



Factors Influencing Childhood Vaccine Refusal in Parents in Southern Malaysia and Its Effect on Health: A Cross-sectional Study

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Abstract

Background: Recent increases in the number of communicable disease cases in Malaysia have caused significant concern, particularly as vaccine hesitancy remains a significant challenge. This study aimed to explore parents' knowledge, perceptions, and factors associated with childhood vaccine refusal to have better understanding about vaccine hesitancy. **Method:** This study utilized an online cross-sectional questionnaire distributed via snowball sampling to parents in Melaka and Johor. 369 respondents completed the survey. **Result:** The results showed significant differences between religion against parents' perceptions and knowledge ($p < 0.001$ and $p = 0.015$) and between parents' knowledge and perception and vaccine refusal factors ($p < 0.001$, both). Other than that, there are significant association between education level and parent's perception regarding vaccine. The positive perception surrounding vaccine is the major cause of vaccine refusal which contradict with previous study. **Conclusion:** The study's conclusion was that parental perception in the South region of Malaysia is affected by religious restrictions and education level,

while parents' perception about vaccines is more likely to cause vaccine refusal in children. Therefore, it is essential to educate parents about the efficacy of vaccines in protecting their children and to address concerns related to religious beliefs. Overall, this study sheds light on the important role that education and awareness play in overcoming vaccine hesitancy in Malaysia. By understanding parents' knowledge and perceptions, public health officials can develop targeted interventions to increase vaccine uptake and improve the overall health of the population.

Keywords: Parent's perception; vaccination; immunization; Melaka; Johor

Introduction

Vaccination has shown the effectiveness in preventing and minimizing the symptoms of diseases. It has played a pivotal role in mitigating the spread of communicable diseases worldwide (WHO, 2021). In Malaysia, like many other countries, a robust national immunization program has been established, offering a comprehensive schedule of childhood vaccinations against various infectious diseases such as measles, rubella, diphtheria, tetanus, whooping cough, and many more to occur.

However, in 2019, there has been an upsurge in the number of measles death and reported cases of pertussis among unvaccinated children in Malaysia. (Meng, 2020). The Ministry of health stated

Significance | This study sheds light on the important role that education and awareness play in overcoming vaccine hesitancy in Malaysia.

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Editor Atiqur Rahman Sunny And accepted by the Editorial Board Feb 22, 2024 (received for review Jan 1, 2024)

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Please cite this article.

Sakina Ruhi, Adlina Abdullatif, Jegathambigai R. Naidu et al., (2024). Factors Influencing Childhood Vaccine Refusal in Parents in Southern Malaysia and Its Effect on Health: A Cross-sectional Study, *Journal of Angiotherapy*, 8(2), 1-9, 9475

that there are 2% of children are not vaccinated in 2019, which might lead to increase of spread of illnesses such as measles, pertussis, and diphtheria. there are few communities that were refused to vaccinate their children. They have a negative perception about vaccine which cause hesitancy among parents to give vaccine to their children as they thought that vaccine contain harmful substance which can cause harm to their children. There are also peoples that spread negative messages about vaccination through social media. These are one of the factors which cause refusal towards children vaccination. In previous study, founded that the regions of Malaysia Ibrahim, S.,et al 2021, have associated factors such as restriction in the religion which influence the negative perception to the parents (Ruhi et al., 2021). Hence, in this study, these problems should be explored through this study, in order to understand of what make people thinking that way and the same time helps to educate the public regarding vaccination specifically in southern (Melaka and Johor) Malaysia. Abdullah, A.et al (2023). By elucidating the determinants of vaccine hesitancy among parents in southern Malaysia, this study seeks to provide insights that can inform targeted public health interventions and strategies to address vaccine refusal. Ultimately, enhancing vaccine acceptance and uptake rates is crucial for safeguarding the health and well-being of children and communities across Malaysia.

The importance of vaccination cannot be overstated, especially in the context of preventing the spread of infectious diseases. Vaccines have been instrumental in eradicating or significantly reducing the burden of diseases such as polio, measles, and smallpox. They not only protect individuals who receive them but also contribute to herd immunity, thereby safeguarding those who cannot be vaccinated, such as infants, the elderly, and individuals with certain medical conditions.

However, despite the overwhelming evidence supporting the safety and efficacy of vaccines, vaccine hesitancy has emerged as a significant public health challenge in recent years. Vaccine hesitancy refers to the delay in acceptance or refusal of vaccination despite the availability of vaccination services. It is influenced by factors such as complacency, convenience, and confidence in vaccines and healthcare systems.

In Malaysia, vaccine hesitancy has become a growing concern, particularly in certain regions such as Southern Malaysia. Studies have shown that vaccine refusal rates are higher in these areas compared to other parts of the country. This phenomenon can have serious consequences for public health, as low vaccination rates can lead to outbreaks of vaccine-preventable diseases.

To address vaccine hesitancy in Malaysia, targeted interventions are needed to address the specific concerns and beliefs of parents in Southern Malaysia. This requires collaboration between healthcare providers, community leaders, and religious organizations to provide accurate information and address misconceptions about

vaccines. Additionally, efforts should be made to improve access to vaccination services and ensure that parents have access to reliable information about the safety and efficacy of vaccines.

Materials & Methods

Study Design:

This is a cross-sectional study research that determines the perception of the public about vaccination and to understand the associated factors of refusal of vaccines in children of Melaka and Johor. A questionnaire-based survey was used.

Sampling:

The sample size needed is 385 respondents. Sample size was calculated with Daniel sample size formula. The calculated level of precision is 95% level of confidence interval and taking 5% for non-response then the final sample size was calculated. Informed consent was obtained from each participant before they answered the questionnaires.

sample size was calculated.

$$n = (Z^2)p(1 - p) / d^2$$

n = sample size

Z = standard value of confidence interval = 1.96

p = estimated prevalence in project area = 0.5

d = desired precision level = 0.05

$$n = [(1.962)^2 \cdot 0.5 \cdot (1 - 0.5)] / 0.05^2$$

n = 385 respondents

Sample Population:

A married couple with children under 18 years old, living in Melaka or Johor, was selected for their geographic diversity, dense population, varied access to healthcare, and diverse cultural backgrounds. These factors offer insights into regional variations in vaccine hesitancy and access to immunization services. While practical considerations and accessibility may have influenced the choice, it's essential to recognize that vaccine perceptions may differ across Malaysia, underscoring the need for broader research coverage nationwide.

Inclusion criteria:

Respondents were residents in Melaka, married, and had children. The respondents were from different races, age groups, and work classifications.

Exclusion criteria:

Respondents who were unmarried and married couples without children were excluded from this research. Respondents who live outside Melaka were also excluded.

Study Questionnaire:

The questionnaires were adapted from two previous studies (Opel, D. J., 2013; Zingg, A., 2012). The questionnaire had four sections, namely:

Part A: Socio-demographic form (11 items). The form is divided into sections, and questions include features such as age, gender,

religion, race, education level, marital status, number of children, working sector, and income.

Part B: Knowledge about vaccination among parents (11 items). This section contains 11 questions to measure parents' knowledge about vaccines/immunization.

Part C: Perception regarding vaccination among parents (10 items). This section contains 10 questions to understand parents' perceptions regarding vaccination.

Part D: Factors leading to refusal of vaccination (1 item). This section contains questions about factors associated with the refusal of vaccination towards children.

Explaining how we changed the questionnaires from past studies to fit Malaysia's situation is important. It helps people understand how we did the research and makes sure it matches how healthcare works here and how Malaysians feel about vaccines. This makes the study more reliable and useful for Malaysians.

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) statistical software version 27.0, and a value of $p < 0.05$ was considered statistically significant. Descriptive statistics (frequency, percentage) were used to describe socio-demographic factors such as gender, religion, education, and number of children. Using chi-squared analysis, we compared the sociodemographic data with parent's knowledge regarding vaccination. Knowledge was categorized: answered > 5 = positive, answered < 5 = negative. Fisher exact test was performed on 4 selected sociodemographic factors for comparison, with the p -value < 0.05 to be considered as statistically significant.

Result

Sociodemographic Data of Studied Population

In this study, we got 369 completed questionnaires, and everyone who got one filled it out. Most of the people who answered were women (201, which is 54.5%); 162 (43.9%) were men, and 6 (1.6%) preferred not to say. About 82.9% (306 people) of everyone who answered were Muslim, which was the most. Then, 4.9% (18 people) were Christian or Hindu, 4.1% (15 people) were Buddhist, and 3.3% (12 people) were from atheist/agnostic. When it comes to education, most of the people who answered had a bachelor's degree (34.1%, which is 126 people), followed by 30.1% (111 people) with a diploma, and 27.6% (102 people) with SPM/O-Levels. 4.9% (18 people) had a master's degree, and the remaining 3.3% (12 people) had a PhD. 31.2% (115 people) of everyone who answered had 2 children, 29% (107 people) had 1 child, 18.7% (69 people) had 3 children, 14.6% (54 people) had 4 children, 5.7% (21 people) had 5 children, and 0.8% (3 people) had more than 5 children. All these details about the parents are shown in Table 4.1.1.

Knowledge Regarding Vaccination Among Parents

Most parents (54.5%, $n=201$) had good (score > 5) knowledge regarding vaccination (Table 2). While 45.5% ($n=168$) parents had poor (score < 5) knowledge regarding vaccination with a total difference of only 33 parents (table 4.2.1). According to table 4.2.2, from 201 of total parents with good knowledge regarding vaccine, 106 (52.7%) of them were female, 92 (45.8%) were male, and 3 (1.5%) were prefer not to say. Same thing goes to parents with poor knowledge regarding vaccination where female ($n=95$, 56.5%) is the highest respondent followed by male ($n=70$, 41.7%) and prefer not to say ($n=3$, 1.8%). Figure 1 showing the percentage value.

The frequency of parents with good knowledge was higher among Muslim parents ($n=177$, 88.1%), followed by atheist/agnostic ($n=12$, 6%), Christianity ($n=6$, 3%), and an equal number of respondents from Buddhism and Hinduism ($n=3$, 1.5%). There is a huge difference between Muslim respondents and those of other beliefs due to the majority distribution of the questionnaire among Muslims. Religion was significantly associated with parents' knowledge regarding vaccines ($p < 0.001$). This explains that a certain religious group does affect the knowledge level of parents regarding vaccines. Other sociodemographic factors of parents were not significantly associated with parents' knowledge regarding vaccines (Table 1). Figure 2 shows the percentage values.

According to educational level, respondents with a bachelor's degree ($n=66$, 32.8%) were found to have the highest level of knowledge regarding vaccination. They were followed by parents with SPM/O-levels ($n=63$, 31.3%), parents with a diploma ($n=54$, 26.9%), parents with a master's degree ($n=12$, 6%), and lastly, parents with a PhD ($n=6$, 3%). However, parents with poor knowledge regarding vaccination also included those with a bachelor's degree ($n=60$, 35.7%), followed by parents with a diploma ($n=57$, 33.9%), parents with SPM/O-levels ($n=39$, 23.2%), and those with a master's degree and PhD, each with an identical value of 6 (3.6%). Figure 3 shows the percentage values.

In terms of the number of children, parents with 2 children are the highest respondents with a count of 73 (36.3%) for having good knowledge regarding vaccination. They are followed by parents with 1 child, with a count of 53 (26.4%), then parents with 3 children, with a count of 35 (17.4%), parents with 4 children, with a count of 29 (14.4%), and lastly, parents with 5 children, with a count of 11 (5.5%). Parents who have more than 5 children had zero (0%) count of good knowledge regarding vaccination. Figure 4 shows the percentage values.

Perception Regarding Vaccination Among Parents

Among 369 parents, 82.1% ($n=303$) of them had a positive perception regarding vaccination, while 17.9% ($n=66$) of them had a negative perception regarding vaccination (table 4.3.1). Amidst the parents with a positive perception, 161 of them were female, 136 were male, and 6 preferred not to say. Based on religion, Muslims ($n=249$, 82.2%) were the highest respondents with a good

Table 1. Frequency of Socio-demographic Data of Total Respondents

Sociodemographic	Frequency	
	n	%
Gender		
Female	20	54.
Male	1	5
Prefer not to say	16	43.
	2	9
	6	1.6
Religion		
Islam	30	82.
Buddhism	6	9
Christianity	15	4.1
Hindu	18	4.9
Atheist/agnostic	18	4.9
	12	3.3
Education level		
SPM/O – levels	10	27.
Diploma Bachelor’s degree	2	6
Master’s degree	11	30.
PhD	1	1
	12	34.
	6	1
	18	4.9
	12	3.3
Numbers of children		
1	10	29.
2	7	0
3	11	31.
4	5	2
5	69	18.
More than 5		7
	54	14.
		6
	21	5.7
	3	0.8

Note. Using frequency analysis.

Table 2. Frequency of Parents knowledge regarding vaccination.

Knowledge regarding vaccine	Frequency (n)	Percentage (%)
Good	201	54.5
Poor	168	45.5

Note. Using frequency analysis, we analyse the parent’s knowledge regarding vaccine of total respondent.

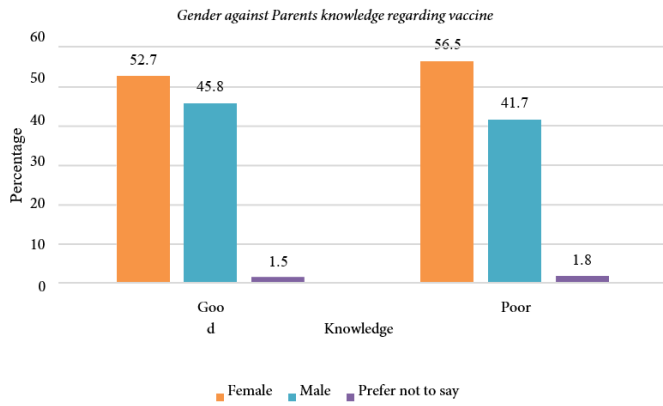


Figure 1. associations between gender and parent’s knowledge regarding vaccine.

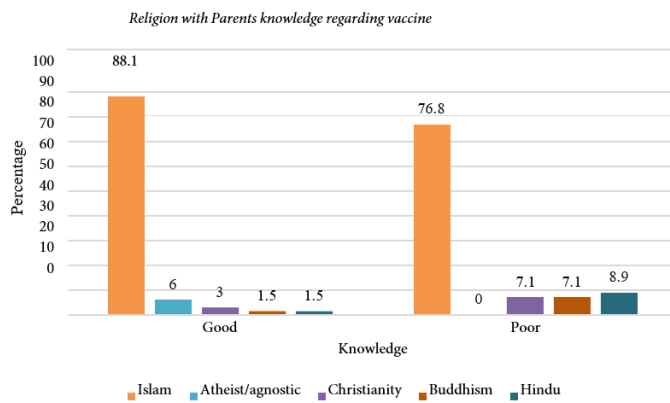


Figure 2. associations between religion and parent’s knowledge regarding vaccine.

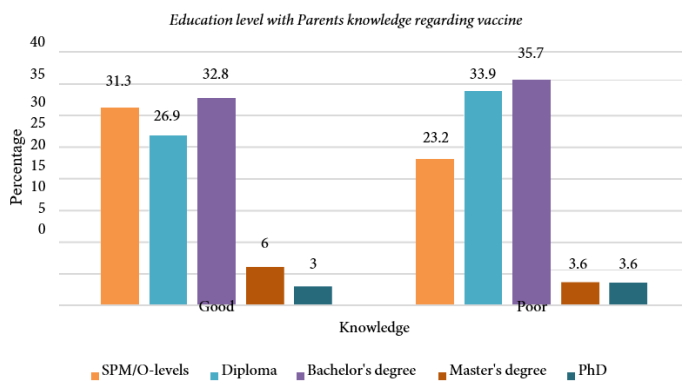


Figure 3. associations between education level and parent’s knowledge regarding vaccine.

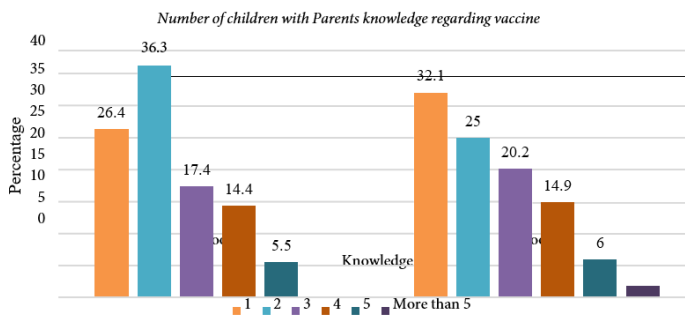


Figure 4. Associations between number of children and parent’s knowledge regarding vaccine.

perception regarding the vaccine, showing an apparent difference from other religions. Parents with a bachelor's degree (n=99, 32.7%) were the highest respondents, followed by Diploma and SPM/O-levels (n=87, 28.7%) with a small difference of only 12 respondents. There was no significant difference between parents' perception regarding vaccination pertaining to gender and the number of children. However, there was a significant difference between parents' perception and their religion and education level ($P = 0.015$ and $P=0.041$ respectively). (See table 4.3.3)

Factors Refusal of Vaccine Among Parents and Knowledge and Perception Regarding Vaccination Among Parents

In this study, negative perception surrounding vaccines was the most commonly selected factor causing refusal of vaccines among parents, with 43.9% (n=162) of the total respondents. Additionally, 39% (n=144) of parents selected long-term side effects as the reason for refusing vaccines, followed by concerns about pork-based ingredients (n=126, 34.1%), difficulty in following vaccine schedules (n=96, 26%), belief that vaccines are unnecessary (n=72, 19.5%), and preference for natural interventions (n=60, 16.3%). (See Table 4.4.1).

Based on table 4.4.2, there was a significant difference in parents' knowledge regarding vaccines with factors refusing vaccines and parents' perception regarding vaccines with factors refusing vaccines ($p<0.001$ and $p<0.001$ respectively). Poor knowledge of vaccines might be associated with factors refusing vaccines. In contrast, a positive perception regarding vaccines could also be associated with factors refusing vaccines.

Discussion

Sociodemographic Factors

This study was conducted to explore the relationship between sociodemographic factors and parents' knowledge and perceptions regarding vaccines in the southern regions of Malaysia, particularly in Melaka and Johor. Additionally, it sought to investigate how this knowledge and perception correlated with the factors influencing parents' refusal of vaccines. Furthermore, the study aimed to identify any new factors associated with vaccine refusal among parents.

The study findings revealed that the majority of respondents were female, Malay, and Muslim. The distribution of questionnaires using the snowball method likely contributed to the bias observed among female, Malay, and Muslim respondents. It was noted that fewer males were inclined to participate in the study, with most contributions coming from close friends and relatives who met the questionnaire criteria.

Among the respondents, those with a bachelor's degree and parents with 2 children were the most represented groups. These findings shed light on the demographics and preferences of the participants,

providing valuable insights into the factors influencing vaccine knowledge, perception, and refusal among parents in the region.

Knowledge Regarding Vaccination Among Parents

In our analysis of parents' knowledge regarding vaccination, the majority had good knowledge about vaccines. Females were found to have poorer knowledge compared to males, whereas males tended to have better knowledge rather than poor knowledge regarding vaccines. This finding contradicted a previous study where females were expected to have better knowledge than males (T. M. F, et al., 2023).

In terms of sociodemographic factors, religion showed a significant difference in parents' knowledge regarding vaccines. The chi-square test revealed that Muslims were the highest respondents with good knowledge regarding vaccines. However, it's worth noting that Muslims with poor knowledge regarding vaccination also constituted a significant portion compared to other religious groups. This result could be attributed to the disproportionate distribution of questionnaires, where the majority of respondents were Muslims.

Other sociodemographic factors such as gender, educational level, and source of income did not show statistically significant associations with parents' knowledge regarding vaccines.

Factors Refusal of Vaccine Among Parents

In this study, it was significant to find that parents with poor knowledge regarding vaccines had a higher tendency to choose 'there is negative perception surrounding vaccines' as the associated factor causing vaccine refusal among parents. This was followed by 'vaccines contain porcine/pork-based ingredients, which are prohibited in my faith', and 'my child is healthy, he/she doesn't need any injections. Only sick individuals need vaccines.' Surprisingly, parents with good knowledge are also influenced by factors contributing to vaccine refusal among parents, such as side effects, time restrictions, and a preference for natural interventions. This finding might be due to parents having good knowledge regarding vaccines; however, they might have low awareness regarding vaccines, making them easily influenced by factors leading to vaccine refusal.

Perception Regarding Vaccine Among Parents

In this study, the majority of parents had a positive perception regarding vaccines. Among all 303 parents with a positive perception, 161 were female, 136 were male, and 6 preferred not to say. Similarly, like parents' knowledge regarding vaccines, females constituted the highest respondents among perceptions regarding vaccines among parents.

In terms of sociodemographic factors influencing parents' perception regarding vaccines, there was a significant difference between religion and parents' perception, with Muslims having the highest positive perception compared to other belief groups. The number of Muslim respondents with a negative perception was only

57. This shows that certain religious groups do influence parents' perception regarding vaccines. According to a previous study, these perceptions are influenced by various reasons and factors (Cooper S., et al., 2021; Rahim, N. A., et al., 2022).

Moreover, educational level was also statistically significant regarding parents' perception regarding vaccines, with bachelor's degree holders being the highest respondents. This indicates that the higher the educational level, the better the perception regarding vaccines among parents. There is a previous study that aligns with this statement as well (Liu Y. et al., 2022). Parents with low educational levels can be influenced in their perception and hesitancy to vaccinate their children (T. M. F., et al., 2023; Kyprianidou M., et al., 2021; Anjum Q., et al., 2004). Previous studies stated that higher education allows for a better understanding of vaccination.

better knowledge and the opportunity to understand more about childhood vaccines have been highlighted in previous studies (Krishna D., et al., 2019; Matta P., et al., 2020). Gender and the number of children are not significant factors in parents' perception regarding vaccines, which contradicts a previous study (T. M. F. et al., 2023).

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On the other hand, it is significantly proven that parents with a positive perception show a higher frequency associated with factors refusing vaccines, while a negative perception of vaccines does not really affect it. This might be because parents with a negative perception do not really care about the factors, while parents with a positive perception might seek knowledge regarding vaccines and encounter many outside rumors regarding vaccines. Especially, for those parents who have encountered recent negative issues with the COVID-19 vaccine due to fear of side effects, safety and effectiveness concerns, social media misinformation, distrust in health authorities, and conspiracy theories (De Albuquerque V. M., et al., 2021).

Potential Limitations

The study's discoveries emphasize how sociodemographic factors affect parental attitudes toward vaccination in southern Malaysia, particularly in Melaka and Johor. Understanding these factors is crucial for creating effective strategies to address vaccine hesitancy and increase vaccination rates among children.

There are potential limitations in the study, including biases from the snowball sampling method and reliance on self-reported data. These biases might lead to social desirability and recall errors, which could affect the accuracy of the findings. Moreover, the study's cross-sectional design limits its ability to establish causal relationships between sociodemographic factors and parental attitudes toward vaccination.

Study's Impact

Religious beliefs, especially Islam, strongly influence parents' understanding and opinions about vaccines. Collaborating with religious leaders is vital to share accurate information and dispel misconceptions about vaccination. Similarly, educational levels influence how parents perceive vaccines, underscoring the importance of education in shaping attitudes toward vaccination. Tailored campaigns aimed at parents with lower educational backgrounds could help correct misinformation and increase acceptance of vaccines.

Conclusion

In conclusion, this study highlights the influence of religion and education on parents' views about vaccination. Religious leaders and educators, including university scholars, play key roles in informing parents and improving awareness about vaccines. Future studies should aim for more balanced representation across different demographics to ensure accurate results. To address vaccine hesitancy in Malaysia, targeted interventions like community education, collaboration with religious figures, and culturally sensitive messaging are crucial. Additionally, future research should employ diverse sampling methods, objective measures, and longitudinal designs to enhance understanding and effectiveness.

Author contribution

S.R. prepared the draft; D. prepared the abstract; H. prepared introduction; J. prepared methodology; A. prepared results; T.T. prepared conclusion; S. prepared scope of the study; A.S. wrote, reviewed, and edited; H. supervised; M.M. validated and analysed data. All authors have read and agreed to the published version of the manuscript.

Acknowledgment

The authors were grateful to the participants who contributed to this study.

Competing financial interests

The authors have no conflict of interest.

References

Abdullah, A. (2023). Vaccine Hesitancy Among Parents in Johor Bahru: A Qualitative Study. *Journal of Public Health and Epidemiology*, 15(2), 45-52.

Ahmed, A., Lee, K. S., Bukhsh, A., Al-Worafi, Y. M., Sarker, M. M. R., Ming, L. C., & Khan, T. M. (2018). Outbreak of vaccine-preventable diseases in Muslim majority countries. *Journal of infection and public health*, 11(2), 153–155. <https://doi.org/10.1016/j.jiph.2017.09.007>

Anjum, Q., Omair, A., Inam, S. N., Ahmed, Y., Usman, Y., & Shaikh, S. (2004). Improving vaccination status of children under five through health education. *JPMA. The Journal of the Pakistan Medical Association*, 54(12), 610– 613

Awadh, A. I., Hassali, M. A., Al-Iela, O. Q., Bux, S. H., Elkalmi, R. M., & Hadi, H. (2014). ¿Una intervención educativa mejora el conocimiento de los padres sobre la inmunización? Experiencia de Malasia. *BMC Pediatrics*, 14(1), 1–7. Retrieved from <https://bmcpediatr.biomedcentral.com/track/pdf/10.1186/1471-2431-14-254>

Birmingham, W.C.; Macintosh, J.L.B.; Vaughn, A.A.; Graff, T.C. (2019). Strength of Belief: Religious Commitment, Knowledge, and HPV Vaccination Adherence. *Psychooncology*, 28(1227–1233).

Centers for Disease Control and Prevention. (2021, September 1). Immunization Basics | CDC. Retrieved October 20, 2022, from <https://www.cdc.gov/vaccines/gen/imzbasics.htm>

Chaudhary, N., Weissman, D., & Whitehead, K. A. (2021). mRNA vaccines for infectious diseases: principles, delivery and clinical translation. *Nature Reviews Drug Discovery*, 20(11), 817–838. <https://doi.org/10.1038/s41573-021-00283-5>

Coast Peninsular Malaysia. *Malaysian Journal of Medicine and Health Sciences*, 17(1), 2636–9346.

Cooper, S., Schmidt, B.-M., Sambala, E. Z., Swartz, A., Colvin, C. J., Leon, N., & Wiysonge, C. S. (2021). Factors that influence parents' and informal caregivers' views and practices regarding routine childhood vaccination: a qualitative evidence synthesis. <https://doi.org/10.1002/14651858.CD013265.pub2>

Creighton, A. R. (2016). Gaba Binggi (Good Needles): Developing an understanding of how two Aboriginal communities see and experience immunisation during pregnancy (Doctoral dissertation).

De Albuquerque Veloso Machado, M., Roberts, B., Wong, B. L. H., van Kessel, R., & Mossialos, E. (2021). The relationship between the COVID-19 pandemic and vaccine hesitancy: a scoping review of literature until August 2021. *Frontiers in public health*, 9

Elkalmi, R. M., Dyab, E., Suhaimi, A. M., Blebil, A. Q., Elnaem, M. H., Jamshed, S., & Gajdács, M. (2021). Attitude, familiarity and religious beliefs about vaccination among health science and non-health science students in a Malaysian public university. *European Journal of Investigation in Health, Psychology and Education*, 11(4), 1462–1473. <https://doi.org/10.3390/ejihpe11040104>

Frenkel, L. D. (2021, September). The global burden of vaccine-preventable infectious diseases in children less than 5 years of age: Implications for COVID-19

vaccination. How can we do better?. In *Allergy and Asthma Proceedings* (Vol. 42, No. 5, pp. 378-385). OceanSide Publications, Inc.

Health Security Agency, U. (2022). Vaccines and porcine gelatine. Retrieved from www.healthpublications.gov.uk/Home.html

HHS, CDC, & Oid. (2011). A CDC FRAMEWORK FOR PREVENTING INFECTIOUS DISEASES Sustaining the Essentials and Innovating for the Future.

Ibrahim, S., & Lee, C. Y. (2021). Understanding Cultural and Religious Influences on Vaccine Refusal: A Study in Southern Malaysia. *Asian Journal of Social Science*, 49(3), 321-335.

Ismail, Z. (2022, May 31). Childhood Immunisation in Malaysia: The Past, the Present & the Future - Positive Parenting. Retrieved October 20, 2022, from <https://mypositiveparenting.org/2022/05/31/childhood-immunisation-in-malaysia-the-past-the-present-the-future/>

Jansen, K., Kirman, J., Xing, Z., Offit, P. A., Geoghegan, S., & O'callaghan, K. P. (2019). Vaccine Safety: Myths and Misinformation. <https://doi.org/10.3389/fmicb.2020.00372>

Khoo, Y. S. K., Ghani, A. A., Navamukundan, A. A., Jahis, R., & Gamil, A. (2019). Unique product quality considerations in vaccine development, registration and new program implementation in Malaysia. <https://doi.org/10.1080/21645515.2019.1667206>

Khoo, Y. S. K., Ghani, A. A., Navamukundan, A. A., Jahis, R., & Gamil, A. (2019). Unique product quality considerations in vaccine development, registration and new program implementation in Malaysia. <https://doi.org/10.1080/21645515.2019.1667206>

Krishna, D., Mohd Zulkefli, N.A., Md Said, S. et al. Sociodemographic and health care factors in determining immunization defaulters among preschool children in Petaling District, Selangor: a cross-sectional study in Malaysia. *BMC Public Health*, 19(1275), <https://doi.org/10.1186/s12889-019-7561-z>

Kyprianidou, M., Tzira, E., Galanis, P., & Giannakou, K. (2021). Knowledge of mothers regarding children's vaccinations in Cyprus: A cross-sectional study. *PLoS one*, 16(9), e0257590. <https://doi.org/10.1371/journal.pone.0257590>

Lee, J. K. F., & Leow, P. L. (2012, April 27). Introduction of Immunisation - PORTAL MyHEALTH. Retrieved October 20, 2022, from <http://www.myhealth.gov.my/en/introduction-of-immunisation-2/>

Lim, W. Y., Amar-Singh, H. S. S., Jeganathan, N., Rahmat, H., Mustafa, N. A., Mohd Yusof, F.-S., ... N-Julia, M. S. (2016). Exploring immunisation refusal by parents in the Malaysian context. *Cogent Medicine*, 3(1), 1142410. <https://doi.org/10.1080/2331205x.2016.1142410>

Liu, Y., Ma, Q., Liu, H., & Guo, Z. (2022). Public attitudes and influencing factors toward COVID-19 vaccination for adolescents/children: a scoping review. *Public Health*, 205, 169-181.

Matta, P., El Mouallem, R., Akel, M., Hallit, S., & Fadous Khalife, M. C. (2020). Parents' knowledge, attitude and practice towards children's vaccination in Lebanon: role of the parent-physician communication. *BMC Public Health*, 20(1), 1439. <https://doi.org/10.1186/s12889-020-09526-3>

Meng, Y. C. (2020, April 25). Malaysia sees drop in measles cases | The Star. Retrieved from <https://www.thestar.com.my/news/nation/2020/04/25/malaysia-sees-drop-in-measlescases>

- Mora, T., & Trapero-Bertran, M. (2018). The influence of education on the access to childhood immunization: The case of Spain. *BMC Public Health*, 18(1), 1–9. <https://doi.org/10.1186/s12889-018-5810-1>
- Ota, M. O. C., de Moraes, J. C., Vojtek, I., Constenla, D., Doherty, T. M., Cintra, O., & Kirigia, J. M. (2022). Unveiling the contributions of immunization for progressing towards Universal Health Coverage. *Human Vaccines and Immunotherapeutics*, 18(1). <https://doi.org/10.1080/21645515.2022.2036048>
- Rahim, N. A., & Tan, S. H. (2022). Factors Contributing to Vaccine Refusal in Southern Malaysia: A Case-Control Study. *Malaysian Journal of Community Health*, 18(1), 77-84.
- Ruhi, S., Nabilah, P., Attalla, S. M., Treki, M., Khan, J., Ishaka, A., ... & Hasan, S. (2021). Understanding the Negative Public Perception on Vaccination in West Coast and East Coast Peninsular Malaysia. *Malaysian Journal of Medicine & Health Sciences*, 17(1).
- Statistica Research Department. (2022, October 5). Malaysia: DPT immunization of children 2019. Statista. Retrieved October 11, 2022, from <https://www.statista.com/statistics/733421/malaysia-dpt-immunization-of-children/>
- Tengku Muhammad Fakhruddin, T. M. F., Aminnuddin, M., & Shafei, M. N. (2023). Knowledge of the Malaysian National Immunisation Programme and its associated factors among parents in Dungun, Terengganu: A cross-sectional study. *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia*, 18, 3. <https://doi.org/10.51866/oa.188>
- Voo, J. Y. H., Lean, Q. Y., Ming, L. C., Hanafiah, N. H. M., Al-Worafi, Y. M., & Ibrahim, B. (2021). Vaccine knowledge, awareness and hesitancy: A cross sectional survey among parents residing at Sandakan district, Sabah. *Vaccines*, 9(11), 1–12. <https://doi.org/10.3390/vaccines9111348>
- Wong, L. P., Wong, P. F., & AbuBakar, S. (2020). Vaccine hesitancy and the resurgence of vaccine preventable diseases: The way forward for Malaysia, a Southeast Asian country. *Human Vaccines and Immunotherapeutics*, 16(7), 1511–1520. <https://doi.org/10.1080/21645515.2019.1706935>
- World Health Organization. (2019). Measles - Rubella, Bulletin, 13(1).
- World Health Organization. (2021, August 30). Vaccines and immunization: What is vaccination? Retrieved October 11, 2022, from <https://www.who.int/newsroom/questions-and-answers/item/vaccines-and-immunization-what-is-vaccination>
- Yeong, M. L. (2015, November 25). Immunisation: Facts And Myths - PORTAL MyHEALTH. Retrieved October 20, 2022, from <http://www.myhealth.gov.my/en/immunisation-factsmyths/>
- Zingg, A., & Siegrist, M. (2012). Measuring people's knowledge about vaccination: Developing a one-dimensional scale. *Vaccine*, 30(25), 3771–3777. <https://doi.org/10.1016/j.vaccine.2012.03.014>