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Childhood Vaccination Views Across Genders: What Do Mothers and Fathers Really Think?

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Abstract

Childhood vaccination is a crucial public health endeavour aimed at preventing infectious illnesses and decreasing child mortality. Although vaccine uptake in Malaysia is generally high, disparities may occur among different demographic groups, including gender. This study evaluates parental views regarding childhood vaccination in Pahang, Malaysia, and assesses whether these attitudes significantly differ between male and female parents. The target population comprised parents who have at least one child under 15 years of age. A quantitative cross-sectional design was utilised, involving 333 parents from Pahang. Data were gathered via a structured questionnaire assessing views regarding childhood vaccination. Descriptive statistics and an independent samples t-test were performed to assess attitudes and gender differences, respectively. The independent t-test revealed a statistically significant disparity between male and female parents, with female parents exhibiting more favourable attitudes toward childhood vaccination. The findings highlight the significance of gender in influencing parental perspectives on immunisation. This study advances the application of Gender Schema Theory in public health research and highlights the need for gender-sensitive strategies to improve vaccine acceptance, particularly among male parents.

***Keywords**: Immunisation, Childhood Vaccination, Parental Attitudes, Gender Differences, Gender Schema Theory, Malaysia*

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INTRODUCTION

Immunisation is one of the most successful and cost-efficient public health interventions for illness prevention and the reduction of child mortality. It is pivotal in attaining the Sustainable Development Goals (SDGs), especially SDG 3, which seeks to eliminate preventable fatalities among children under five by 2030 (United Nations [UN], 2023). Immunisation directly contributes to this objective by protecting children from life-threatening, vaccine-preventable illnesses (Petu et al., 2025; Sinnokrot et al., 2025). Notwithstanding these international initiatives, the United Nations Children's Fund (UNICEF) (2023) indicates that many children persist in succumbing to preventable diseases, underscoring the necessity for coordinated, multisectoral actions to safeguard child health.

In 2018, almost 700,000 children under five succumbed to vaccine-preventable diseases, with 99% of these fatalities occurring in developing countries (Frenkel, 2021). Vaccines are projected to avert 2 to 3 million fatalities each year, constituting a fundamental element of primary healthcare systems worldwide (Asghar et al., 2025; Zhou et al., 2024; Shattock et al., 2024; Oyo-Ita et al., 2023). High vaccination coverage not only safeguards individuals but also fosters herd immunity and mitigates the risk of extensive disease outbreaks (Szalast et al., 2025; Abd Rahman et al., 2024). Recent instances of child death due to vaccine-preventable diseases in Malaysia, especially measles and diphtheria, indicate concerning regressions (Ansari et al., 2021). The COVID-19 pandemic intensified the issue, resulting in a decrease in childhood vaccination rates as many parents failed to attend their planned clinic sessions (Abd Rahman et al., 2024).

Measles has reemerged as a public health concern in Malaysia, despite the launch of a nationwide Measles Elimination Program in 2004. In Pahang, cases rose sharply from 13.51 to 50.97 per million between 2018 and 2019, while the national rate fell from 59.5 to 32.3 during the same period (Ministry of Health Malaysia [MOHM], 2019). This rise in Pahang has been linked to low immunisation coverage among certain demographic groups (Mat Daud et al., 2022; Mohd Rosman et al., 2020).

A crucial component affecting vaccination rates is parental attitude towards childhood immunisation. Parents are the principal decision-makers about a child's immunisation, and their attitudes and views profoundly influence public health outcomes (Opel et al., 2011). A favourable parental disposition enhances vaccination rates and fosters herd immunity, while hesitancy or rejection may result in preventable outbreaks (Demir Pervane et al., 2025). Szalast et al. (2025) observed the worldwide proliferation of vaccine-related apprehensions and urged for a more thorough examination of the factors affecting parental attitudes and decisions. Notwithstanding global interest, research on parental attitudes on vaccination in Malaysia, specifically in Pahang, is still scarce. There is an absence of region-specific empirical data examining the social and psychological aspects of parental vaccine decisions, including gender-based differences in views. Current research has inadequately explored the influence of demographic characteristics, particularly gender, on parental views and decision-making concerning childhood vaccination.

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This study utilises Gender Schema Theory (GST) to address this gap, which asserts that individuals internalise gender-based frameworks that shape their interpretation of information and decision-making processes (Bem, 1981). This theory posits that male and female parents may interpret vaccine-related dangers and duties differently due to socially created gender norms. Comprehending these gender-specific attitudinal disparities is essential for formulating targeted health education initiatives and enhancing immunization rates.

Previous research (e.g., Anaam & Alsahali, 2023; Alnasser et al., 2021; Gao et al., 2020; Khan et al., 2020) revealed no substantial disparity in vaccination attitudes between male and female participants. Conversely, some research (e.g., Al-Hanawi et al., 2020; Wilson et al., 2021; Okello et al., 2020; Jadoo et al., 2021) indicated substantial disparities in vaccination attitudes according to gender. This inconsistency in findings highlights the necessity for additional context-specific research to investigate the extent to which gender influences parental attitudes on childhood vaccination, especially in areas like Pahang, where data is limited. This study attempts to ascertain the level of parental attitudes toward childhood vaccination in Pahang. This study also aims to investigate the statistically significant differences in parental attitudes about childhood vaccination between male and female parents in Pahang, Malaysia.

LITERATURE REVIEW

Gender Schema Theory (GST)

The Gender Schema Theory (GST) was formulated by Sandra Lipsitz Bem, an American psychologist. GST is a social-cognitive framework that elucidates how individuals are gendered from an early age and the impact of this gendering on their cognitive and categorical processing throughout their lives. From an early age, children formulate concepts and beliefs regarding masculinity and femininity, known as gender schemas, which they utilise to classify information, make decisions, and govern behaviour (Bem, 1981a). This theory posits that men frequently interpret information through socially constructed gender frameworks, resulting in a tendency to emphasise data that corresponds with conventional masculine roles, such as competition and goal-directed behaviour, while disregarding or downplaying aspects linked to femininity, such as emotional support and caregiving (Bem, 1981b). This cognitive framework determines the allocation of attention (Wang et al., 2025).

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The preceding discussion suggests that parental views on childhood vaccination may be shaped by internalised gender schemas, influencing how male and female parents perceive health-related responsibilities and hazards. Mothers, typically linked to caring responsibilities, may demonstrate greater concern for preventative child health measures like immunisation, but men may be less involved in these decisions due to varying gender role expectations. Therefore, examining the extent of parental attitudes and the gender-specific variations in those attitudes, as outlined in the research objectives, is crucial for comprehending the impact of gender on vaccine decision-making in Pahang. These results may guide gender-sensitive public health measures to enhance immunisation rates among children.

Hypothesis Development

Vaccination is fundamental to public health, averting millions of fatalities each year by mitigating the transmission of infectious illnesses. Recent reductions in vaccination coverage have resulted in the recurrence of avoidable outbreaks globally (Matta et al., 2020). A significant component in this tendency is parental apprehension, frequently influenced by personal convictions, ignorance, and societal pressures (Rainey et al., 2011). Parental refusal or postponement of child vaccinations jeopardizes herd immunity and diminishes the efficacy of national immunization initiatives.

Multiple studies demonstrate that parental attitudes substantially affect vaccination behaviour. Adverse attitudes correlate with vaccine reluctance and the resurgence of diseases (Torun et al., 2025), whereas favourable attitudes typically indicate trust in medical consensus and a dismissal of misinformation (Soveri et al., 2020). Sendekie et al. (2025) discovered that persons with positive perceptions of the HPV vaccine were three times more likely to obtain it. Likewise, research conducted by El Bilbeisi et al. (2025), Verulava et al. (2019), and Shati et al. (2021) indicated elevated levels of mother endorsement for children's vaccinations in multiple nations. These findings predominantly represent maternal viewpoints, with insufficient consideration of paternal attitudes, highlighting a gender disparity in the literature.

The impact of gender on health attitudes has garnered heightened interest, with global data indicating that women engage in more preventive health behaviours and exhibit greater risk aversion (Toshkov, 2023; Amarie et al., 2020). Gender influences access to healthcare, caregiving responsibilities, and the processing of health

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information (Anaam & Alsahali, 2023), indicating its potential impact on vaccination choices. The research about gender disparities in vaccine attitudes remains ambiguous. Some studies indicate no significant differences between male and female participants (Anaam & Alsahali, 2023; Alnasser et al., 2021), while others identify statistically significant gender-based disparities (Al-Hanawi et al., 2020; Wilson et al., 2021; Jadoo et al., 2021), with women typically exhibiting more favourable attitudes.

Research has consistently demonstrated that mothers are more engaged in vaccination decisions and possess more knowledge of immunization schedules compared to fathers (Matta et al., 2020; Smith et al., 2004; Elbur et al., 2014). Nonetheless, these studies frequently depend on conventional gender roles, presuming mothers as the primary caretakers, while overlooking the increasing participation of fathers in child health decisions. Moreover, the emphasis on maternal viewpoints highlights a deficiency in comprehending the comparative attitudes of both parents, especially in situations where both may affect the outcome.

While several Malaysian studies have explored parental attitudes toward childhood vaccination (e.g., Ansari et al., 2021; Abd Rahman et al., 2024), these investigations have largely examined general acceptance and awareness without disaggregating findings by parental gender. Ansari et al. (2021), for instance, focused on vaccine hesitancy in urban populations but did not differentiate between mothers' and fathers' perspectives. Similarly, Abd Rahman et al. (2024) provided valuable insights into socioeconomic factors affecting vaccine uptake, but treated parents as a homogenous group. This lack of gender-specific analysis limits individuals understanding of how maternal and paternal attitudes may differ in shaping vaccination decisions.

Moreover, there is a notable absence of region-specific data, particularly in states like Pahang, which have experienced an increase in vaccine-preventable diseases despite national immunisation efforts. Existing literature does not adequately address how sociocultural and demographic factors, such as gender roles, might influence parental decisions in this context. This study addresses these gaps by offering a comparative analysis of male and female parental attitudes toward childhood vaccination in Pahang. By focusing on gender as a key variable, this research contributes novel insights to the Malaysian public health literature and supports the development of more targeted, gender-sensitive vaccination strategies. These

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constraints highlight the necessity for additional empirical research that specifically investigates the influence of gender on parental views on childhood vaccination. This research investigates this deficiency by evaluating the subsequent hypothesis:

H1: There is a statistically significant difference in parental attitudes toward childhood vaccination between male and female parents.

RESEARCH METHODOLOGY

This research utilised a quantitative, cross-sectional survey methodology to assess parental attitudes regarding childhood vaccination and to investigate gender-based disparities in those attitudes. A quantitative method was considered suitable to statistically examine the correlation between gender and vaccination attitudes in accordance with the study's aims and theoretical framework. This study was underpinned by Gender Schema Theory (GST) established by Bem (1981), which asserts that individuals internalise gender-oriented cognitive frameworks that shape their interpretation of information and decision-making processes. The GST served as a framework for analysing potential substantial differences in attitudes toward childhood vaccination between male and female parents, influenced by socially imposed gender norms and roles.

The target demographic consisted of parents, both male and female, living in Pahang, Malaysia, with at least one child under the age of 15. A convenience sampling technique was employed, and the sample size was calculated using G*Power analysis for an independent samples t-test, with an effect size of 0.50, a power of 0.80, and an alpha level of 0.05 (Kang, 2021). The requisite minimum sample size is 128 responses. This study successfully gathered 333 respondents, surpassing the minimum required sample size. Consequently, the study's sample size was sufficient to identify significant differences in attitudes between male and female parents. Data were gathered utilising a structured and self-administered questionnaire. The questionnaire used in this study was adopted from Abd Halim et al. (2020), who previously established the content and face validity, as well as the reliability, of the items. To ensure suitability for the current research context, the items were carefully reviewed and adapted accordingly. The questionnaire was administered in both English and Bahasa Malaysia, and a forward-backward translation process was employed to guarantee linguistic accuracy and conceptual equivalence. A pilot test was conducted to assess the clarity, relevance, and comprehensibility of the items. Additionally, expert feedback was obtained to further

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enhance content validity. Reliability analysis was performed using Cronbach's alpha to confirm internal consistency. These validation procedures ensured that the instrument was appropriate and reliable for use in this study. The research utilised a 5-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree.

Data were gathered with the use of trained enumerators. Participants were solicited at healthcare facilities, supermarkets, and community centres in Pahang, Malaysia. Informed consent was obtained from all individuals, and participation was voluntary and confidential. The research obtained ethical clearance from the TAR UMT Ethics Committee Board (Ethics Clearance No: TAR UMT/EC/2023/07/04). Data were analysed via IBM SPSS Statistics version 29. Descriptive statistics were utilised to evaluate parental attitudes toward childhood vaccination. An independent samples t-test was performed to assess statistically significant differences in attitudes regarding childhood immunisation between male and female parents.

Table 1 presents the demographic profile of the respondents. The majority are female parents, comprising 60.7%, while male parents account for 39.3%. Most respondents are between 30 and 39 years old (47.5%), and their monthly household income falls within the range of RM 2,560 to RM 5,249 (33.1%). The majority work in the public sector, and respondents are equally represented from all 11 districts in Pahang, Malaysia.

Table 1:
Demographic Profile of the Respondents

Items	Frequency	Percentage (%)
Gender		
Male	131	39.3
Female	202	60.7
Age		
18-24	18	5.4
25-29	50	15.0
30-39	158	47.5
40-49	88	26.4
50 and above	19	5.7
Monthly Household Income		
RM 2,559 and below	105	31.5
RM 2,560 - RM5,249	110	33.1
RM 5,250-RM11,819	86	25.8
RM11,820 and above	32	9.6

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Working Sectors		
Public Sector	216	64.9
Private Sector	13	3.9
Unemployed	44	13.2
Businessperson	38	11.4
Housewife/Househusband	22	6.6
Districts		
Pekan	30	9.0
Kuantan	30	9.0
Rompin	30	9.0
Maran	30	9.0
Bera	30	9.0
Jerantut	30	9.0
Temerloh	31	9.3
Raub	31	9.3
Bentong	30	9.0
Lipis	31	9.3
Cameron Highlands	30	9.0

FINDINGS

Research objective 1: To identify the level of parental attitudes towards childhood vaccination in Pahang.

Loeb (2017) stated that descriptive analysis evaluates the levels of independent and dependent variables, classified as low (1.00–2.33), medium (2.34–3.66), and high (3.67–5.00). Table 2 illustrates the extent of parental attitudes regarding childhood vaccination in Pahang, Malaysia. The mean value is 3.72, categorising it as high, which signifies elevated parental sentiments. In other words, parents in Pahang typically demonstrate favourable attitudes towards childhood vaccination.

Table 2:
The Level of Parental Attitudes towards Childhood Vaccination

Variable	N	Min.	Max.	Mean	SD
ACV	333	1.00	5.00	3.72	1.21

Notes: ACV = Attitude towards childhood vaccination, Min = Minimum, Max = Maximum, SD = Standard deviation.

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Research Objective 2: To examine the statistically significant differences in parental attitudes towards childhood vaccination between male and female parents in Pahang, Malaysia.

H1: There is a significant difference in parental attitudes toward childhood vaccination between male and female parents.

Levene's t-test was utilised in this study to ascertain the second research objective. The researchers undertook several steps to appropriately interpret the results of the Independent t-test analysis. The descriptive statistics (means and standard deviations) for each group were analysed to comprehend the central tendency and variability of scores. Table 3 and Figure 1 indicate that female parents (Mean = 3.84, SD = 1.13) exhibit higher mean scores regarding childhood vaccination compared to male parents (Mean = 3.53, SD = 1.31).

Table 3:
Descriptive Statistics of Attitude towards Childhood Vaccination

Gender	*n*	Mean	SD	SE
Male	131	3.53	1.31	0.11
Female	202	3.84	1.13	0.08

Notes: SD = Standard deviation, SE = Standard errors

Following Cunningham and Aldrich (2012) and Field (2018), normality and homogeneity of variance were assessed before conducting the independent samples t-test. Skewness and kurtosis are effective measures of normality, with values between ±2 considered acceptable (Field, 2013; Gravetter & Wallnau, 2014; Hatem et al., 2022). Table 4 shows that parental attitudes toward childhood vaccination had slight negative skewness (Skewness = -1.02, SE = 0.13) and minor platykurtosis (Kurtosis = -0.33, SE = 0.27), both within the acceptable ±2 range, indicating assumptions for parametric testing were met.

Cronbach's alpha, as a measure of reliability, goes from 0 to 1. Cronbach's alpha value exceeding 0.7 is deemed satisfactory (Lavrakas, 2008). Table 4 illustrates that the Cronbach's alpha value for the ACV is 0.98, surpassing the threshold of 0.70. Therefore, the measurement items used in this study have good internal consistency, signifying that the questions included to assess parental attitudes toward childhood vaccination are highly reliable.

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Table 4:
Normality and Reliability Analysis

Variable	Mean	SD	Skewness	Kurtosis	CA	No. of Items
ACV	3.72	1.21	-1.02	-0.33	0.98	10

Notes: SD = Standard Deviation, CA = Cronbach's Alpha

Next, Levene's Test for Equality of Variances (EVA) was utilised to examine the homogeneity of variance. If $p > 0.05$, variances are equal, it is advisable to use the first row of the t-test output. Cunningham and Aldrich (2012) and Field (2018) suggested that if $p < 0.05$, variances are not equal, and the researchers need to use the second row (adjusted t-test). Table 5 shows that the *p*-value for EVA is less than 0.05; hence, there is a need to refer to the EVNA *p*-value (second row's *p*-value). On top of that, the researchers need to review the t-statistic, degrees of freedom (df), and *p*-value to determine if the group difference is statistically significant (Field, 2018; Pallant, 2020).

An independent samples t-test was conducted to examine whether attitudes toward childhood vaccination differed by gender. Levene's test for equality of variances was significant, $F(1, 331) = 14.26$, $p < .001$, indicating that the assumption of equal variances was violated. Therefore, the results reported are based on the equal variances not assumed model. As shown in Table 5, the results revealed a statistically significant difference in attitudes toward childhood vaccination between male parents (coded as 1) and female parents (coded as 2), $t(247.84) = -2.24$, $p = .026$. The mean difference was -0.312 (SE = 0.139), with a 95% confidence interval ranging from -0.59 to -0.038. This suggests that females reported significantly more favourable attitudes toward childhood vaccination compared to males. Therefore, H1 is supported.

Table 5:
Independent Samples T-Test Results for Attitude towards Childhood Vaccination by Gender

		F	Sig.	t	df	Sig.	Mean Difference	SED	95% CI of the Difference	
ACV	EVA	14.26	.00	-2.32	331	.021	-.312	.135	-.58	-.047
	EVNA			-2.24	247.84	.026	-.312	.139	-.59	-.038

Notes: MD = Mean difference, SED = Std. Error Difference, EVA = Equal variances assumed, EVNA = Equal variances not assumed, ACV = Attitude towards childhood vaccination

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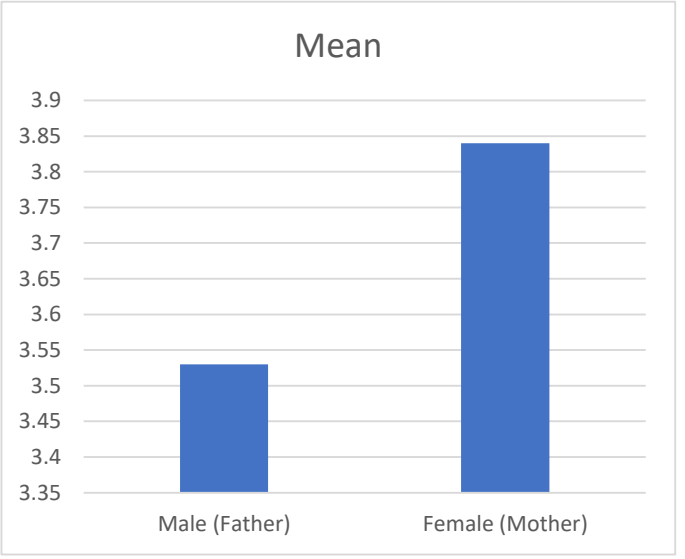

Figure 1: Gender Differences in Attitudes Toward Childhood Vaccination

DISCUSSION

The descriptive analysis of the data indicated that most parents in Pahang demonstrate a strong positive attitude toward childhood vaccination. This conclusion is promising, indicating widespread acceptance and endorsement of immunisation efforts in the region. Favourable parental views are a vital factor influencing vaccination uptake, as they signify trust in the healthcare system, assurance in vaccine safety and efficacy, and a commitment to safeguarding children from vaccine-preventable diseases (Torun et al., 2025; Zhou et al., 2024). This finding corresponds with prior research undertaken in diverse global and regional settings. El Bilbeisi et al. (2025) and Shati et al. (2021) indicated that the majority of mothers in Palestine and Saudi Arabia, respectively, held positive attitudes towards childhood vaccination. Such attitudes are crucial for attaining herd immunity, enhancing community health outcomes, and advancing toward global objectives, particularly the Sustainable Development Goals (SDG 3) aimed at decreasing child mortality (UN, 2023).

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Moreover, substantial parental endorsement for vaccination may indicate effective public health initiatives in Pahang, encompassing awareness campaigns, vaccine accessibility, and confidence in healthcare professionals. Nonetheless, despite the generally favourable disposition, it is crucial to recognise and tackle subgroups that may continue to possess reservations or misconceptions to avert localised vaccine reluctance. In Pahang, two epidemics transpired within the Bateq tribe in the Jerantut and Lipis districts, presumably associated with adjacent outbreaks attributable to their nomadic lifestyle across surrounding states, including Kelantan and Terengganu (Mat Daud et al., 2022). Mohd Rosman et al. (2020) emphasised that a significant reason was the limited number of vaccine recipients within the Bateq community.

Hence, the Pahang state government should prioritise indigenous groups by instituting focused health education initiatives designed to enhance attitudes and augment vaccination rates. Culturally attuned outreach techniques that incorporate community leaders, mobile health services, and trust-building activities are crucial for mitigating vaccine hesitancy in high-risk populations and guaranteeing equal access to immunisation for all demographic segments. This discovery establishes a basis for further examination of potential gender disparities in these attitudes, as investigated in the next portions of the study.

The independent t-test findings indicated a statistically significant disparity in attitudes toward childhood vaccination between male and female parents, with female parents (mothers) reporting significantly more favourable attitudes than male parents (fathers). The findings contradict past studies (e.g., Anaam & Alsahali, 2023; Alnasser et al., 2021), which found no gender difference in attitudes toward childhood vaccination. This situation happened because, in Pahang, traditional gender roles position mothers as the primary caregivers, making them more engaged and informed about their children's health needs, including immunisation schedules. Additionally, health education and community outreach programs in the region often target mothers more directly, increasing their awareness and positive attitudes toward vaccination compared to fathers, who may be less involved in day-to-day childcare decisions. This gender difference aligns with prior research suggesting that women generally demonstrate greater concern for health matters and are more likely to engage in preventive health behaviours (Amarie et al., 2020; Wilson et al., 2021). However, beyond observable gender roles, this finding is more robustly explained through the lens of Gender Schema Theory (Bem, 1981).

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Gender Schema Theory posits that individuals internalize culturally constructed norms and expectations associated with their gender, which then guide their cognitive processing and behavioural choices (Bem, 1981a). These schemas serve as mental filters through which individuals interpret health-related information. In this framework, men and women assimilate and prioritize information differently, depending on the alignment between the content and their gender-based cognitive schemas. For example, men are often socialized to value traits such as independence, competition, and control, and may therefore filter health messages through schemas that emphasize autonomy and action over vulnerability and care (Bem, 1981b; Wang et al., 2025). Information that aligns with traditionally feminine traits, such as nurturing, emotional support, and caregiving, may be unconsciously deprioritized by male individuals, as it does not fit within their internalized schema (Bem, 1981b). This helps explain why fathers, in the context of this study, demonstrated less favourable attitudes toward childhood vaccination compared to mothers.

Female parents, on the other hand, are more likely to internalize caregiving roles as central to their identity, and thus may cognitively frame vaccination decisions as a core aspect of protecting and nurturing their children. Their attentional and evaluative biases, shaped by early and ongoing gendered socialization, likely lead them to engage more positively and responsively with vaccination information (Anaam & Alsahali, 2023). Therefore, this study's findings offer strong empirical support for Gender Schema Theory. The observed attitudinal differences are not simply behavioural or informational gaps, but rather manifestations of deeply rooted, schema-driven cognitive processes. These gendered schemas guide not only how information is interpreted but also how individuals determine their parental responsibilities in the context of health decisions. From a public health perspective, this highlights the need for gender-sensitive vaccination campaigns. Health messaging that continues to frame vaccination as a maternal responsibility may unintentionally reinforce existing schemas and disengage fathers. Future interventions should aim to reframe vaccination as a shared parental duty, actively integrating language and imagery that resonates with both masculine and feminine identity schemas to foster greater paternal engagement.

Matta et al. (2020) and Elbur et al. (2014) discovered that moms exhibited a greater awareness of immunisation schedules and prioritised vaccination appointments more than fathers. Amarie et al. (2020) observed that women typically exhibit heightened awareness of health issues and are more engaged in pursuing healthcare

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information, potentially resulting in more positive attitudes toward vaccination. Conversely, males socialised to prioritise autonomy, risk-taking, and self-reliance may perceive health-seeking activities, such as vaccination, as inconsistent with conventional masculine values (Anaam & Alsahali, 2023). This may result in diminished perceived urgency about childhood vaccines and an increased vulnerability to disinformation or scepticism about their usefulness.

The finding that female parents in Pahang exhibit more positive attitudes toward childhood vaccination can be attributed to several socio-cultural and contextual factors specific to the region. In many Malaysian communities, including Pahang, women, particularly mothers, are traditionally the primary caregivers and decision-makers regarding children's health. This caregiving role often leads to greater exposure to health information, closer interaction with healthcare providers, and stronger motivation to ensure children's well-being (Matta et al., 2020; Smith et al., 2004). Additionally, cultural expectations in Pahang may reinforce nurturing roles among women, encouraging them to prioritize preventive health measures such as vaccination. Conversely, male parents may have less involvement in day-to-day child healthcare decisions, potentially resulting in less positive attitudes toward vaccination. Furthermore, access to community health programs and maternal health education campaigns in Pahang is often targeted more toward women, which could further enhance mothers' awareness and acceptance of immunization benefits. These combined social and cultural dynamics help explain the gender differences in vaccination attitudes observed in this region.

Therefore, the Pahang state government must establish gender-sensitive health communication strategies that actively involve both mothers and fathers in vaccination-related decision-making. Although current public health initiatives may effectively engage moms, further outreach is necessary to actively involve fathers, confront conventional gender norms about health habits, and promote shared parental responsibility. Strategic initiatives such as community education programs, media efforts explicitly directed at males, and promoting paternal involvement in pediatric health visits can effectively reduce the gender disparity in perceptions of childhood vaccination and foster a more unified public health strategy.

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One key recommendation is the active involvement of the Jabatan Kemajuan Orang Asli (JAKOA), the government agency responsible for indigenous affairs, to improve vaccination outreach among Orang Asli communities. These groups often experience limited access to healthcare services and information, which may contribute to lower vaccination rates. Collaborating with JAKOA can facilitate culturally sensitive education programs and healthcare delivery tailored to the needs of indigenous populations, thereby increasing vaccine acceptance.

Public health agencies in Malaysia can effectively operationalise gender-sensitive strategies to improve childhood vaccination rates by adopting a multifaceted approach involving targeted resource allocation, community engagement, and inter-agency collaboration. Collaborating with agencies such as the JAKOA, the Ministry of Women, Family and Community Development, and educational institutions can strengthen gender-sensitive initiatives. JAKOA's involvement is crucial for addressing indigenous communities' specific barriers, while partnerships with women's and family organizations can enhance outreach to mothers. Schools and workplaces can serve as platforms for disseminating vaccination information, engaging both parents collectively.

Furthermore, involving male leaders and prominent individuals in advocacy initiatives may facilitate a transformation of norms around masculinity and enhance the acceptance of vaccination among males. Ridzuan et al. (2022) underscored the significant role of non-governmental organisations (NGOs) in bolstering government initiatives by providing the Malaysian public with timely and correct information regarding the importance and efficacy of vaccines. By considering the distinct cognitive and social elements that shape male and female opinions differently, policymakers can enhance vaccine acceptability across all demographics and promote more equal health outcomes for children statewide. Consequently, comprehending these gender-specific disparities is crucial for formulating focused health communication methods that successfully meet the distinct concerns and motivations of both male and female parents.

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Limitations of the Study and Suggestions for Future Research

This study utilized convenience sampling, which, while practical for data collection, may introduce selection bias and limit the generalisability of the findings. Notably, the sample over-represented parents employed in the public sector (64.9%), which may less accurately reflect the broader parental population's demographics and attitudes toward childhood vaccination. Public sector employees might have different access to healthcare information, resources, and social influences compared to those in the private sector or informal employment, potentially affecting their vaccination intentions.

Although the study found statistically significant differences in parental attitudes toward childhood vaccination between male and female parents, the actual mean differences were relatively small. This raises questions about the practical significance and real-world impact of these findings. The cross-sectional design further limits the ability to determine whether these attitude differences translate into meaningful differences in vaccination behaviour. Future studies incorporating behavioural measures and longitudinal designs are needed to better understand the practical implications of these attitudinal differences.

Future research should aim to address these limitations by employing probability sampling methods, such as stratified or random sampling, to capture a more representative and diverse parental population across different employment sectors and socio-economic backgrounds. Longitudinal studies could provide deeper insights into how parental attitudes evolve over time and in response to public health campaigns or disease outbreaks. Furthermore, qualitative approaches may enrich understanding of the nuanced cognitive and cultural factors influencing vaccination decisions among different gender groups.

CONCLUSION

This study sought to evaluate parental views regarding childhood vaccination in Pahang and to investigate gender-based disparities in these attitudes. The results indicated that parents in Pahang exhibit a predominantly positive attitude towards childhood vaccination, signifying robust support for immunisation initiatives. The independent t-test analysis revealed a statistically significant difference between male

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and female parents, with female parents demonstrating more favourable sentiments. This gender gap highlights the impact of socially imposed roles and obligations, as elucidated by Gender Schema Theory (Bem, 1981).

This study advances the literature by applying Gender Schema Theory to explain gender differences in health beliefs about childhood vaccination. It underscores the notion that gender norms influence how individuals interpret health information, prioritise care, and make decisions concerning their children's welfare. This study enhances comprehension of the psychological and social dynamics that influence vaccination uptake by analysing attitudes via this theoretical framework.

The study provides significant insights for public health officials and practitioners in Malaysia and other contexts. The results highlight the necessity for gender-sensitive health communication strategies that acknowledge the unique responsibilities of mothers and fathers. Although existing initiatives may successfully target moms, further efforts are required to involve fathers and promote joint parental accountability in health-related decision-making. Culturally customised outreach, inclusive communication, and male-centric educational initiatives could significantly enhance vaccine acceptance across all demographic groups.

In conclusion, although the overall perspective on childhood vaccination in Pahang is favourable, focused initiatives, particularly among marginalized or hesitant populations, are crucial to maintain elevated immunization rates and avert future outbreaks. Future research could gain from investigating other sociodemographic variables and broadening the theoretical framework to improve comprehension of vaccine-related behaviours.

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Author contributions

Nur Hidayahtul was responsible for conceptualisation, methodology, data collection, writing the original draft, and securing the research grant. Mohd Rozaimy Ridzuan provided supervision, contributed to writing the original draft, conducted data analysis, and oversaw project administration. Noor Amira Syazwani handled data curation and visualisation, and also contributed to writing – review and editing. Muhammad Redzuan was involved in investigation, writing and editing, and validation. Muhammad Iqbal managed software, performed data entry, and contributed to writing – review and editing. All authors discussed the results and contributed to the final manuscript.

Conflict of interest

The authors agree that this research was undertaken without any self-benefits or commercial or financial conflicts, and they state that they have no conflicts of interest with the funders.

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