

Maternal Knowledge, Perceptions and Age-appropriate Coverage of Routine Immunization in Children under Five Years in Southern Sri Lanka

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ABSTRACT— *Background: Immunization is one of the most cost-effective strategies used for control of life-threatening infectious diseases. Use of immunization services in childhood is greatly influenced by parental knowledge and attitudes regarding immunization and its benefits.*

Objective: To assess the maternal knowledge, perceptions and coverage of routine immunization in children under five years in Bope-Poddala health division in Southern Province, Sri Lanka.

Methods: A cross-sectional study was conducted among 216 mother-child pairs attending Maternal and Child Health clinics in Bope-Poddala area. An interviewer-administered questionnaire was used to collect data on maternal knowledge, beliefs and attitudes regarding routine immunization of children under five years, under Expanded Programme of Immunization (EPI). The level of knowledge was determined by assigning marks to correct responses for questions on knowledge. Age appropriate immunization of children was assessed using Child Health Development Records. Data were analyzed using SPSS statistical software package.

Results: Although 32% of mothers knew that vaccination prevents communicable diseases, only 11% had good knowledge regarding the EPI vaccine schedule and the diseases prevented by these vaccines. Public Health Midwife was the source of knowledge in 91.2%. Mothers' knowledge was significantly associated with their occupation ($p < 0.001$). Majority of the mothers (>75%) had positive attitudes towards immunization, while attitudes were not associated with maternal characteristics. Almost all of the children (99.5%) were appropriately vaccinated for their age.

Conclusions: Maternal knowledge regarding the EPI schedule is poor and is influenced by their occupation. In contrast, the attitudes and practices regarding immunization appear to be satisfactory. Further health education is necessary to eliminate misbeliefs regarding immunization.

Keywords— knowledge, attitudes, immunization coverage, Expanded Programme of Immunization, Sri Lanka

1. INTRODUCTION

Immunization is the process from which a person is protected against an infectious disease, normally by the administration of a vaccine [1]. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease. Immunization is a key public health strategy used for control and elimination of life-threatening infectious diseases, especially among children [2]. The Expanded Programme of Immunization (EPI) was established in 1974 to impart protection against six vaccine preventable diseases including whooping cough, diphtheria, tetanus, tuberculosis, measles and poliomyelitis [3]. Since then, it has become a part and parcel of maternal and child health care in many countries including Sri Lanka [4].

In Sri Lanka, the coverage of routine immunization within the first two years of life is over 99% in many areas. The areas reporting low coverage are located in the plantation estate sector, North & East regions affected by the civil war and urban slum areas in Colombo [5]. However, immunization with subsequent vaccines, especially vaccines administered to school going children such as Diphtheria & Tetanus (DT) or adult Tetanus and Diphtheria (aTD) show relatively poor coverage compared to infant immunization coverage [5]

The reasons contributing to poor immunization coverage has been studied by researchers worldwide and among other things, parental knowledge and beliefs has been recognized to influence utilization of immunization services. A study performed in Lao People's Democratic Republic found that both the knowledge and coverage of vaccination in children were low and were driven by maternal ethnicity, paternal education as well as notice of the vaccination date by medical staff [6]. In an Ethiopian study, maternal education and birth order were considerably related with good knowledge of vaccination and maternal education was also linked with positive attitude towards immunization of infants [7]. Another rising issue that threatens immunization coverage, especially in developed countries is 'concerns about vaccine safety'. Due to disease elimination, the memory of vaccine preventable diseases is fading; therefore, parents feel more threatened by the side effects of vaccines. A study in the United States found that children of parents who concern regarding side effects or who thought that their child was getting too many shots had considerably lower coverage than children of parents who had no such fear [8].

Conversely, in Sri Lanka limited evidence is available on awareness of immunization services and factors affecting their use among target populations. A study conducted in Colombo, Sri Lanka revealed that children in urban and urban slum areas report substantially different rates of immunization. This particular study concluded that, low immunization rates were associated with increasing age of the child and lower levels of education and poor knowledge of immunization of the mother [9]. Similar results were observed by other researchers across the world. Furthermore, improving maternal knowledge on immunization was proven to be effective in enhancing immunization rates, especially among low-literate populations [10-13]

This study aims to determine maternal knowledge, perceptions and age-appropriate coverage of routine immunization according to Expanded Programme of Immunization (EPI) among children under five years, the primary target group for immunization, in a health unit area in Southern Sri Lanka. The study helps in identifying the extent of knowledge deficits and possible contributory factors as well as understanding maternal attitudes towards immunization which are two important considerations in designing appropriate educational interventions to enhance immunization coverage.

2. SUBJECTS AND METHODS

A descriptive, cross-sectional study was conducted in three Maternal & Child Health (MCH) clinics situated in Kurunduwata, Godakanda and Kaleganain in the Bope-Poddala health division, in the Galle district, Southern Province of Sri Lanka. The study population comprised of mothers having children less than five years residing in Bope-Poddala area and their children. The sample size for the study was calculated based on the formula for estimating a population proportion $\{n = z^2 p (1-p)/d^2\}$ given by Lwanga and Lemeshow [14]. A z value of 1.96 and a degree of precision of 5% was considered in the above calculation and the anticipated population proportion of good knowledge regarding immunization was set at 87.2%, based on a previous study done in Western province of Sri Lanka [15].

2.1 Participants

The mothers having children less than five years, attending MCH clinics were eligible for the study. Elders/caregivers who are accompanying children other than their mothers and mothers having children who have experienced adverse effects following immunization were excluded from the sample.

The mothers accompanying children less than five years to immunization clinic who met inclusion criteria were selected using convenience sampling. All the eligible mothers who were present on each day of data collection were recruited, leading to a final sample size of 216 mothers, even though the number exceeded the calculated minimum sample size of 191. The purpose, procedure and benefits of the study were explained verbally and confidentiality of responses was assured to each participant and written informed consent was obtained before data collection.

2.2 Study instruments and data collection

The data were collected using a pre-tested, interviewer-administered questionnaire which consisted of four sections; namely socio-demographic details of the mother and the child, questions on knowledge regarding immunization and EPI vaccines, the diseases prevented by them and their adverse effects, the attitudes regarding immunization programme and the vaccines received by the child. Questions were formulated based on World Health Organization (WHO) guidelines on immunization schedule, study instruments used in similar and previous research and published literature of knowledge and attitudes related to immunization. The information on immunization received by the child collected through the questionnaire was verified by cross-checking with the Child Health Development Record of the child, which contained the details of all vaccinations given to the child.

Data collection was carried out by the principal investigator at MCH clinics. A separate room was arranged for interviews to ensure privacy and comfort of the participant. Confidentiality of information obtained was assured by assigning a unique identification number for each participant and storing data in password-protected computers.

Each correct answer for the questions related to knowledge was given one mark and incorrect answers or unknown answers were given 0 marks. The attitudes regarding immunization were also scored similarly by assigning one mark for each positive attitude. The initial scoring was carried out by the principal investigator and verification of assignment of marks was done by a second independent assessor. Based on the cumulative marks scored by the respondents (expressed as a percentage of the total score), their knowledge on EPI was categorized into three levels as poor, average or good.

2.3 Statistical analysis

Responses were numerically coded and entered into a database created using Microsoft Excel (2007) worksheet. Data were analyzed using SPSS (version 17.0) statistical software package. All categorical variables were described by using frequencies and percentages. Pearson's chi square test was used to assess the significance in associations between the level of knowledge/attitudes and demographic variables.

The study protocol has been reviewed and approved by the Ethical Review Committee of Faculty of Medicine, University of Ruhuna, Sri Lanka. Administrative approval for data collection was obtained from the Medical Officer of Health of the Bope–Poddala health division.

3. RESULTS

3.1 Characteristics of mothers and children in the sample

The mean age (\pm SD) of the mothers in the sample was 29.1 (\pm 0.4) years at the time of survey. Minimum age was 16 years and maximum was 43 years. Approximately 70% of the sample was Sinhalese and the rest comprised of Muslims (29%), Tamils (0.5%) and other minor ethnic groups (**Table 1**).

Demographic characters	(n) %
Age of the mother (years)	
<25	65(30.1)
26-30	59(27.3)
>30	92(42.6)
Nationality	
Sinhala	152(70.3)
Tamil	10 (0.5)
Muslim	62(28.7)
Other	10 (0.5)
Religion	
Buddhism	152(70.4)
Hindu	10(0.5)
Catholic	20(0.9)
Islam	61(28.2)
Educational level	
No schooling	6(2.8)
Grade1-5	12(5.6)
Grade6-11	37(17.1)
Up to G.C.E.O/L	87(40.3)
Up to G.C.E A/L	62(28.7)
Tertiary education	10(4.6)
Income (LKR)	
<5000	16(7.5)
5000-10000	29(13.4)
11000-15000	62(28.7)
16000-20000	48(22.3)
>21000	61(28.2)
Present occupation	
Not working	196(90.7)
Government	15(6.9)
Private	5(2.3)
Children's age	
<2 months	9(4.2)
3-24 months	76(35.2)
25-36 months	38(17.6)
37-48months	68(31.5)
>49 months	25(11.5)
Total	216(100.)

Table 1: Distribution of sample according demographic characteristics

Nearly Forty Percent of the mothers (40.3%) had completed post primary education. Only 4.6 % of the sample had tertiary educational qualifications. Approximately 90% of the mothers were housewives and the rest worked for government and private sector. Most of them had monthly family incomes between 11,000 to 15,000 Sri Lankan rupees (LKR) (approximately \$85-120) [16].

3.2 Knowledge of mothers regarding immunization and EPI vaccine schedule

The mean score obtained for the questions assessing knowledge regarding EPI was 33.6% (SD \pm 0.8%, median=32.6%, minimum=10.9%, and maximum=100.00%). Only 11% of the mother's had good knowledge (scores

above 55%), whereas 64 % had poor knowledge (scores below 26%).

Although 98% of the mothers were aware about the importance of immunization for their children’s health, only 32% knew that vaccination prevents communicable diseases. Interestingly, 64% of the mothers erroneously believed that vaccination prevents both communicable diseases and hereditary diseases. The majority were aware about BCG and Oral polio vaccines (approximately 87% and 88% respectively) and the awareness of other vaccines was comparatively low (**Table 2**).

Vaccine	Number correctly answered (%)		
	Whether given in Routine immunization	Time Schedule	Indication
BCG	188 (87.0)	177 (81.9)	180(83.3)
Pentavalent (DPT,Hep.B,Hi.B)	14 (06.5)	14 (06.5)	5(02.3)
Tetanus	34 (15.7)	10 (04.6)	7(03.2)
Hi.B	12 (05.5)	12 (05.5)	4 (01.8)
Hepatitis B.	66 (30.5)	67 (31.0)	7 (03.2)
Pertussis	15 (06.9)	14 (06.5)	7 (03.2)
Diphtheria	22 (10.2)	25 (11.5)	11 (05.1)
Oral Polio	191 (88.4)	178 (82.4)	145 (67.1)
Japanese Encephalitis	91 (42.1)	86 (39.8)	55 (25.4)
MMR	93 (43.0)	90 (41.7)	7 (03.2)
Measles	10 (04.6)	9 (04.2)	4 (01.8)
Mumps	18 (08.3)	15 (06.9)	6 (02.8)
Rubella	41 (18.9)	37(17.1)	14 (06.5)

Table 2: Distribution of knowledge of the mothers regarding EPI vaccine schedule (n=216)

Approximately 95% of the mothers were aware of the possibility of adverse reactions following immunization and anaphylaxis was the most recognized adverse reaction (92.1%). The most common source of information about immunization was the public health midwives (91%) and the mothers were made aware about vaccination during MCH clinic sessions. The mothers had been informed less by doctors (24.5%), neighbors (24.1%) and media (26-35%).

During bivariate analysis, the variables age groups, ethnicity, religion, education level, occupation and monthly income were assessed for their association with the level of knowledge on immunization. The chi-square test revealed there was a significant association between maternal occupation and the knowledge of immunization. A poor knowledge regarding EPI was seen among unemployed mothers and the knowledge was significantly better among mothers who are government sector employees ($p<0.001$). However, the knowledge of immunization was not associated with the age, ethnicity, religion, educational status or monthly income of the mothers (**Table 3**).

Demographic variable	Level of Knowledge on EPI vaccination schedule			P Value
	Poor No (%)	Average No (%)	Good No (%)	
Age of the mother (years)				
<25	15(25.4)	41(69.5)	03(5.1)	0.520
26-30	16(24.6)	43(46.3)	06(4.8)	
>31	15(16.3)	70(76.1)	07(7.6)	
Ethnicity				
Sinhala	26(05.0)	113(74.3)	13(8.6)	0.157
Muslim	19(30.5)	40(64.5)	03(4.8)	
Tamil	1(100.0)	0 (0.0)	0 (0.0)	
Religion				
Buddhism	26(17.1)	113(74.3)	13(8.6)	0.126
Islam	19(31.1)	36(63.9)	3(4.9)	
Hindu	1(100.0)	0 (0.0)	0 (0.0)	
Catholic	0 (0.0)	2(100.0)	0 (0.0)	
Educational Level				
Upto grade 11	12(21.8)	40(74.5)	2(3.60)	0.584
O/L-A/L	10(22.1)	103(69.1)	13(8.7)	
Tertiary Education	01(8.3)	10(83.3)	1(8.3)	
Occupation				
Government Sector	0 (0.0)	10(66.7)	5(33.5)	0.000
Private Sector	0 (0.0)	5(100.0)	0 (0.0)	
House Wives	46(23.5)	139(70.9)	11(5.6)	
Monthly Income (LKR)				
<15,000	28(26.2)	74(62.9)	5(4.7)	0.098
15,000 and above	18(16.5)	86(73.4)	11(10.1)	

Table 3: Association between socio-demographic characteristics and mother's knowledge on immunization

3.3 Attitudes of mothers regarding immunization

Results revealed that 98% of the mothers were in favor of vaccination. Despite the low levels of knowledge, the majority of the mothers (>75%) demonstrated positive attitudes regarding the Expanded Programme of Immunization (Table 4). There was no association between the attitudes and the socio-demographic characteristics of the participants.

Attitudes	Number (%)				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Administering vaccines brings deadly effects to your child.	3(139.0)	43(19.8)	34(15.6)	87(40.0)	49(22.5)
There is no need to immunize the child against rare diseases Like Polio, Diphtheria.	2(0.9)	12(5.5)	12(5.5)	125(57.5)	73(33.6)
Vaccines given in the Private hospitals are of better quality than Vaccines given in Government hospitals.	1(0.5)	15(6.9)	15(6.9)	130(59.8)	72(33.1)
It is better not to give vaccines like JE, Rubella than be ill after giving the vaccine.	7(3.2)	10(4.6)	10(4.6)	132(60.7)	61(28.1)
Going to the clinic to immunize your child is just waste of time.	0 (0.0)	3(1.4)	3(1.4)	135(62.1)	65(14.6)
You have to give immunization as it is important for the school entry of your child	2(0.93)	5(2.3)	8(3.7)	135(62.1)	65(14.6)

Table 4: Distribution of attitudes of the mothers regarding EPI Programme (n=216)

3.4 Age appropriate immunization coverage of the children

The overall coverage of age appropriate immunization was (99.53%). Irrespective of the source of information and level of knowledge regarding EPI, nearly all mothers had immunized their children (Table 5).

4.

Age Groups	Age Appropriation Immunization Coverage		
	Yes No (%)	No No (%)	Total No (%)
Up to 12 months	53(24.5)	0 (0.0)	53(24.5)
13 to 24 months	34(15.7)	0 (0.0)	34(15.7)
25-36 months	37(17.1)	0 (0.0)	37(17.1)
37-48 months	67(31.0)	1(0.5)	68(31.5)
≥49 months	24(11.1)	0 (0.0)	24(11.1)
Total	215(99.5)	1(0.5)	216(100.0)

Table 5: The distribution of age-appropriate immunization coverage in different age groups of the sample

5. DISCUSSION

This study was conducted to assess the maternal knowledge regarding routine immunization under the Expanded Programme of Immunization of children under five years in Bope-Poddala health division in Galle district. The demographic characters associated with the knowledge, mothers' attitudes on immunization, the information sources contributing to awareness and the age appropriate immunization of their children were also assessed.

The majority of the mothers (98%) in this study were aware about importance of immunization though with a certain degree of confusion. This is evident by the beliefs that immunization can prevent hereditary and non-communicable diseases. The knowledge on individual vaccines in the schedule was inadequate except for the BCG and Oral Polio vaccines, known to over 80% of the subjects. However, their poor awareness of the EPI vaccines, the vaccine schedule and indications was not a limiting factor in accepting the immunization services which was evident by the near 100% coverage of age appropriate immunization among the children of these mothers.

The findings of this study revealed some similarities and differences when compared to studies conducted in other Asian settings such as Pakistan, India and Cambodia. In accordance with our study findings, several revealed inadequate levels of knowledge on immunization, particularly in rural area [17-19]. Bope-Poddala is classified as a rural area according to the classification used by the Department of Census and Statistics [20]. However, one study conducted in Colombo, the capital of Sri Lanka demonstrated contrasting findings, and in the particular study 87.2% of the mothers had good knowledge regarding immunization [15]. Although the differences in methods and instruments used to assess knowledge could have contributed for the contrast findings observed, this urban-rural disparity in knowledge has been observed by researchers in other settings [21].

Evaluation of factors associated with knowledge regarding immunization revealed some important findings. Maternal knowledge on immunization was influenced by the mother's occupation in this sample, thus employed mothers had better knowledge scores, compared to unemployed mothers. Although it could be hypothesized that the employed mothers are better educated and have more access to information through a wider social circle which could explain their better knowledge regarding EPI, this assumption was not supported by the findings. Although, an association was found between occupational status and maternal knowledge of EPI and the main source of knowledge for the majority was the Public Health Midwife.

Interestingly, there was no association of knowledge on EPI with the mother's age, ethnicity, educational status and the age of the child. This is in contrast to the findings observed in similar studies conducted in several other settings [11] [13] [22-24]. The relationship between poor maternal education and an insufficient knowledge regarding immunization has been well known, both in Sri Lanka and other settings [15] [25-26]. In the present study however, the educational level of mothers failed to demonstrate an association with their knowledge regarding immunization and the EPI programme. This could possibly be due to the equal access to health information by all social strata including the underprivileged groups through field healthcare workers, which is a remarkable feature in Sri Lankan health care system.

The majority of the mothers were informed about the immunization programme by the Public Health Midwives – the grass root level health workers of their respective residential areas. Consequently, irrespective of the educational level of the mothers and their inadequate knowledge regarding immunization, the coverage of age appropriate immunization had been optimal. This emphasizes the importance of a well-trained field staff, with capability of directing the community towards utilization of preventive care services despite the knowledge gaps in the target groups.

Considering the attitudes of mothers on EPI programme, the study revealed that more than 75% of participants had good attitudes. There was no association between the attitudes and the socio-demographic characteristics of the participants, which again could be a reflection of the efficacy of the health education efforts by the public health field staff.

Despite a relatively high awareness of the immunization and adverse reactions following immunization in 94%, the use of print and electronic media as a source of information was insufficient. In concordance, other studies also reveal that the parents' access to EPI knowledge and information was obtained mainly from publicity of doctors and supporting staff [27-28]. The passive, person-to-person transfer of knowledge through health care workers appears to be the most successful method of improving health care utilization across social boundaries. A community based randomized clinical trial conducted in Pakistan has confirmed the effectiveness of home based, focused education to mothers regarding importance of immunization in enhancing immunization coverage among less literate, low income groups [10]. These findings suggest that a detailed education on individual vaccines may be unimportant in improving immunization coverage. A positive health message of the benefits of immunization, along with ongoing reminders of the next scheduled vaccine as practiced in Sri Lanka appear to be highly effective in enhancing participation in vaccination programmes [29-30].

The age appropriate immunization coverage observed among children under five years in this study was 99.53%, confirming an equitable access of immunization services by all social groups. This is comparable to the immunization

coverage patterns observed in developed countries [31] [32]. Routine immunization coverage among children under 5 years was reported to be lower in many other countries of the region [33] [34]. Frequent opportunities of directing children for immunization services by the Public Health Midwives, available through clinic and domiciliary care, could be the main reason for high coverage of immunization in this sample of infants and preschoolers. This may further explain the poor immunization coverage for vaccines such as DT and aTD in school going children, since regular contact with health services offered by Public Health Midwife and MCH clinics is discontinued after the preschool years.

One major limitation in this study is that the sample was recruited from those attending Maternal and Child Health (MCH) clinics. Such mothers are likely to have better health seeking behaviors and this could be the reason for their positive attitudes and remarkable coverage of age appropriate immunization even among older children in this sample. A more accurate picture of the immunization coverage would be obtained by replicating this study in the community, which would enable inclusion of mothers and children who do not attend MCH clinics as well. The poor knowledge of immunization among the mothers attending clinics may also be predictive of even lower levels of knowledge among those who fail to attend the field clinics, an aspect which can be captured only by a community based design.

Another limitation of this study is the inability to provide explanations for the misconceptions observed in relation to immunization. No probing was done to identify the underlying factors and beliefs contributing to the misconceptions. Such knowledge would be useful in designing health education interventions for mothers of children with poor vaccination histories.

A common source of error in studies of this nature is the bias due to provision of ‘socially desirable responses’ by the participants, especially when assessing attitudes. Although use of an interviewer-administered questionnaire may increase the possibility of such bias, we expect that the assurance of anonymity and confidentiality of data and emphasis on the importance of providing true responses would have limited its occurrence.

Although calculation of sample size for this study was done based on a higher estimated proportion of good knowledge of immunization, our findings revealed a much lower value. It was not possible to verify whether the differences of proportions were due to actual differences in study populations or due to the effect of a greater sampling variation affecting the generalizability of findings.

The inability to assess the temporal relationship between variables is an inherent flaw in cross sectional designs. However, the dependent variables used in this study (knowledge and attitudes of immunization) are unlikely to have a reverse association with the socio-demographic variables, thereby ruling out any ambiguities in interpretation of findings.

6. CONCLUSION

This study concluded that the knowledge on routine immunization among mothers of children under five years was not satisfactory though the majority of mothers had positive attitudes towards the EPI programme. The age appropriate immunization coverage was nearly 100% despite poor awareness, which highlights the role of public health field staff in promoting immunization in children under 5 years, especially in rural communities. While strengthening this role, additional efforts should be made to dispel wrong beliefs regarding immunization which considers it as a means of preventing any form of illness.

The knowledge deficits identified in this study will guide health care workers in designing educational programmes /short seminar sessions for vulnerable groups, based on parents’ demographics. A qualitative approach is recommended to facilitate in-depth analysis of factors underlying the misconceptions regarding vaccination. Amidst growing concerns about vaccine safety and the waning nature of vaccine preventable diseases, the challenge of public health professionals would be to identify effective messages to maintain optimum coverage and continued participation in vaccination programmes.

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