Original research

Parental knowledge, attitude and behaviour of varicella and its vaccination in Klang Valley, Malaysia

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Abstract

Background: Varicella is a childhood disease with potentially severe complications and has seen a significant reduction in its impact in countries such as the United States, Taiwan, and Hong Kong due to successful vaccination programs. However, vaccination efforts worldwide face challenges stemming from parental misconceptions and limited knowledge about the disease. Notably, Malaysia currently does not include varicella vaccination in its routine immunization schedule, making it a critical area for study. This research aims to explore parental knowledge, attitudes, and behaviours related to varicella vaccination, as well as their correlation with demographic factors and health beliefs. The overarching goal is to address the existing knowledge gap and improve its awareness in Malaysia, where varicella's prevalence remains understudied. **Materials and Methods:** This study gathered data from 400 voluntary participants, collecting information on demographic backgrounds, knowledge levels, behaviours, and attitudes concerning varicella and its vaccination. **Results**: There was an overall 69% of positive vaccination behaviour. Health belief statements showed a statistically significant difference between the recommended vaccination and not recommended vaccination groups (p <0.05); and between three groups of knowledge level and their perception towards varicella and its vaccination (p <0.01). A higher knowledge level is associated with positive behaviour towards varicella vaccination. Low parental education, low household income, widow and higher number of children were predictors of antagonistic behaviour towards varicella vaccination (all p <0.05). **Conclusion:** This study underscores the need to include varicella vaccination in the Malaysia National Immunization Programme, particularly focusing on promoting varicella vaccination in schools. Such an initiative can help combat varicella and address the identified predictors of reluctance towards vaccination.

Keywords: Communicable Diseases, Demography, Epidemiology, Medical Education, Vaccination

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Introduction

Varicella is a common childhood disease that may lead to severe complications such as pneumonia, encephalitis, and bacterial skin infection, and it can be transmitted by sneezing, coughing and direct contact with vesicle fluid from person to person [1]. Varicella vaccination has been essential in declining incidence, hospitalisation, and mortality worldwide. According to Centres for Disease Control and Prevention (CDC), in the prevalence era of the early 1990s, an average of 4 million people were infected with varicella and an estimated 10,000 cases were hospitalised in the United States (US) [2]. Besides that, there was an average of 100 deaths each year between 1990 and 1996 before the licensure of varicella vaccine. Within ten years following the licensure of the varicella vaccine in 1995, there was a significant decline in hospitalisation and death rates caused by varicella [3-5]. Varicella should not be considered a minor disease, and to fight against it, vaccination is important.

World Health Organization (WHO) recommends ensuring more than 80% of vaccine coverage where the disease has an important public health impact [6]. Following WHO's recommendation, the Universal Varicella Vaccination (UVV) program was introduced in 2004 in Taiwan and Hong Kong [7, 8]. A study found that varicella incidence and hospitalisation significantly decreased among post-vaccination preschool children, especially 3 to 6 years old after nationwide varicella immunisation was introduced in Taiwan [7]. Another study concluded that the usage of varicella vaccination has increased by 50 % from 2009 to 2015 in Hong Kong [9]. In countries such as the US, Taiwan, and Hong Kong, the incidence, hospitalisation, and death rate caused by varicella have shown significant reduction post varicella vaccination [3, 4, 7-12]. The importance of the varicella vaccination in controlling the spread of the disease has had positive influences towards other developed countries such as Italy and Latvia which have introduced compulsory varicella vaccination [13].

Different studies showed that parents have a poor understanding of varicella and lack of knowledge on varicella vaccination [14, 15]. Studies concluded that only a low percentage of participants knew the complete dose of varicella vaccination [14, 16]. Besides that, parental health

belief was another factor that their children did not get vaccinated [14, 15]. Parents underestimate the severity of varicella, thinking that it is a minor childhood disease. Parents were also concerned about the effect caused by vaccination [14, 15]. Researchers found similar results that there was a significant difference between parents' educational level, knowledge and attitude towards varicella in Kuwait, China, and Italy [14-16]. It was reported that doctors could play an important role in educating parents on varicella and also help to address misconceptions since parental beliefs may be a major factor influencing whether a child receives varicella vaccine [17].

In Malaysia, vaccines for preventable diseases such as measles and poliomyelitis have achieved more than 95% of vaccination coverage. Vaccination coverage for children has met the target of Universal Child Immunisation (UCI). However, varicella vaccine is not listed under routine national immunisation schedule [18, 19]. The varicella incidence rate per 100,000 populations in Kuala Lumpur was 1.89. Four death cases caused by varicella were reported in Malaysia in 1995, which is 0.01% of total death [20]. Post-2008, little is known about this topic in Malaysia. Therefore, it is important to investigate the relationship between parental perception and knowledge to vaccination status to increase awareness on varicella among parents in Malaysia.

In the present study, we are interested to survey the knowledge, attitude, and behaviour on varicella and its vaccination among parents. In addition, association between demographic characteristics, knowledge, parental health belief, and vaccination status are examined.

Materials and Methods

Study Design

This cross-sectional study was conducted from June to August 2020, and collected from Klang Valley, Malaysia, which consists of three main areas, the Federal territory of Kuala Lumpur, the Federal territory of Putrajaya, and Selangor, which was categorized into several districts (Selangor district of Petaling; Selangor district of Klang; Selangor district of Gombak; Selangor district of Hulu Langat; Selangor district of Sepang; Selangor district of Kuala Langat).

Inclusion criteria

The inclusion criteria of participants were (1) Malaysian; (2) parents (married, widowed, divorced); (3) aged between 18 to 55; (4) aware of the presence of varicella; (5) residing within Klang Valley, Malaysia.

Sample size determination

Sample size was calculated using Daniel's sample size formula, $n = \frac{z^2pq}{d^2}$, where n is the sample size, z denoted standardized value of the level of confidence, q equals to $1\text{-}p$, p is the proportion of the population, and d as the precision (margin of error) [21, 22]. Due to absence of previous studies on this topic for the prevalence of proportion of population, ergo it was assumed $p = 0.5$ as it would help in obtaining a sample large enough to ensure precision while remaining impartial. We considered $z = 1.96$ at 95% confidence interval, and $d = 0.05$, thus

$$n = \frac{1.96^2(0.5)(0.5)}{(0.05)^2}$$

$$n = 384.16 \approx 385$$

Questionnaire

The questionnaire was developed in multilingual, namely English, Bahasa Malaysia, and Mandarin to accommodate the multiracial culture of the Malaysia population. Each question was methodical reviewed by three experts in health sciences for its alignment with the scope, length, and clarity. The questionnaire consisted of five sections: (a) a brief introduction on the availability of varicella vaccination; (b) demographics information of respondent; (c) knowledge assessment on varicella and its assessment; (d) behavioural assessment of participants toward varicella and its vaccination; (e) attitude towards varicella and its vaccination (Likert scale). Data was collected via google doc (https://docs.google.com/forms; accessed in May 2020). Samples were collected using by snowball sampling. A pilot study consisted of forty samples was conducted prior to optimize the questionnaire and the instrument demonstrated good internal consistency with the Cronbach's Alpha reliability test. (Knowledge: $\alpha = 0.76$; behaviour: $\alpha = 0.7$; attitude: $\alpha = 0.94$).

Statistical Analysis

Descriptive statistics was used for the distribution of different characteristics backgrounds among respondents. The knowledge level of respondents was categorized into three groups based on the distribution of pilot study: high (≥19), intermediate (13-18), and low (0-12). Behaviour (positive = would vaccinate; negative = would not vaccinate) towards varicella vaccination was categorized based on whether the respondents would vaccinate their children. The calculation of sample size was performed using the formula: $r = Z/\sqrt{N}$ with N noted as sample size, and Z noted as Z-score. All analyses $p<0.05$ was considered as statistically significant [23]. Statistical analysis was performed using SPSS (Statistical Package for the Social Sciences) 22.0.

Results

Descriptive findings

A total of 400 respondents completed the questionnaire. The frequency and demographics of the respondents are listed in **Table 1**.

Tabel 1: Socio-demographic of participants (n = 400)

Backgrounds characteristics		**(%)**
Area		
	Federal territory of Kuala Lumpur	59 (14.8)
	Federal territory of Putrajaya	29 (7.3)
	Selangor district of Petaling	79 (19.8)
	Selangor district of Klang	71 (17.8)
	Selangor district of Gombak	42 (10.5)
	Selangor district of Hulu Langat	35 (8.8)
	Selangor district of Sepang	47 (11.8)
	Selangor district of Kuala Langat	38 (9.5)
Gender		
	Male	130 (32.5)
	Female	270 (67.5)
Religion		
	Muslim	100 (25.0)
	Buddhist	185 (46.3)
	Hindu	33 (8.3)
	Sikh	4 (1.0)
	Christian	55 (13.8)
	Others	23 (5.8)
Age (Year)		
	18 – 30	121 (30.3)
	31 – 43	181 (45.3)
	44 – 55	98 (24.5)
Monthly household income (RM[a])		
	<1000	7 (1.8)
	1001 – 2500	45 (11.3)

	2501 – 4000	110 (27.5)
	4001 – 6500	122 (30.5)
	≥6500	116 (29.0)
Marital status		
	Married	357 (89.3)
	Divorced	29 (7.3)
	Widowed	14 (3.5)
Number of children		
	1	164 (41.0)
	2	134 (33.5)
	≥3	102 (25.5)
Education level		
	No formal	9 (2.3)
	Primary	63 (15.8)
	Secondary	96 (24.0)
	Tertiary	232 (58.0)
Varicella vaccinated **status**		
	Yes	322 (80.5)
	No	47 (11.8)
	Not sure	31 (7.8)
Varicella vaccination status		
	Yes	73 (18.3)
	No	264 (66.0)
	Not sure	63 (15.8)
Knowledge level		
	Low	105 (26.3)
	Intermediate	239 (59.8)
	High	56 (14.0)

[a]: RM; Malaysian currency Ringgit

Behaviour towards varicella and its vaccinations

Health belief statement of varicella and its vaccination

Difference between behaviour of respondents and statements regarding varicella and its vaccination

Table 2: Statistics of Respondents' Behaviour Towards Varicella and its Vaccinations

No.	Behavior towards varicella and its vaccination	(n = 400) (%)
1	**Would you purposefully allow your child/children to be infected by varicella form someone else?**	
	Yes	44 (11.0)
	No	356 (89.0)
2	**Would you avoid bringing your child to places with varicella infected children?**	
	Yes	311 (77.8)
	No	89 (22.3)
3	**Have you talked to your doctor about varicella vaccination?**	
	Yes	142 (35.5)
	No	258 (64.5)
4	**Would you be willing to pay for the varicella vaccine?**	
	Yes	253 (63.3)
	No	147 (36.8)
5	**Would you take the initiative to look up more information on varicella vaccination?**	
	Yes	277 (69.3)
	No	123 (30.8)
6	**Would you share the information of varicella vaccination with people around you?**	
	Yes	280 (70.0)
	No	120 (30.0)
7	**Have you vaccinated your child against varicella?**	

	Yes	171 (42.8)
	No	229 (57.3)
8	**Would you vaccinate your child against varicella?**	
	Yes	275 (69.0)
	No	125 (31.0)

All the health belief statements showed statistically significant difference of population medians (p <0.05) between the recommend of vaccination and not recommend of vaccination groups (**Table 3**).

Table 3: Mann Whitney U Analysis between Behaviour of Respondents and Health Statements Regarding Varicella and its Vaccination (n = 400)

No.	**Health belief statement**	**Recommend $\tilde{X}$ (IQR)[a]**	**Not Recommend $\tilde{X}$ (IQR)[a]**	**Mann-Whitney U**	***p*- value**	
1	Varicella vaccination is effective	4 (3-4)	3 (3-3)	7747	<0.001	
2	Benefits of varicella vaccination outweigh its side effects	4 ((3-4)	3 (3-3)	8486	<0.001	
3	Varicella is not a minor illness	4 (3-4)	3 (3-3.75)	11735.5	<0.001	
4	It's worth the vaccination even if it doesn't provide lifelong immunity to varicella	4 (3-4)	3 (2-3)	8468	<0.001	
5	There's long term benefit from	4 (3-4)	3 (2-3)	9036	<0.001	

	varicella vaccination					
6	I'm worried about my child contracting varicella	4 (3-5)	3 (3-4)	8730	<0.001	
7	Varicella is not a common childhood disease	2 (2-3)	3 (2-3)	14134	0.003	
8	Varicella vaccination is safe for the public	4 (3-4)	3 (3-3)	10458.5	<0.001	
9	Varicella vaccination should be made compulsory	4 (3-4)	3 (3-3)	9865.5	<0.001	
10	I would recommend varicella vaccination	4 (3-4)	3 (3-3)	8287.5	<0.001	

[a]: Responses range from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), 5 (strongly agree); IQR: Interquartile range; $\tilde{X}$: Median value.

Association between the knowledge level of respondents and statements regarding varicella and its vaccination

All the health belief statements showed statistically significant difference of population medians between the three groups of knowledge level (p <0.01), with each of the varicella and its vaccination statement (**Table 4**).

Table 4: Association Between the Knowledge Level of Respondents and Beliefs Regarding Varicella and its Vaccination (n = 400)

No.	**Health belief statement**	**Low level $\tilde{X}$ (IQR)[a]**	**Intermediate level $\tilde{X}$ (IQR)[a]**	**High level $\tilde{X}$ (IQR)[a]**	**Chi-Square**	**p-value**	

1	Varicella vaccination is effective	3 (3-4)	4 (3-4)	4 (4-5)	42.268	<0.001	
2	Benefits of varicella vaccination outweigh its side effects	3 (3-4)	4 (3-4)	4 (4-5)	44.64	<0.001	
3	Varicella is not a minor illness	3 (3-4)	4 (3-4)	4 (3-4)	20.33	<0.001	
4	It's worth the vaccination even if it doesn't provide lifelong immunity to varicella	3 (3-4)	3 (3-4)	4 (3-5)	22.861	<0.001	
5	There's long term benefit from varicella vaccination	3 (2.5-4)	3 (3-4)	4 (4-4)	20.984	<0.001	
6	I'm worried about my child contracting varicella	3 (3-4)	4 (3-5)	5 (4-5)	39.036	<0.001	
7	Varicella is not a common childhood disease	3 (2-4)	2 (2-3)	2 (1-3)	22.138	<0.001	
8	Varicella vaccination is safe for the public	3 (3-4)	3 (3-4)	4 (3-4)	10.427	0.005	
9	Varicella vaccination	3 (3-4)	3 (3-4)	4 (3-4)	16.348	<0.001	

	should be made compulsory						
10	I would recommend varicella vaccination	3 (3-4)	4 (3-4)	4 (4-5)	23.581	<0.001	

[a]: Responses range from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), 5 (strongly agree); IQR: Interquartile range; X̃: Median value.

Predictors of demographic backgrounds

Table 5 shows the results of binomial logistic regression multivariate analysis that examine the predictors of negative behaviour towards varicella vaccination, with the exclusion of gender as a variable due to being noted as statistically insignificant variable during univariate analysis. Adjusted odd ratios (AOR) were calculated in favour of negative behaviour towards varicella vaccination group. The binomial logistic regression model explained that 38.3% of the variation of behaviour towards varicella vaccination by selected characteristics of respondents, and the model was correctly classified 78.3% of cases with a predicted probability of 0.5 or greater, with sensitivity of 81.7% and the specificity of 68.2%. The model demonstrated that respondents from Selangor district of Kuala Langat (AOR = 3.906, $p<0.05$) were 3.906 times more like to exhibit negative behaviour towards varicella vaccination than respondents from Federal territory of Kuala Lumpur. Respondents who were widowed (AOR = 5.481, $p<0.05$) were 5.481 times more likely to exhibit negative behaviour towards varicella vaccination. Respondents with more than 3 children (AOR = 2.197, $p<0.05$) were 2.197 more likely to exhibit negative behaviour towards varicella vaccination. While respondents who possessed at least a tertiary education qualification (AOR = 0.096, $p<0.05$) were associated with a reduction in the likelihood of displaying negative behaviour towards varicella vaccination.

Table 5: Effect of background respondents' characteristics on their behaviour towards varicella vaccination (n = 400)

		95% CI[b] for AOR[c] (Lower - Upper)	***p-value***
Area			

	Federal territory of Kuala Lumpur	1	
	Federal territory of Putrajaya	2.227 (0.650 – 7.630)	0.202
	Selangor district of Petaling	2.091 (0.740 – 5.909)	0.164
	Selangor district of Klang	1.765 (0.630 – 4.950)	0.280
	Selangor district of Gombak	1.490 (0.463 – 4.791)	0.504
	Selangor district of Hulu Langat	1.144 (0.328 – 3.995)	0.833
	Selangor district of Sepang	1.037 (0.328 – 3.276)	0.951
	Selangor district of Kuala Langat	3.906 (1.185 – 12.877)	0.025
Religion			
	Muslim	1	
	Buddhist	1.068 (0.537 – 2.122)	0.852
	Hindu	0.897 (0.328 – 2.455)	0.832
	Sikh	1.255 (0.085 – 18.607)	0.869
	Christian	0.711 (0.249 – 2.024)	0.522
	Others	1.681 (0.500 – 5.657)	0.402
Age (Year)			
	18 – 30	1	
	31 – 43	0.651 (0.321 – 1.318)	0.233
	44 – 55	0.606 (0.266 – 1.380)	0.233
Monthly household income (RM[a])			
	<1000	1	
	1001 – 2500	1.480 (0.108 – 20.248)	0.769
	2501 – 4000	8.274 (0.669 – 102.388)	0.100
	4001 – 6500	9.886 (0.769 – 127.147)	0.079
	≥6500	10.054 (0.768 – 131.610)	0.079

Marital status			
	Married	1	
	Divorced	4.551 (1.695 – 12.219)	0.003
	Widowed	5.481 (1.332 – 22.556)	0.018
Number of children			
	1	1	
	2	1.079 (0.553 – 2.105)	0.824
	≥3	2.197 (1.048 – 4.606)	0.037
Education level			
	No formal	1	
	Primary	2.040 (0.354 – 11.764)	0.425
	Secondary	0.612 (0.097 – 3.851)	0.601
	Tertiary	0.096 (0.014 – 0.663)	0.017
	(Nagelkerke R^2 = 0.383, Percentage Correct = 78.3%)		

[a]: RM; Malaysian currency Ringgit; [b]: Confidence interval; [c]: AOR: adjusted odds ratio.

Discussion

Behaviour of parents on varicella and its vaccination

We found that 11% of the participants would purposely allow their children to be infected of varicella by someone else. As the CDC has pointed out, 'Chickenpox parties' have been an occurring event in the past, whereby parents would participate in these parties to purposefully expose their children, who have not been vaccinated against varicella, to a child who is currently contracting varicella, in the chance of their children would be infected too. Contracting the disease itself could be fatal, compared to getting the vaccine, which is a safer method, considering the vaccine contains only the weakened form of the virus [24]. The CDC has stated that they are fully against such act, and fully recommend that parents not to participate in such events, for the wellbeing of their children. This assessment helps to understand that most parents would not intentionally expose their child to varicella intentionally which abides

to the recommendation of the CDC [25]. 69.3% of the respondents would avoid bringing their children to these places. For example, if there happens to be an 'outbreak' of varicella in a school or day-care, the CDC recommends parents to vaccinate their children for varicella. However, if the parents opt to not vaccinate their children, the CDC urges parents to exclude their children from schools and areas nearby the outbreak for 21 days [26]. It is good to know that the respondents are aware on the risk of infection of varicella towards their children. Even if it is recommended that children should be vaccinated against varicella, it is also best to avoid your children from places with existing varicella cases. The perceive risk of infection helps the respondents to exhibit a positive behaviour towards varicella.

Just over one-thirds of the total respondents had talked to their doctor regarding the varicella vaccination. This data shows certain similarities to a study conducted in Singapore, whereby just under half of its respondents had consulted their doctors and relied information on varicella and its vaccination from them [27]. Contrary, the studies by Vezzosi *et al.* and Tam *et al.* in 2015 showed that 74.2% and 69% of its respondents, respectively had consulted and relied information on varicella and its vaccination from medical practitioners [8, 16]. Over one-third of the respondents would rather have the vaccination made free-of-charge. The finding was supported by the study conducted by Tam *et al.* in 2015 noted that 94.5% of its 2,727 respondents highlighted that they would prefer if the varicella vaccination were administered for free-of-charge [8].

In this current study, as reported, 80.5% respondents were infected by varicella, and 66% did not have vaccinated for varicella. Compared to a study conducted in Hungary between October 2018 and February 2019 showed that, out of 1042 parents as participating respondents, 46.7% (487) have not vaccinated any of their children [28]. While, another study in Sweden revealed that 48% of the respondents' children have been infected with varicella [29].

We found that 69.3% of the respondents would take the initiative to look up more information on the varicella vaccination. The study by Harmsen *et al.* showed that 45.8% of their respondents, who were parents, would search for extra information regarding the healthcare of their children. The main information that was searched for were the vaccines available and childhood diseases [30]. Moreover, 70% of the respondents would share the information. Through sharing information, parents are likely to express any concerns that they may have, as well as have brainstorming sessions to find ways to overcome such concerns [31]. We found that over 40% of the respondents had vaccinated their children against chickenpox. This result can be reflected to the study by other study whereby just under 40% of its

respondents reported that they had vaccinated their child against varicella, prior to undertaking the survey [16].

Association between parental education level and knowledge level on varicella and its vaccination

It was found that education level of respondents was identified as one of the strongest predictors, with tertiary education being noted as dominant factor for the reduction in the likelihood of exhibiting negative behaviour towards varicella vaccination. Hence, parents' education level could very well be a detrimental factor of knowledge, attitudes, and practices they possessed towards a particular disease, in this case, varicella. A Caribbean study reported that the level of education could be a key determinant of knowledge, attitudes, and practices on dengue [32]. Participants with higher level of education exhibited higher knowledge in relation to the disease dengue. Moreover, multiple studies done were done on the association between education level and knowledge level [33, 34].

Association between demographic backgrounds of respondents and varicella vaccination

We found that low education of parents, low household income, marital status of parents, and higher number of children was associated with negative behaviour towards varicella vaccination. Other study found that women with low-income experience depression more frequently, which was identified as a determining factor of inadequate care [35]. Thus, it might partially explain the reason on marital status association with behaviour towards varicella vaccination. It is probable that divorced women might have an increased chance of experiencing depression.

Compared to other districts, parents from Selangor district of Kuala Langat were noted to have the likelihood of higher times to exhibit negative parental behaviour towards varicella vaccination compared to Federal Territory of Kuala Lumpur. According to the Department of Statistics Malaysia, Kuala Langat are one of the districts that spent the least in health aspect. Residents in Kuala Langat only used 1.8% from their monthly household income for health expenses [36]. Conversely, emphasis was placed more on transportation and basic necessities (housing, electricity, water and fuel). Besides that, Kuala Langat was also recorded with the lowest monthly household consumption expenditure [36].

Attitudes towards varicella and vaccination

Despite the higher score of median value for positive parental behaviour among most of the statements, the statement 'Varicella is not a common childhood disease.' showed that negative parental behaviour has a high score in median value (3) compared to positive parental behaviour (2). This disparity may be due to the positive phrasing of the statement that resulted in the misunderstanding for respondents. It was most probable that respondents interpreted the meaning as varicella is not commonly seen in child, thus resulting in most of them rated neutral to disagree.

Even with the lack of implementation of varicella vaccine in Malaysia National Immunisation Programme (NIP)[37], there's a reasonable amount of parental awareness towards varicella vaccine. Nevertheless, it's also an indication of parental support on the inclusion of varicella vaccine in Malaysia National Immunisation Programme (NIP), which was supported by another study [20].

Positive parental perception towards varicella vaccine is associated with positive parental behaviour towards varicella vaccine. Similar result was noted between parental perception and parental knowledge level in our study. According to Fabrigar *et al.* (2006), at least one dimension of knowledge is responsible for the underlying of attitude directly relevant to the goal of a behaviour, and it is likely that there would typically be a positive association between complexity of knowledge and attitude-behaviour consistency [38]. Tam *et al.* (2015) in Hong Kong has a similar finding that showed better perceived knowledge of varicella is associated with vaccination [8]. Similar result was found in another study regarding cardiovascular disease, Yahya *et al.* (2012) from USM (Universiti Sains Malaysia) noted there were significant association between attitude and knowledge, with increase knowledge level motivates the respondents to adjust their attitude positively [39]. They also noted there's a significant association between positive attitude toward cardiovascular prevention and healthy behaviour [39]. The relationship between attitude and knowledge level is not only found in cardiovascular disease but also in varicella as well.

Limitation

It should be bear in mind that this study utilized non-probability sampling technique due to the physical restriction imposed during the pandemic, so the results might not be representative to its targeted population. Moreover, the demographic background and vaccination status were collected virtually using the questionnaires, therefore it was solely dependent on the honesty and recollection of respondents; clearly more research is required regarding this area.

Conclusion

Our findings have shown that there is a substantial need to increase the awareness of varicella, specifically on the modes of transmission and the serious complications that can arise from its infection among parents, and particularly, single parents. Educational campaigns are important to disseminate and increase the awareness of varicella among the public, as the best prevention. As healthcare providers are the most reliable source of information on vaccination for parents, their role in providing information to parents on the benefits of the varicella vaccination is vital, in turn this may influence a positive behaviour towards varicella and its vaccination. Subsequently, leading to an increased immunisation rates towards varicella.

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Declaration of Conflicting Interests

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References

1. Pergam SA, Limaye AP, Practice ASTIDCo. Varicella zoster virus (VZV) in solid organ transplant recipients. Am J Transplant. 2009;9 Suppl 4(Suppl 4):S108-S15.
2. Wharton M. THE EPIDEMIOLOGY OF VARICELLA-ZOSTER VIRUS INFECTIONS. Infectious Disease Clinics of North America. 1996;10(3):571-81.
3. Bialek SR, Perella D, Zhang J, Mascola L, Viner K, Jackson C, et al. Impact of a Routine Two-Dose Varicella Vaccination Program on Varicella Epidemiology. Pediatrics. 2013;132(5):e1134-e40.
4. Civen R, Lopez AS, Zhang J, Garcia-Herrera J, Schmid DS, Chaves SS, Mascola L. Varicella Outbreak Epidemiology in an Active Surveillance Site, 1995–2005. The Journal of Infectious Diseases. 2008;197(Supplement_2):S114-S9.
5. Leung J, Marin M. Update on trends in varicella mortality during the varicella vaccine era-United States, 1990-2016. Hum Vaccin Immunother. 2018;14(10):2460-3.

6. Varicella vaccines. WHO position paper. Wkly Epidemiol Rec. 1998;73(32):241-8.
7. Cheng H-Y, Chang L-Y, Lu C-Y, Huang L-M. Epidemiology of Breakthrough Varicella after the Implementation of a Universal Varicella Vaccination Program in Taiwan, 2004–2014. Scientific Reports. 2018;8(1):17192.
8. Tam WWS, Chan J, Lo KKH, Lee A, Chan PKS, Chan D, Nelson EAS. Parental Attitudes and Factors Associated With Varicella Vaccination in Preschool and Schoolchildren in Hong Kong: A Cross-Sectional Study. Medicine. 2015;94(36):e1519.
9. Chan Y-WD, Edmunds WJ, Chan H-L, Wong M-L, Au K-WA, Chuang S-K, et al. Varicella vaccine dose depended effectiveness and waning among preschool children in Hong Kong. Human Vaccines & Immunotherapeutics. 2020;16(3):499-505.
10. Chang L-Y, Huang L-M, Chang IS, Tsai F-Y. Epidemiological characteristics of varicella from 2000 to 2008 and the impact of nationwide immunization in Taiwan. BMC Infectious Diseases. 2011;11(1):352.
11. Tang C-W, Huang S-H, Weng K-P, Ger L-P, Hsieh K-S. Parents' Views About the Vaccination Program in Taiwan. Pediatrics & Neonatology. 2011;52(2):98-102.
12. Leung J, Bialek SR, Marin M. Trends in varicella mortality in the United States: Data from vital statistics and the national surveillance system. Hum Vaccin Immunother. 2015;11(3):662-8.
13. Bozzola E, Spina G, Russo R, Bozzola M, Corsello G, Villani A. Mandatory vaccinations in European countries, undocumented information, false news and the impact on vaccination uptake: the position of the Italian pediatric society. Ital J Pediatr. 2018;44(1):67.
14. Hu Y, Chen Y, Wang Y, Liang H. Knowledge, Attitude and Practice of Pregnant Women towards Varicella and Their Children's Varicella Vaccination: Evidence from Three Distrcits in Zhejiang Province, China. Int J Environ Res Public Health. 2017;14(10):1110.
15. Alnema A, Alhuwais S, Danbouh H, Albannai R, Alrumaidhi NB, Alenezi A, et al. Knowledge and awareness about chickenpox vaccine among parents with children under the age of 5 years in Kuwait health centers in 2014. International Journal of Medical Science and Public Health. 2017;6:1.
16. Vezzosi L, Santagati G, Angelillo IF. Knowledge, attitudes, and behaviors of parents towards varicella and its vaccination. BMC Infectious Diseases. 2017;17(1):172.
17. Taylor JA, Newman RD. Parental attitudes toward varicella vaccination. The Puget Sound Pediatric Research Network. Arch Pediatr Adolesc Med. 2000;154(3):302-6.

18. Hariraj V. Allopurinol: An Update on Usage in the Ministry of Health Facilities and Related Adverse Cutaneous Drug Reactions. Malaysian Adverse Drug Reactions Newsletter. 2012.

19. Kusnin F, editor Immunisation Programme in Malaysia. Vaccinology 2017-III International Symposium for Asia Pacific Experts; 2017; Hanoi, Vietnam.

20. Hesham R, Cheong JY, Hasni JM. Knowledge, attitude and vaccination status of varicella among students of Universiti Kebangsaan Malaysia (UKM). Med J Malaysia. 2009;64(2):118-23.

21. Daniel WWCCL. Biostatistics : a foundation for analysis in the health sciences2019.

22. Naing L, Winn T, editors. Practical Issues in Calculating the Sample Size for Prevalence Studies2006.

23. Agresti A, Kateri M. Categorical Data Analysis. In: Lovric M, editor. International Encyclopedia of Statistical Science. Berlin, Heidelberg: Springer Berlin Heidelberg; 2011. p. 206-8.

24. Adverse Effects of Vaccines: Evidence and Causality. Stratton K, Ford A, Rusch E, Clayton EW, editors. Washington, DC: The National Academies Press; 2012. 894 p.

25. Chickenpox (Varicella) Transmission: Centers for Disease Control and Prevention.; April 28, 2021 [Available from: https://www.cdc.gov/chickenpox/about/transmission.html.

26. Adriana S Lopez MaMM, MD. Strategies for the Control and Investigation of Varicella Outbreaks Manual, 2008. 2008.

27. Ho EW, Ereno IL, Ibrahim M, Yeo CL. Knowledge, Attitudes, and Practices regarding Chickenpox Disease and its Prevention in Singapore: Comparison between Parents and Medical Students. Proceedings of Singapore Healthcare. 2012;21(4):257-64.

28. Huber A, Gazder J, Dobay O, Mészner Z, Horváth A. Attitudes towards varicella vaccination in parents and paediatric healthcare providers in Hungary. Vaccine. 2020;38(33):5249-55.

29. Arnheim-Dahlström L, Zarabi N, Hagen K, Bencina G. Parental acceptance and knowledge of varicella vaccination in relation to socioeconomics in Sweden: A cross-sectional study. PLOS ONE. 2021;16(10):e0256642.

30. Harmsen IA, Doorman GG, Mollema L, Ruiter RAC, Kok G, de Melker HE. Parental information-seeking behaviour in childhood vaccinations. BMC Public Health. 2013;13(1):1219.

31. El Nokali NE, Bachman HJ, Votruba-Drzal E. Parent involvement and children's academic and social development in elementary school. Child Dev. 2010;81(3):988-1005.

32. Diaz-Quijano FA, Martínez-Vega RA, Rodriguez-Morales AJ, Rojas-Calero RA, Luna-González ML, Díaz-Quijano RG. Association between the level of education and knowledge, attitudes and practices regarding dengue in the Caribbean region of Colombia. BMC Public Health. 2018;18(1):143.

33. Nugroho PS, Wiarisa H, Wulandari M. EDUCATION LEVEL AND KNOWLEDGE LEVEL IN OPEN DEFECATION BEHAVIOR. Journal of Research in Public Health Sciences. 2019;1(2).

34. Sani A, Naab F, Aziato L. Influence of educational level on knowledge and practice of breast self-examination among women in Sokoto, Nigeria. Journal of Basic and Clinical Reproductive Sciences. 2016;5:100.

35. Tertuliano GC, Stein AT. Atraso vacinal e seus determinantes: um estudo em localidade atendida pela Estratégia Saúde da Família. Ciencia & Saude Coletiva. 2011;16:523-30.

36. Household Consumption Expenditure 2019: Department of Statistics Malaysia; July 10, 2020 [Available from: https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=323&bul_id=c3JpRzRqeTNPamMxL1FpTkNBNUVBQT09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09.

37. Immunisation Schedule for National Immunisation Program, Ministry of Health Malaysia: Ministry of Health Malaysia; March 1, 2022 [Available from: http://www.myhealth.gov.my/en/immunisation-schedule/.

38. Fabrigar LR, Petty RE, Smith SM, Crites SL. Understanding knowledge effects on attitude-behavior consistency: the role of relevance, complexity, and amount of knowledge. Journal of personality and social psychology. 2006;90 4:556-77.

39. Yahya R, Muhamad R, Yusoff H. Association between Knowledge, Attitude and Practice on Cardiovascular Disease among Women in Kelantan, Malaysia. International Journal of Collaborative Research on Internal Medicine and Public Health. 2012;4:1507-23.