ORIGINAL ARTICLE

THE I-PEACH FRAMEWORK ON THE CONTRIBUTING FACTORS OF PARENTAL VACCINE HESITANCY TOWARDS COVID-19 VACCINATION IN PETALING SELANGOR

Sarah Nabila Zulkifli[1], Halimatus Sakdiah Minhat[2*] and Lim Poh Ying[2]

[1]Department of Community Health, Faculty of Medicine, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia
[2]Department of Community Health, Faculty of Medicine, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

***Corresponding author: Halimatus Sakdiah Minhat**
Email: halimatus@upm.edu.my

ABSTRACT

Since the emergence of the COVID-19 pandemic, vaccination has been regarded as one of the most effective mitigating measures to stop virus transmission. This research seeks to explore the contributing factors of parental vaccine hesitancy against the COVID-19 vaccination among KEMAS preschool parents, Petaling district, Selangor. A qualitative study design, utilizing in-depth interviews was conducted among vaccine-hesitant parents guided by a semi-structured interview protocol. Each interview session was transcribed verbatim and analysed thematically prior to the conduction of the consecutive in-depth interviews. The thematic analysis was performed inductively and deductively based on the constructs of the Health Belief Model (HBM) and Theory of Planned Behaviour (TPP). Related codes and themes were identified, guided by the HBM and TPP constructs. A total of seven vaccine hesitant parents were conveniently sampled for the in-depth interviews, with five themes and 17 subthemes successfully identified. The themes and subthemes were presented as the Integrated Parental Vaccine Hesitancy (i-PEACH) framework. In conclusion, the HBM and TPP provide a solid and comprehensive understanding towards vaccine hesitancy against the COVID-19 vaccination among the KEMAS preschool vaccine hesitant parents, through the development of the i-PEACH framework. These findings may guide targeted public health strategies to increase vaccine acceptance.

Keywords: *Parental vaccine hesitancy, COVID-19 vaccination, children, i-PEACH Framework, KEMAS*

INTRODUCTION

Children and adolescents under the age of 20 account for 18% of the 160 million recorded COVID-19 cases and 33% of the population till January 2022. Furthermore, nearly 12,300 COVID-19 deaths occurred in children and adolescents under the age of 20. Of the approximately 12,300 deaths reported in individuals under the age of 20, 58% happened among adolescents aged 10–19, and 42% occurred among children aged 0–9. These deaths only account for 0.4% of the total COVID-19 death of the whole population (1)

Even though children have a significantly reduced risk of severe symptoms when infected (2), COVID-19 vaccines for children can protect children from developing long covid or Multisystem Inflammatory Syndrome in Children (MIS-C) post-COVID-19 infection. Multisystem inflammatory syndrome in children (MIS-C) is a potentially severe and hazardous complication of COVID-19 in children, and it can cause life-threatening complications with the heart and other organs. Various organs, including the heart, lungs, kidneys, brain, skin, eyes, and gastrointestinal organs, might become inflamed as a result of this illness (3) To mitigate these risks and prevent such severe outcomes, it is crucial to address vaccine hesitancy effectively.

In Malaysia, from the 23rd of August 2021 to the 3rd of February 2022, 10.1 percent (147282 cases) of COVID-19 cases were children aged 5 to 11 years old. From June 2020 to December 2021, 174 children under the age of 18 were diagnosed with Multisystem Inflammatory Syndrome in Children (MIS-C) as a result of COVID-19 infection. The majority of people suffering from MIS-C require intensive care and therapy in the Intensive Care Unit (ICU) and resulted in the deaths of 26 children.

Vaccination is considered an important public health program component because of its effectiveness in inhibiting outbreaks and prevalence of infectious diseases. The outbreak of COVID-19 has severely affected the world with devastating consequences. Despite the success and the availability of COVID-19 vaccines, convincing people to take the vaccines remains a major challenge. As a result, many people are still hesitant to be vaccinated against COVID-19 or less inclined to receive booster shots, or even less likely to vaccinate their offspring. There are significant obstacles to achieving complete herd immunity with COVID-19, as it can only be achieved with mass vaccination.

Vaccine hesitancy refers to a delay in acceptance or refusal of safe vaccines despite the availability of vaccination services (4). Various factors can

influence vaccine hesitancy including socio-economic, psychological, and informational aspects, with people's health beliefs being the major determinants of COVID-19 vaccine hesitancy (5). Additionally, parental opinions about vaccines may be influenced by parental fears, anxieties, and the desire to protect their children (6). Furthermore, disparities in information, access to healthcare, and logistical challenges may all restrict vaccine uptake among certain groups of people (7)

Thus, applying behavioural theories to understand complicated health behaviours such as vaccine hesitancy might be advantageous. Throughout the years, behavioural theories have facilitated a better understanding towards human behaviour, including individual decision-making processes, as well as providing a framework for modelling, explaining, and predicting desired behaviour (8). Among renowned models that have proven to effectively explained behavioural changes include the Health Belief Model, Theory of Reasoned Action, Theory of Planned Behaviour, Social-Cognitive Theory, and Socio-ecological Model (9).

METHODS

The study was conducted in Petaling district in Selangor, Malaysia. Selangor is one of the 13th states in Malaysia, which is located on the west of Peninsular Malaysia. KEMAS preschools are run by the Ministry of Rural Development's Department of Community Development.

Basic qualitative study was employed, aimed to understand how people's experience will affect their behaviour in relation to COVID-19 vaccine hesitancy. This study differs from other qualitative studies such as phenomenology, ethnography, grounded theory, narrative analysis, or case study as it has no additional dimensions (10). Therefore, to explore and understand the perceived drivers of vaccine hesitancy, the basic qualitative study design is the best approach. Data was collected among KEMAS vaccine hesitant parents. Eligibility criteria include parents with children aged 5 to 12 years old who were hesitant towards COVID-19 vaccination, able to speak Bahasa Melayu or English and consented to be voice-recorded for the interview session.

Vaccine-hesitant parents were identified via purposive sampling technique. The sample size was determined based on the saturation point of information, where no more new insights or themes being observed to answer the research questions. A semi-structured interview protocol was used to collect data from vaccine-hesitant parents. Interview in research is defined as "a process in which a researcher and participant engage in a conversation focused on questions related to a research study" (11). In semi-structured interview, it is guided by a set of questions and issues to be explored, but neither the exact wording nor the order of questions is predetermined. By using this format, it allows the researcher to respond to the current situation at hand, the emerging worldview of the respondent, and new ideas to the topic while still getting the specific information desired (10).

Several field visits to the preschools and houses of the participants were conducted prior to the onset of study to build rapport with the study populations and familiarise with the study location to identify potential candidate and setting to conduct data collection. Informed and verbal consents were obtained prior to the interview, which lasted between 30 minutes to one hour each session. Individual data was audiotaped and transcribed verbatim. Both inductive and deductive approaches for thematic analysis were used, with the inductive approach used to ensure that no themes were missed, and the deductive approach provide a framework for the themes discovered in the interviews using the Integrated Parental Vaccine Hesitancy (i-PEACH) framework, which is an integration of Health Belief Model (HBM) and Theory of Planned Behaviour (TPB).

The Health Belief Model (HBM) is the most widely used framework to explain vaccination behaviour (12). HBM suggests that people's confidence in whether they are at risk for a disease or a health condition and their understanding of the advantages of taking steps to prevent it affect their willingness to engage in health behaviour (13)The constructs of HBM include perceived susceptibility, severity, benefits, barriers, cues to action, and self-efficacy. The simplicity of the model is to be said to enable researchers to identify constructs that were important, but however, this same simplicity also creates some of the major limitations of this model. Furthermore, according to the theory of Planned Behaviour (TPB), behaviour is driven by the intention to carry out the behaviour, which is ultimately determined by constructs of attitude, subjective norms, and perceived behavioural control. The attitude construct overlaps with the belief constructs in HBM, but other interpersonal factors, such as subjective norms and perceived behavioural control, are also considered (9)

Integration of theories has the potential to improve understanding of the complexities of parental vaccine hesitancy factors, but it is critical to consider independence between constructs because behavioural theories are largely complementary, with significant degrees of overlap (14). As a result, this study employed the Integrated Parental Vaccine Hesitancy (I-PEACH) framework, which combines the Health Belief Model and the Theory of Planned Behaviour.

Institutional approval was obtained from the Community Development Department of Selangor, and ethical approval from the UPM Ethical

Committee on Research involving Humans (JKEUPM) was also obtained to carry out this research.

RESULTS

There were four main themes emerged from the thematic data analysis which are displayed in Table 1 and simplified in Figure 1. Perceived barrier appeared as the major themes, with four subthemes identified. Perceived susceptibility and perceived severity served as subthemes rather than themes contributing towards perceived barriers. None of the subthemes or coding were related to perceived benefits since the interviews were conducted among vaccine hesitant parents.

Table 1. Summary of thematic data analysis for factors contributing towards parental vaccine hesitancy

Theme	Sub theme	Coding
Perceived barriers	Perceived susceptibility	Still at risk towards infection despite vaccinated Inability of vaccine to stop transmission
	Perceived severity	Side effects – long COVID Severe manifestation of disease post vaccination. Children have lower risk mild disease manifestations among children
	Children's vulnerability	Perceived weak children's antibody. Risk difference children and adult
	Alternative measures	Natural food SOP – social distancing/ hygiene Health supplements
Cues to action	Experiences on side effect	Self-experience on side effects (parental) Surrounding people experience on side effects.
	Parental accountability	Potential risks Terrifying rumours New vaccine Vaccine uncertainty/ Inadequate supporting evidence particularly on long-term effects Advice from others
Subjective norms	Normative belief	Less susceptible to infection Perceived strong children's antibody
	Group norm	Majority of hesitant parents
	Important referent's belief	Hesitancy of spouse Hesitancy of family members
Perceived behavioural control	Concern of accessibility	No availability of COVID-19 vaccine No information on COVID-19 vaccine
	Hurdle at vaccination facility	Crowded facility Long waiting time Timing of appointment

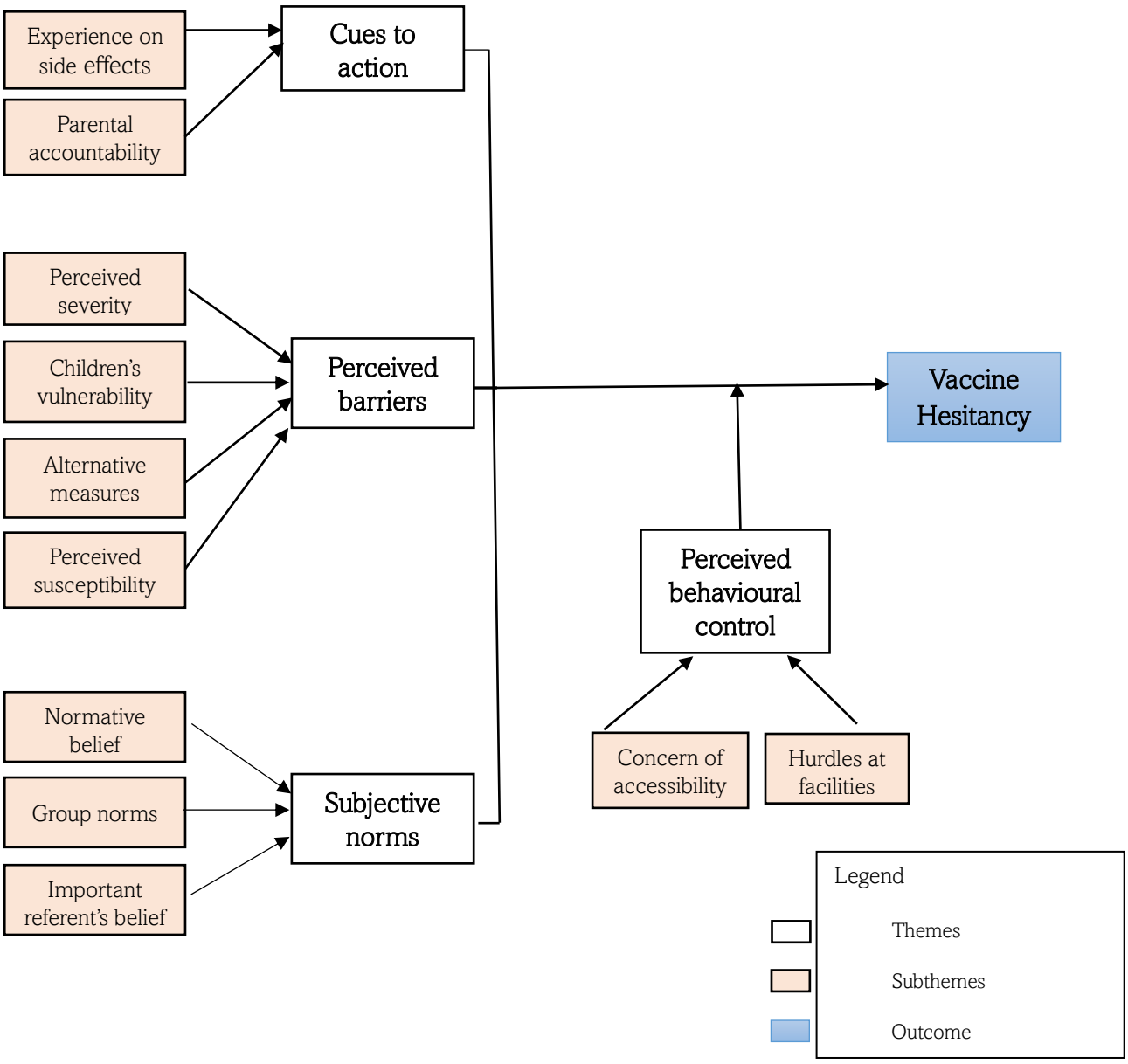

Figure 1. Thematic framework of factors contributing towards parental vaccine hesitancy

DISCUSSION

Perceived barriers

Perceived barrier is defined as the potential negative aspects of a particular health action that may act as barriers to engaging in suggested health behaviours (9). In this study, the identified barriers in getting the children vaccinated against covid-19 related to the perceived susceptibility and perceived severity towards the COVID-19 infection, children's vulnerability and alternative measures.

Perceived susceptibility refers to people's beliefs about their chances or possibility of getting an illness or condition (9). Informants believed that they are still susceptible to COVID-19 infection after receiving the COVID-19 vaccination, as well as the perceived inability of the vaccine to stop virus or disease transmission, which eventually lead to dissatisfaction and doubt towards the benefits of the vaccination program. In multiple studies, these concerns about vaccination side effects have been shown to be one of the most common reasons why parents declined to vaccinate their children with the COVID-19 vaccine (15–17). Another similar study on vaccine intention and identified reasons for vaccine hesitancy in the capital city of Jakarta reported that, those with a high score of perceived susceptibility to the COVID-19 vaccine were significantly predicted vaccine hesitancy (OR = 0.18, 95% CI: 0.16–0.21) (18). The same study also concluded the role of perceived susceptibility as one of the major contributions to predicting vaccine intention and refusal compared to the other HBM constructs. Furthermore, perceived susceptibility was also found to significantly predict vaccine hesitancy in a survey involving 804 Malaysian adults (19).

Meanwhile, perceived severity, which is another construct of the Health Belief Model, refers to people's beliefs about the severity of health problems caused by getting or not getting vaccinated, which might vary from person to person. In this context, informants believed the vaccine causes severe manifestation of the disease post-vaccination during re-infection and related to severe side effects, as well as the perception that children have lower risk of serious consequences when infected with COVID-19 than adults. However, these perceptions may have been contributed towards the negative rumours among the anti-vaxx movement. Contrast findings have been reported in a cohort study published in the BMJ, involving 28 356 participants aged 18-69 years in the UK with, likelihood of long covid symptoms was observed to decrease after covid-19 vaccination and evidence suggested sustained improvement after a second dose, at least over the median follow-up of 67 days (20).

The perceptions towards the less likelihood for severe infections among children were also contributed towards barriers in getting the vaccines. Mild manifestations of the disease have been reported repeatedly. According to a study in Shandong Province, China (Du et al., 2020), fever (35.7%) and dry cough (21.4%) were described as clinical manifestations in children's cases, and although there is substantial lung injury even among children, but that there is less clinical disease, perhaps because of a less pronounced inflammatory response, and that the occurrence of this pattern appears to inversely correlate with age.

On the other hand, some informants were also emphasized on their adherence towards other alternative preventive measures which include the use of natural substances such as honey, habatussauda, fruits, and vegetables, complying to the standard operating procedures (SOP) - social distancing and ensuring hygiene, as well as intake of vitamin and health supplements aiming to boost the immunity of their children. However, there is no scientific evidence that any of these alternative remedies can prevent or cure COVID-19. Furthermore, some of them may not be safe to consume and it is important to understand that although many herbal or dietary supplements (and some prescription drugs) come from natural sources, it does not always mean that a product is a safer or better option for your health. A belief that traditional complementary and alternative medicine (TCAM) use is safer, and pseudoscience beliefs were among the reasons for refusing to vaccinate reported in a local qualitative study conducted among health professionals to explore vaccine hesitancy and the resurgence of vaccine preventable diseases in Malaysia (21). However, there is little scientific evidence to back the use of alternative medicine as a vaccine substitute, and relying exclusively on alternative medicine can expose children to serious and preventable diseases such as COVID-19. Moreover, some alternative medicine practitioners or sources may spread misinformation about vaccines or promote anti-vaccine beliefs, which can further fuel vaccine hesitancy among parents.

Cues to action

Cues to action in this study refers to the cues that can cause a parent to be vaccine-hesitant towards the COVID-19 vaccines. Majority of the subthemes identified from the interviews revolved around the informants' or others observed experiences on the side effects post-vaccination, enforcement and parental sense of accountability.

There have been many reports of side effects after getting a COVID-19 vaccine. Although vaccines are now considered the best way to achieve collective safety and control mortality, due to the critical situation, these vaccines have been issued the emergency use licenses and some of their potential subsequence side effects have been overlooked. The most important and common complications are cerebrovascular disorders including cerebral venous sinus thrombosis, transient ischemic attack, intracerebral haemorrhage, ischemic stroke, and demyelinating disorders (22). However, according to the vaccine study literature, adverse effects have always been part of the mass vaccination strategy, but ultimately the desired effects of the vaccination are more significant (22). Side effects of COVID-19 vaccination have been reported more frequently in people with a history of immune-related diseases or who are more sensitive to age and physiological conditions. Evidence-based evidence are needed in order to convince the parents on big ratio difference on the proportion between the potential risks and benefits that can be obtained from the vaccines.

Parental accountability was another theme identified under perceived barrier, in which the parents felt that they were accountable in making the right decision with regard to vaccinating their children, particularly on keeping their children safe from the potential risk related to the side effects of the vaccines. Parental attitudes and behaviours play a key role in the vaccination of children, which are associated with psychological factors, such as depression, anxiety, and fear, as well as parental gender and educational and socioeconomic status (23). The literature shows that individuals' concerns and fears about their loved ones positively affect vaccination against Covid-19 (24). The parental accountability was also contributed by the vaccine uncertainty as it is very new, rapidly produced and there have been inadequate supporting evidence particularly on long-term effects and halal status, triggering numerous terrifying rumours, which were also reported in another qualitative study conducted locally (25). Parental vaccine hesitancy in relation to COVID-19 vaccines is frequently associated with uncertainty and concerns about the vaccines'

safety and efficacy, especially given the vaccines' rapid development and emergency use authorization (26).

Subjective norms

Subjective norm refers to the perceived social pressure to perform or not execute the behaviour (27). In this study, it refers to the surrounding opinion and societal pressure that causes the behaviour of vaccine hesitancy. There were three subthemes that developed under this theme, that is group norms, significant referent's belief, and normative belief. Group norms are the shared expectations and standards of behaviour within a group, such as a family or a society. The subtheme emerged when vaccine-hesitant parents revealed that the majority of other parents they knew were also opposed to the COVID-19 vaccination for children. Similar reports have been found in which a culture of vaccine hesitancy towards the COVID-19 vaccination among parental social networks heavily influenced parental decision making (28). Also, the lack of support for COVID-19 vaccination for children from other parents, and others in one's community has been reported as major barrier to parental vaccine acceptance (29).

Spouse is an important referent, and informants have stated that their spousal belief plays a big role in their hesitancy against COVID-19 vaccination. Therefore, although mothers have been identified to be more hesitant towards COVID-19 vaccination for their children than the fathers in previous researches (30,31) , both parents' belief play a significant role as one can influence the other.

Additionally, several informants had normative beliefs that children have better chance of recovery than adult and children's antibody is stronger than adults, which make vaccines unnecessary. However, these normative beliefs were not supported by scientific evidence. While it is true that children generally have milder symptoms of COVID-19 than adults, they can still get infected and transmit the virus to others, including vulnerable individuals who may be at higher risk of severe illness or death (2). Therefore, vaccination is an important tool for protecting children from COVID-19 and reducing the spread of the virus in the community. While normative beliefs can influence behavior, they should be based on accurate information rather than misinformation or unfounded assumptions. Encouraging accurate and evidence-based beliefs about vaccination can help to promote vaccination uptake and protect individuals and communities from COVID-19.

Perceived behavioural control

Perceived behavioural control refers to people's perception of the degree to which they are capable of, or have control over, performing a given behaviour. In this study, it is the perception of the ability to take the COVID-19 vaccination for their children. This theme was related to the concerns related to access to the vaccines and the observed hurdles experienced at vaccination facility.

In Malaysia, the COVID-19 vaccination programme was made available for free to anyone who qualified during the campaign, and it was stated that it would be available even after the campaign ended to children who had just turned 5 years old and newly qualified. However, after the campaign concluded, there were concerns that there was little information available about where to register for the vaccination and that it was no longer available at the nearest clinic. This finding demonstrated a poor behavioural control in parents after the vaccination campaign period that led to vaccine hesitancy.

CONCLUSION

The i-PEACH Framework, which incorporates and integrates the Health Belief Model (HBM) and the Theory of Planned Behaviour, served as the main framework for this study, with both an inductive and deductive approach used. All the main themes that emerged fit well into the i-PEACH Framework construct, which included four themes and two subthemes. Because these interviews were conducted only with vaccine-hesitant parents, only one construct did not emerge directly: perceived benefits. To the best of the researchers' knowledge, there have been no qualitative studies utilising both models, and this research demonstrates the potential of the I-PEACH Framework in understanding parental vaccine hesitancy, offering a comprehensive model that enhances the explanatory power of both HBM and TPB constructs. The findings provide valuable insights for developing targeted public health interventions and communication strategies to address vaccine hesitancy effectively.

However, it is important to acknowledge the limitations of this study, including its focus on a specific group of vaccine-hesitant parents, which may affect the generalizability of the results. Future studies should consider diverse populations to validate and refine the framework further. Despite these limitations, the I-PEACH Framework shows promise in guiding public health efforts to increase vaccine acceptance.

Acknowledgements

The researchers would like to thank the PPPKAM for funding this study and KEMAS for giving approval to conduct this study.

Ethical approval

This study was approved by the UPM Ethical Committee on Research involving Humans (JKEUPM) [ID: JKEUPM-2022-310].

Declaration of conflicting interests

The authors declare no conflicting interests.

Funding
This research was supported by The Malaysian Public Health Physician's Association (PPKAM) [PPKAM ID:0657].

REFERENCES

1. UNICEF. Child mortality and COVID-19 [Internet]. 2022 [cited 2022 Feb 8]. Available from: https://data.unicef.org/topic/child-survival/covid-19/

2. Zimmermann P, Curtis N. Why is COVID-19 less severe in children? A review of the proposed mechanisms underlying the age-related difference in severity of SARS-CoV-2 infections. Arch Dis Child [Internet]. 2021 May 1 [cited 2022 Feb 8];106(5):429–39. Available from: https://adc.bmj.com/content/106/5/429

3. Abrams EM, Greenhawt M. Risk Communication During COVID-19. Journal of Allergy and Clinical Immunology: In Practice [Internet]. 2020 Jun 1 [cited 2021 Feb 11];8(6):1791–4. Available from: https://doi.org/10.1016/j.jaip.2020.04.012

4. MacDonald NE, Eskola J, Liang X, Chaudhuri M, Dube E, Gellin B, et al. Vaccine hesitancy: Definition, scope and determinants. Vaccine. 2015 Aug 14;33(34):4161–4.

5. Limbu YB, Gautam RK, Pham L. The Health Belief Model Applied to COVID-19 Vaccine Hesitancy: A Systematic Review. Vaccines 2022, Vol 10, Page 973 [Internet]. 2022 Jun 18 [cited 2023 Jan 12];10(6):973. Available from: https://www.mdpi.com/2076-393X/10/6/973/htm

6. Gavaruzzi T, Caserotti M, Leo I, Tasso A, Speri L, Ferro A, et al. The Role of Emotional Competences in Parents' Vaccine Hesitancy. Vaccines (Basel) [Internet]. 2021 Mar 1 [cited 2023 Jun 16];9(3). Available from: /pmc/articles/PMC8005154/

7. Williams SE. What are the factors that contribute to parental vaccine-hesitancy and what can we do about it? Hum Vaccin Immunother [Internet]. 2014 Sep 1 [cited 2020 Dec 24];10(9):2584–96. Available from: https://pubmed.ncbi.nlm.nih.gov/25483505/

8. Kwon HR, Silva EA. Mapping the Landscape of Behavioral Theories: Systematic Literature Review. J Plan Lit [Internet]. 2020 May 1 [cited 2021 Jun 26];35(2):161–79. Available from: https://journals.sagepub.com/doi/full/10.1177/0885412219881135

9. Glanz Karen, Rimer BK, Viswanath K (Kasisomayajula). Health behavior and health education : theory, research, and practice. Jossey-Bass; 2008. 552 p.

10. Merriam SB, Tisdell EJ. Qualitative research: a guide to design and implementation. 4th ed. San Francisco, CA: Jossey-Bass; 2016. 1–371 p.

11. Demarrais K. Qualitative interview studies: Learning through experience. Foundations for Research Methods of Inquiry in Education and the Social Sciences. 2004 Jan 1;51–68.

12. Li L, Wood CE, Kostkova P. Vaccine hesitancy and behavior change theory-based social media interventions: a systematic review. Transl Behav Med [Internet]. 2022 Feb 1 [cited 2023 Jun 16];12(2):243–72. Available from: https://pubmed.ncbi.nlm.nih.gov/34850217/

13. Glanz K, Bishop DB. The role of behavioral science theory in development and implementation of public health interventions [Internet]. Vol. 31, Annual Review of Public Health. Annual Reviews ; 2010 [cited 2021 Jan 29]. p. 399–418. Available from: www.annualreviews.org

14. Weinstein ND. Testing Four Competing Theories of Health-Protective Behavior. Health Psychology. 1993;12(4):324–33.

15. Aldakhil H, Albedah N, Alturaiki N, Alajlan R, Abusalih H. Vaccine hesitancy towards childhood immunizations as a predictor of mothers' intention to vaccinate their children against COVID-19 in Saudi Arabia. J Infect Public Health [Internet]. 2021;14(10):1497–504. Available from: https://doi.org/10.1016/j.jiph.2021.08.028

16. Dubé E, Gagnon D, Pelletier C. COVID-19 vaccination in 5-11 years old children: Drivers of vaccine hesitancy among parents in Quebec. Hum Vaccin Immunother [Internet]. 2022 [cited 2023 Oct 4];18(1). Available from: https://pubmed.ncbi.nlm.nih.gov/35103550/

17. Fedele F, Aria M, Esposito V, Micillo M, Cecere G, Spano M, et al. COVID-19 vaccine hesitancy: a survey in a population highly compliant to common vaccinations. Hum Vaccin Immunother [Internet]. 2021

[cited 2023 Oct 4];17(10):3348–54. Available from: https://pubmed.ncbi.nlm.nih.gov/34096836/

18. Id IH, Amir Id S, Pelupessy DC, Rahvenia Z. Using a health belief model to assess COVID-19 vaccine intention and hesitancy in Jakarta, Indonesia. PLOS Global Public Health [Internet]. 2022 Oct 28 [cited 2023 Oct 5];2(10):e0000934. Available from: https://journals.plos.org/globalpublichealth/article?id=10.1371/journal.pgph.0000934

19. Jian Ng JW, Vaithilingam S, Nair M, Hwang LA, Musa KI. Key predictors of COVID-19 vaccine hesitancy in Malaysia: An integrated framework. PLoS One [Internet]. 2022 May 1 [cited 2023 Oct 5];17(5):e0268926. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0268926

20. Ayoubkhani D, Bermingham C, Pouwels KB, Glickman M, Nafilyan V, Zaccardi F, et al. Trajectory of long covid symptoms after covid-19 vaccination: community based cohort study. BMJ [Internet]. 2022 [cited 2023 Oct 5];377. Available from: https://pubmed.ncbi.nlm.nih.gov/35584816/

21. Wong LP, Wong PF, AbuBakar S. Vaccine hesitancy and the resurgence of vaccine preventable diseases: the way forward for Malaysia, a Southeast Asian country. Hum Vaccin Immunother [Internet]. 2020 Jul 2 [cited 2023 Mar 31];16(7):1511. Available from: /pmc/articles/PMC7482793/

22. Hosseini R, Askari N. A review of neurological side effects of COVID-19 vaccination. European Journal of Medical Research 2023 28:1 [Internet]. 2023 Feb 25 [cited 2023 Oct 4];28(1):1–8. Available from: https://eurjmedres.biomedcentral.com/articles/10.1186/s40001-023-00992-0

23. Baş K, Gürarslan Baş N. Parents' Level of COVID-19 Fear, Anxiety and Their Attitudes and Behaviors Toward Vaccination of Their Children. Omega (Westport) [Internet]. 2022 [cited 2023 Oct 5]; Available from: https://pubmed.ncbi.nlm.nih.gov/36516015/

24. Xu Y, Zhang R, Zhou Z, Fan J, Liang J, Cai L, et al. Parental psychological distress and attitudes towards COVID-19 vaccination: A cross-sectional survey in Shenzhen, China. J Affect Disord [Internet]. 2021 Sep 1 [cited 2023 Oct 5];292:552–8. Available from: https://pubmed.ncbi.nlm.nih.gov/34147967/

25. Mohd Rani MD, Mohamed NA, Solehan HM, Ithnin M, Ariffien AR, Isahak I. Assessment of acceptability of the COVID-19 vaccine based on the health belief model among Malaysians-A qualitative approach. PLoS One [Internet]. 2022 Jun 1 [cited 2023 Oct 3];17(6). Available from: https://pubmed.ncbi.nlm.nih.gov/35700197/

26. Gillman AS, Scharnetzki L, Boyd P, Ferrer RA, Klein WMP, Han PKJ. Perceptions and tolerance of uncertainty: relationship to trust in COVID-19 health information and vaccine hesitancy. J Behav Med [Internet]. 2022 [cited 2023 Mar 30];1:1. Available from: /pmc/articles/PMC8990605/

27. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179–211.

28. Williams SN. 'I don't want my son to be part of a giant experiment': public attitudes towards COVID-19 vaccines in children. Public Health. 2022 Apr 1;205:116–21.

29. Fisher CB, Gray A, Sheck I. Covid-19 pediatric vaccine hesitancy among racially diverse parents in the united states. Vaccines (Basel) [Internet]. 2022 Jan 1 [cited 2023 Jan 12];10(1):31. Available from: https://www.mdpi.com/2076-393X/10/1/31/htm

30. Horiuchi S, Sakamoto H, Abe SK, Shinohara R, Kushima M, Otawa S, et al. Factors of parental COVID-19 vaccine hesitancy: A cross sectional study in Japan. PLoS One [Internet]. 2021;16(12 December):1–15. Available from: http://dx.doi.org/10.1371/journal.pone.0261121

31. Goldman RD, Ceballo R. Parental gender differences in attitudes and willingness to vaccinate against COVID-19. J Paediatr Child Health [Internet]. 2022 Jun 1 [cited 2023 Jan 13];58(6):1016–21. Available from: https://onlinelibrary.wiley.com/doi/full/10.1111/jpc.15892