in changing negative perceptions about COVID-19 vaccination for children.

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