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## Critical evaluation of factors influencing maternal knowledge, attitude, and practice regarding the immunization of their children

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### ABSTRACT

**Objective.** The objective of the study is to assess the knowledge, attitude and practice of mothers regarding the immunization of their children and find out the factors associated with it.

**Materials and Methods.** A prospective, cross-sectional study of seven months duration was carried out among 206 mothers, satisfying the inclusion criteria of having at least one child of less than 5 years of age. The socio-demographic details and other relevant information pertaining to the subjects were collected by using the data collection form and newly developed and validated questionnaire. The knowledge, attitude and practice of the subjects were assessed by using suitable statistical methods. Statistical package for social sciences (SPSS) 29.0 was used to analyse the data.

**Results.** The mean knowledge, attitude and practice scores of the total subjects enrolled in the study was found to be  $4.17 \pm 0.85$ ,  $3.61 \pm 1.08$  and  $4.06 \pm 0.99$ , respectively. Age, number of children and occupation were found to be the factors significantly associated with knowledge, attitude and practice levels of the subjects.

**Conclusions.** The findings of the present study may form the basis of all future implications to improve the level of knowledge, attitude and practice towards the immunization of their children, which ultimately contributes to better health outcomes.

### INTRODUCTION

Immunization refers to the act of providing individuals protection against infectious diseases or strengthening their resistance to them, typically through the administration of vaccines [1]. It re-

mains one of the most important public health interventions and a cost-effective technique for reducing the morbidity and mortality of infectious diseases [2, 3]. Ensuring that children receive their immunizations at the recommended

intervals and appropriate ages is of utmost importance in order to provide them with optimal protection against infectious diseases. The fundamental objective of routine immunization is to administer the full series of recommended, potent vaccines to every child in a timely, safe, and effective manner. This comprehensive approach ultimately leads to robust protection against the targeted diseases [4].

The significance of immunization extends beyond individual well-being. When a child is vaccinated, it not only safeguards their health but also plays a crucial role in preventing the spread of vaccine-preventable diseases to others within the community. Immunization acts as a vital tool for creating herd immunity, where a significant portion of the population is immune, thereby reducing the likelihood of outbreaks and protecting those who may be more vulnerable to infections [4-6]. Moreover, immunizing children with the appropriate vaccinations yields substantial economic benefits. By significantly reducing disease incidence and severity, immunization helps lower disease treatment costs and alleviate the burden on healthcare systems. This, in turn, has a positive impact on the child's quality of life, as they are less likely to experience the detrimental effects of preventable diseases. However, the poor level of knowledge, attitude and reduced compliance towards the practice of immunization may increase the vulnerability of children toward contracting the diseases [7-9].

Pregnant women should receive sufficient guidance regarding the safety and effectiveness of any medical procedures for both their own well-being and that of their newborns. Insufficient counseling often results in women missing recommended appointments and subsequently neglecting recommended vaccinations for themselves and their children, which can lead to poor compliance [10, 11].

Over the years, successful immunization programs have made significant strides in reducing the prevalence of vaccine-preventable diseases and alleviating their impact to some extent. The field of vaccine development, manufacturing, and supply has shown remarkable progress, enabling the availability of effective vaccines. Despite the presence of a systematic and efficient reporting system for adverse events following immunization, many individuals still harbour concerns regarding potential risks and injuries associated with vaccines [1,

12]. This hesitation is particularly prevalent among a significant portion of the population, including illiterate mothers living in rural areas, who firmly hold various vaccination-related myths and misconceptions. Even though immunizations including Bacille Calmette-Guérin and Oral Polio Vaccine are offered under the government schemes, there is a reluctance among these communities to utilize government-held vaccination programs. This situation poses a notable policy challenge that needs to be addressed [12, 13]. To tackle this issue effectively, it is essential to conduct studies aimed at assessing the knowledge, attitudes, and practices of mothers regarding the immunization of their children. By gaining insights into their perspectives and addressing their concerns, targeted interventions can be developed to promote vaccine acceptance and utilization, ultimately enhancing immunization coverage and safeguarding the health of children in these communities.

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## MATERIALS AND METHODS

### *Preparation, validation, translation and reliability assessment of questionnaire*

Questionnaire on knowledge, attitude and practice of mothers towards immunization of their children was developed by referring to various resources of information. Once the questionnaire was developed, it was subjected to content validation by an expert committee of members, consisting of doctors, academic and clinical pharmacists. The validated KAP questionnaire was then be translated into the local languages, Kannada and Malayalam, by professional translators. The translated versions of the questionnaire were then back translated to check the consistency of information. Test-retest reliability was assessed for all language versions of the questionnaire by administering them twice to the same patients, a week apart.

### *Study design, sample size and data collection*

A prospective cross-sectional study was conducted from November 2022 to May 2023 in the Department of Pediatrics, Justice K.S. Hegde Charitable Hospital, Deralakatte, Mangaluru. Respondents included in the current study were the

mothers who presented to the paediatrics OPD. A questionnaire was delivered to the participants who met the inclusion criteria of having at least one child of less than 5 years of age. However, the mother or child with the critical illnesses and mothers who were not willing to take part in the study were excluded. The study was approved by the Institutional Ethics Committee of NGSM Institute of Pharmaceutical Sciences, Mangaluru (NGSMIPS/IEC/029/2022).

At 95% confidence interval, considering 65.1% as the proportion ( $p$ ) of study participants with good level of knowledge and a marginal error ( $d$ ) of 7%, assuming 10% non-response rate, the calculated sample size was found to be 206. The sample size for the study was determined by using population proportion formulae:  $N = [(Z1 - \alpha / 2) / 2 p (1-p)] / d^2$ .

The data was collected from the mothers who met the study criteria in a well-developed data collection form. The relevant details of the mothers including the socio-demographic parameters such as their age, domiciliary status, educational status, marital status, occupation, socioeconomic status and their number of children was collected and recorded. Followed by this, 15-item KAP questionnaire was administered to the mothers to obtain their responses recorded in it. The questionnaire was provided based on their language of preference. By assigning a unit score for every positive response, the total score obtainable by a participant is 5 in each section.

### Statistical analysis

The data was analysed using SPSS 29.0 at 95% confidence level. Categorical variables were presented as frequency and percentage and continuous variables as mean  $\pm$  standard deviation. The difference in the mean scores of knowledge, attitude and practice was analysed by using independent t-test and ANOVA. Karl Pearson's coefficient of correlation was used to perform the correlation between knowledge, attitude and practice. The factors influencing knowledge, attitude and practice was analysed by using multiple linear regression analysis. In addition to this, a Cronbach's alpha coefficient greater than 0.70 was considered acceptable for the reliability test of the questionnaire.

### Risk and confidentiality

There was no associated risk of the current study, and the participants information were kept confidential during and after the study.

## RESULTS

### Reliability of KAP questionnaire

The reliability test was done among a total of 60 outpatients, of which 20 each were enrolled for English, Kannada and Malayalam versions of KAP questionnaire. On analysing the results, it was found that all language versions of the questionnaire were reliable with Cronbach's alpha value greater than 0.70. The details are summarized in **Table 1**.

**Table 1.** Reliability of KAP questionnaire.

Languages	Domain	Day 1 score (Mean $\pm$ SD)	Day 7 score (Mean $\pm$ SD)	Cronbach's alpha value
English	Knowledge	4.7 $\pm$ 0.55	4.7 $\pm$ 0.55	1.000
	Attitude	4.3 $\pm$ 0.47	4.4 $\pm$ 0.51	0.840
	Practice	4.1 $\pm$ 0.78	4.15 $\pm$ 0.74	0.979
Kannada	Knowledge	4.9 $\pm$ 0.30	4.9 $\pm$ 0.30	1.000
	Attitude	4.3 $\pm$ 0.48	4.6 $\pm$ 0.50	0.749
	Practice	4.3 $\pm$ 0.57	4.3 $\pm$ 0.58	0.961
Malayalam	Knowledge	4.6 $\pm$ 0.47	4.7 $\pm$ 0.41	0.866
	Attitude	4.3 $\pm$ 0.41	4.3 $\pm$ 0.49	0.943
	Practice	4.2 $\pm$ 0.73	4.2 $\pm$ 0.73	1.000

SD: Standard deviation.

### Demographic details of the subjects

Out of the total subjects enrolled, the highest number of subjects were found belonging to the age group of 25-29 years, 80 (38.8%) and 195 (94.7%) were rural residents. 205 (99.5%) were found to be married whereas 1 (0.5%) was widowed. Highest number of subjects were found to have upper primary level of education, 71 (34.5%). The majority of the subjects were found to be unemployed, 181 (87.9%) and 107 mothers constituting 51.9% were found to be belonging to the upper-lower socio-economic class as per Modified Kuppuswamy Scale (version 2022). Based on the number of children, 48.1% of mothers had 2, followed by 37.9% with one child. The details are summarized in **Table 2**.

**Table 2.** Demographic details of the subjects.

Categories	Frequency (n)	Percentage (%)
<b>Age groups</b>		
18-24	44	21.4
25-29	80	38.8
30-34	59	28.6
35-39	20	9.7
≥ 40	3	1.5
<b>Domiciliary status</b>		
Urban	11	5.3
Rural	195	94.7
<b>Marital status</b>		
Married	205	99.5
Widowed	1	0.5
<b>Educational qualification</b>		
No formal education	3	1.5
Primary level	19	9.2
Upper primary level	71	34.5
High school level	58	28.2
High secondary level	44	21.4
University level and above	11	5.3
<b>Occupation</b>		
Employed	25	12.1
Unemployed	181	87.9
<b>Socio-economic class</b>		
Upper middle	30	14.6
Lower middle	69	33.5
Upper lower	107	51.9
<b>Number of children</b>		
1	78	37.9
2	99	48.1
3	19	9.2
≥ 4	10	4.9

**Assessment of knowledge, attitude and practice of the subjects**

The mean knowledge, attitude and practice scores of the total subjects enrolled in the study was found to be 4.17 ± 0.85, 3.61 ± 1.08 and 4.06 ± 0.99 respectively.

**Comparison of knowledge, attitude and practice scores according to socio-demographic variables**

The mean score of attitudes significantly varied between the age groups as well as the level of educational qualification with P-value of 0.019 and 0.012 respectively. It was observed that there was no statistically significant difference between the knowl-

edge, attitude and practice scores of respondents based on their domiciliary status and socio-economic class. Employed mothers were found to have significantly higher level of knowledge, attitude and practice scores when compared to their counterpart. The mean scores of knowledge and attitude of the respondents varied significantly according to their number of children with P-value 0.014 and 0.023. The details are summarized in **Table 3**.

**Correlation between knowledge, attitude and practice of the respondents**

On analysing the data, a significant positive correlation was observed between knowledge and attitude (r-value = 0.232; P-value = 0.001), knowledge and practice (r-value = 0.234; P-value = 0.001), as well as with attitude and practice (r-value = 0.436; P-value < 0.001).

**Multiple linear regression analysis of knowledge, attitude and practice**

Compared to the reference category, mothers with 2 children were found significantly associated with higher knowledge. Mothers within the age group of 25-29 years and those who were employed were found to be significantly associated with higher attitude. Mothers within the age group of 25-29 and 35-39 years were found to be significantly associated with higher practice. Respondents with ≥ 4 children and who were unemployed were found significantly associated with lower practice scores. The details are summarized in **Table 4**.

**DISCUSSION**

The present study was conducted to assess the knowledge, attitude, and practice of mothers regarding the immunization of their children. To achieve this aim, a KAP questionnaire was prepared with five questions each within the three domains. Upon validation and translation, reliability of the questionnaire was evaluated. The Cronbach’s alpha values calculated for the three domains of the English version of the questionnaire were 1.000, 0.840, and 0.979, respectively. The mean scores of knowledge, attitude and practice were obtained as 4.17 ± 0.85, 3.61 ± 1.08, and 4.06 ± 0.99, by assigning a score of one for each correct answer to a question. Sinuraya *et al.* conducted a study similar to the pres-

**Table 3.** Comparison of knowledge, attitude and practice scores.

Variables	Knowledge		Attitude		Practice	
	Mean ± SD	P-value	Mean ± SD	P-value	Mean ± SD	P-value
<b>Age group</b>						
18- 24	3.89 ± 1.04	0.108	3.34 ± 1.36	0.019*	3.73 ± 1.17	0.06
25- 29	4.28 ± 0.78		3.86 ± 0.87		4.19 ± 0.83	
30- 34	4.27 ± 0.74		3.54 ± 1.04		4.17 ± 0.85	
35- 39	4.05 ± 0.89		3.60 ± 0.99		4.05 ± 1.19	
≥ 40	4.00 ± 0.00		2.33 ± 1.15		3.33 ± 2.08	
<b>Domiciliary status</b>						
Urban	4.64 ± 0.67	0.057	4.00 ± 0.63	0.219	4.55 ± 0.69	0.092
Rural	4.14 ± 0.85		3.59 ± 1.09		4.03 ± 0.99	
<b>Educational qualification</b>						
No formal education	4.00 ± 1.00	0.209	3.33 ± 1.15	0.012*	3.67 ± 1.53	0.101
Primary level	4.00 ± 0.88		3.16 ± 1.17		3.79 ± 0.92	
Upper primary level	4.28 ± 0.72		3.51 ± 1.07		3.96 ± 0.90	
High school level	4.03 ± 0.99		3.48 ± 1.11		4.00 ± 1.14	
High secondary level	4.11 ± 0.84		4.05 ± 0.94		4.30 ± 0.93	
University level and above	4.64 ± 0.50		4.09 ± 0.70		4.64 ± 0.50	
<b>Occupation</b>						
Employed	4.52 ± 0.65	<b>0.025*</b>	4.32 ± 0.63	<b>&lt; 0.001*</b>	4.68 ± 0.56	<b>0.001*</b>
Unemployed	4.12 ± 0.86		3.51 ± 1.09		3.97 ± 1.00	
<b>Socio-economic class</b>						
Upper middle	4.37 ± 0.81	0.202	3.97 ± 1.22	0.146	4.23 ± 1.14	0.516
Lower middle	4.04 ± 0.95		3.57 ± 1.04		4.07 ± 0.93	
Upper lower	4.19 ± 0.78		3.54 ± 1.05		4.00 ± 0.98	
<b>Number of children</b>						
1	4.00 ± 0.93	<b>0.014*</b>	3.78 ± 1.10	<b>0.023*</b>	4.14 ± 1.00	0.065
2	4.34 ± 0.76		3.64 ± 1.00		4.10 ± 0.96	
3	4.16 ± 0.69		3.11 ± 0.94		3.89 ± 0.81	
4	3.70 ± 0.95		3.61 ± 1.08		3.30 ± 1.16	

SD: Standard deviation; \*indicates the statistically significant values.

**Table 4.** Multiple linear regression analysis of knowledge, attitude and practice.

Variables	Knowledge				Attitude				Practice			
	B	P-value	95%CI for B		B	P-value	95%CI for B		B	P-value	95%CI for B	
			Lower bound	Upper bound			Lower bound	Upper bound			Lower bound	Upper bound
Constant	4.79	0.00	3.53	6.06	4.09	0.00	2.51	5.67	4.37	0.00	2.89	5.85
<b>Age</b>												
25- 29 vs 18- 24 <sup>a</sup>	0.22	0.20	-0.11	0.55	0.52	<b>0.01*</b>	0.11	0.94	0.45	<b>0.02*</b>	0.07	0.84
30- 34 vs 18- 24 <sup>a</sup>	0.19	0.31	-0.17	0.54	0.17	0.46	-0.28	0.61	0.41	0.06	-0.01	0.83
35- 39 vs 18- 24 <sup>a</sup>	0.04	0.87	-0.46	0.54	0.51	0.11	-0.12	1.13	0.60	<b>0.04*</b>	0.01	1.19
≥ 40 vs 18- 24 <sup>a</sup>	0.14	0.79	-0.89	1.18	-0.46	0.48	-1.76	0.83	0.16	0.80	-1.06	1.37
<b>Domiciliary status</b>												
Rural vs Urban <sup>a</sup>	-0.41	0.14	-0.96	0.14	-0.05	0.89	-0.73	0.63	-0.30	0.35	-0.94	0.34
<b>Educational qualification</b>												
Primary level vs No formal education <sup>a</sup>	-0.25	0.64	-1.30	0.80	-0.27	0.69	-1.58	1.04	-0.15	0.81	-1.38	1.08
Upper primary level vs No formal education <sup>a</sup>	0.02	0.97	-1.00	1.05	0.00	1.00	-1.28	1.28	-0.03	0.96	-1.23	1.17
High school level vs No formal education <sup>a</sup>	-0.27	0.61	-1.31	0.78	-0.08	0.91	-1.38	1.23	0.00	1.00	-1.22	1.23
Higher secondary level vs No formal education <sup>a</sup>	-0.28	0.61	-1.35	0.79	0.29	0.67	-1.05	1.63	0.13	0.83	-1.12	1.39
University level and above vs No formal education <sup>a</sup>	0.07	0.91	-1.11	1.26	0.14	0.85	-1.34	1.62	0.28	0.69	-1.11	1.67
<b>Occupation</b>												
Unemployed vs employed <sup>a</sup>	-0.32	0.10	-0.71	0.06	-0.56	<b>0.02*</b>	-1.04	-0.08	-0.47	<b>0.04*</b>	-0.93	-0.02
<b>Socioeconomic class</b>												
Lower middle vs Upper middle <sup>a</sup>	-0.20	0.32	-0.60	0.19	-0.14	0.57	-0.64	0.35	0.16	0.50	-0.31	0.62
Upper lower vs Upper middle <sup>a</sup>	-0.07	0.72	-0.48	0.33	-0.11	0.67	-0.61	0.40	0.16	0.51	-0.32	0.63
<b>Number of children</b>												
2 vs 1 <sup>a</sup>	0.33	<b>0.02*</b>	0.06	0.59	-0.16	0.35	-0.49	0.17	-0.11	0.49	-0.42	0.20
3 vs 1 <sup>a</sup>	0.09	0.68	-0.36	0.54	-0.53	0.06	-1.09	0.03	-0.25	0.36	-0.77	0.28
≥ 4 vs 1 <sup>a</sup>	-0.28	0.41	-0.95	0.39	-0.57	0.18	-1.40	0.26	-0.88	<b>0.03*</b>	-1.66	-0.10

<sup>a</sup>Reference category; \*indicates statistically significant values, CI: interval of confidence.

ent research, where they employed a questionnaire originally prepared in English language, translated into the participants' native language. The questionnaire consisted of 9 questions on knowledge, 4 questions on attitude, and 5 questions on practice. Upon comparing the Cronbach's alpha values, they obtained lower values, indicating the better reliability of our study tool. By following a scoring pattern similar to the present study, the mean scores obtained for the knowledge, attitude, and practice domains were  $7.22 \pm 1.30$ ,  $3.93 \pm 0.31$ , and  $3.59 \pm 0.97$ , respectively [14].

On analysing the data, a significant positive correlation was observed between knowledge and attitude (P-value 0.001), knowledge and practice (P-value 0.001), as well as attitude and practice (P-value < 0.001). Sinuraya *et al.* also reported a similar observation in their study [14].

According to the multiple linear regression analysis, mothers with 2 children when compared to those with one child were found significantly associated with higher knowledge in the present study. Although not significant, the mean knowledge score among mothers with 4 or more children were found to be less than those with one child. As per the results of Bernsen RM *et al.* number of children was not found as a factor associated with knowledge [15]. These variations could be due to individual differences as every person has unique characteristics and experiences that influence their knowledge and behaviour. Having two children provides mothers with double the experience and exposure to the vaccination process. They may have already gone through the vaccination journey with their first child, witnessing the benefits and safety of vaccines firsthand. This experience helps build their knowledge and understanding of vaccination. Moreover, mothers with two children often have interactions with healthcare providers for routine check-ups, immunization and healthcare consultations. These repeated visits provide opportunities to receive detailed information about vaccinations. Mothers with many numbers of children may have more demands on their time and attention which could affect their ability and opportunity to actively seek out information about immunization through discussions with health care professionals.

According to the present study results, mothers within the age group of 25-29 years were found to be significantly associated with higher attitude when compared to the age group of 18-24 years

and the later were significantly associated with lower practice in comparison to mothers who were of 25-29 and 30-34 years of age. Adefolalu *et al.* conducted a similar study and have found a statistically significant association between the mother's age and immunizing their children. The study concluded that the older the mothers the better their practice of immunizing [1]. There could be several factors that contribute to younger mothers having lower attitudes and practices regarding immunization of their children, compared to older mothers. Older mothers may have more parenting experience and a great sense of responsibility, which can lead to a more proactive approach towards their child's health, including immunization. These experiences may also lead to stronger beliefs in the effectiveness and importance of vaccines.

According to the multiple linear regression analysis, the mothers who were unemployed were found to be significantly associated with lower practice when compared to the employed mothers. Awadh *et al.* conducted a similar study in which significantly higher practice score was found among employed subjects when compared to unemployed [16]. Adefolalu *et al.* also conducted a similar study in which the occupation of the mother showed a statistically significant association with the practice of mothers' immunization. Higher proportions of mothers who were able to fully immunize their children were found among those who were formally employed [1]. Employed mothers may have more exposure to information related to child health and immunization through their colleagues and other workplace programs. Unemployed mothers, on the other hand may have less access to such information networks, which can impact their attitude and practice towards immunization.

According to the present results, the respondents with  $\geq 4$  children were found significantly associated with lower practice when compared to those with one child. Mothers with multiple children may face greater time constraints and demands on their day-to-day schedules. With their competing priorities, managing the needs of multiple children including their healthcare appointments, can be challenging, and it may result in difficulties in keeping up with the immunization schedules.

Nevertheless, various factors influencing mothers' understanding, attitudes, and behaviours regarding their children's future, starting from pregnancy, can shape their perceptions. Experiencing an adverse event in a previous pregnancy tends to foster

protective attitudes toward the unborn child and heighten awareness regarding the desired health outcomes for the child [17]. Such past negative experiences prompt vigilance among mothers and may also impact their inclination towards seeking vaccinations for their children.

There are a few limitations in this study that should be acknowledged. Firstly, being a single centred study, the findings may not be easily applicable or generalizable to other settings or populations. Secondly, as the data was collected exclusively through participant self-reporting, it may introduce the possibility of biases, including recall and response biases commonly associated with surveys of this type.

## CONCLUSIONS

The mean knowledge, attitude and practice scores of the total subjects enrolled in the study was found to be  $4.17 \pm 0.85$ ,  $3.61 \pm 1.08$  and  $4.06 \pm 0.99$ , respectively. Compared to the reference category, mothers with 2 children were found significantly associated with higher knowledge. On analysis, mothers within the age group of 25-29 years and those who were employed were found to be significantly associated with higher attitude. Mothers within the age group of 25-29 and 35-39 years were found to be significantly associated with higher practice. Respondents with  $\geq 4$  children and who were unemployed were found significantly associated with lower practice scores. The findings of the present study would form the basis of all future implications including education intervention programs to improve the level of knowledge, attitude and practice towards the immunization of their children, which ultimately contributes to better health outcomes.

## COMPLIANCE WITH ETHICAL STANDARDS

### *Authors' contribution*

N.S., N.U.P., D.S.K.M., S.C.: Conceptualization. N.S., N.U.P., D.S.K.M., C.G.: Data Curation. N.S., N.U.P., R.K., S.C.: Formal analysis, investigation, methodology, software, resources. N.U.P., D.S.K.M.: Supervision. N.U.P., R.K.: Validation. N.S., C.G.: Writing - original draft. N.U.P., S.C.: Writing - review & editing.

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None.

### *Study registration*

N/A.

### *Disclosure of interests*

The authors declare that they have no conflict of interests.

### *Ethical approval*

The study was approved by the Institutional Ethics Committee of NGSIM Institute of Pharmaceutical Sciences, Mangaluru (NGSMIPS/IEC/029/2022).

### *Informed consent*

Written volunteer consent was obtained from all the patients prior to enroll them in the study.

### *Data sharing*

Data are available under reasonable request to the corresponding author.

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