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Original Investigation

Factors Associated with Japanese Encephalitis Vaccination Status during Routine Immunization among Children Aged 24-59 Months in Birendranagar Municipality, Nepal

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ABSTRACT

INTRODUCTION: Most authorities agree that the control of JE requires universal childhood immunization. JE (Japanese Encephalitis) vaccination in routine immunization coverage is low and fluctuating sometimes in Nepal. Therefore, this study conducted to understand the factors associated with the low coverage of JE. **MATERIALS AND METHODS:** A cross-sectional study design was conducted among children in routine immunization in Birendranagar Municipality of Nepal. Mix methods were applied to gather information from the respondents. Lottery method was used to select wards and respondents were selected randomly based on Proportionate to Population Size (PPS). Face to face interview was done with the help of structured questionnaire to the mother of children. Univariate and multivariate analysis were performed. **RESULTS:** Among 321 respondents of the study, the mean age of mothers of 15-44 years was 26.3 ± 4.4 years. It was found that, 20.9% (n=67) of mothers had heard about JE disease however only 15% (n=48) of the mothers had heard about JE vaccine. About 38.3% (n=123) of the mothers, reported that Female Community Health Volunteer (FCHV) were the major source of information. This study reported that the coverage of JE vaccine was 52.3% (n=168), and average age of receiving JE vaccine was 13±1.4 months. **CONCLUSIONS:** The findings of this study recommends that focused program should be conducted to increase the knowledge of mothers and FCHV and health workers should be mobilized as major source of information for vaccination.

Keywords: FCHV, Immunization, Japanese Encephalitis, Vaccination.

INTRODUCTION

Japanese encephalitis (JE) is a mosquito borne zoonotic disease caused by Japanese Encephalitis Virus (JEV), which is a member of the family Flaviviridae [1]. First Outbreak was observed in Tokyo metropolitan, affecting many people. The causative agent of the disease was transmitted by mosquitoes *Culex tritaeniorhynchus* [2]. JE is the leading cause of viral encephalitis in Asia, with 30,000–50,000 cases reported annually [3]. Major epidemics were reported from Japan (1871 and 1924); northern Vietnam (1965); Thailand (1969, 1970); India (1973); Nepal (1978) and from Sri Lanka (1985-87). JE was first confirmed in western part of Nepal in 1978. Since then, JE has been confirmed in 54 districts of Nepal. 1777 cases of JE has been serologically confirmed in Nepal from 2004-2007, and has been confirmed in all age groups in Nepal. Almost 50 % of the cases were 15 year or younger in age. The highest incidence rate was in the age group of 5-15 years. JE is more common in males than in females, probably due to their greater exposure during the mosquitoes feeding hours [3]. Within the Terai region, JE incidence and mortality rate are higher in four hyper-endemic western districts - Kailali, Bardiya, Banke and Dang [4]. High mortality and disability rate has made JE a disease of public health priority [3]. Most authorities agree that the control of JE requires

universal childhood immunization, because 70% of the reported cases occur in children and mosquito vectors breed in rice paddies, making vector control virtually impossible [5]. The incidence of the disease among non-vaccinated districts was found to be comparatively higher than the vaccinated districts. Vaccination has been found to be an effective intervention in reducing the JE morbidity and mortality. Therefore, it is recommended for regular JE vaccination in all the endemic areas and is highly suggestive [6]. In Nepal, vaccination campaign began in 2006 and by 2009 mass campaign was conducted in 23 districts with the highest JE burden, followed by routine immunization for the age group 12-23 months. JE has been recognized as a public health problem in Nepal since the mid-1970s, when cases were reported from the *Terai* region in the south. Of an estimated 67,900 cases of JE annually, approximately 20–30% are fatal, and 30–50% of the survivors have neuropsychiatric sequel [7].

In Nepal, most of the studies were conducted to explore factors associated with complete immunization, upto measles vaccination. However, there has been little or no studies performed to explore factors associated with JE vaccination among the children of 24-59 months of age for routine immunization. Therefore, the objective of this study was to identify the coverage and factors associated with JE vaccination among children aged 24-59 months in regular immunization.

MATERIALS AND METHODS

Study design and setting

A descriptive cross-sectional study was designed to assess the factors associated with JE vaccination in routine immunization in Birendranagar Municipality of Nepal.

Participants, sampling and sample size

Mothers who had child aged 24-59 months and who belonged to Birendranagar Muncipality, Nepal, were eligible to participate in this study. Sample size was calculated using the formula for descriptive cross-sectional study, and the calculated sample size was 321 and was represented through simple random sampling technique. Out of the 16 wards of municipality, eight wards were selected using simple random sampling technique. From each ward, households were selected randomly based on proportionate to population size (PPS).

Data collection and study variables

Semi-structured questionnaire for household survey was used, and face to face interview technique was adopted to collect data from the mothers of children. Eligible household was found through household visit within the catchment ward. During data collection, immunization status was based on immunization card or from verbal report of mothers.

Upon identification of a child aged between 24-59 months from the household, mother of the child was asked for the presence of child's immunization card. For children's with immunization card, information about the doses and types of vaccine was copied from their immunization cards. In case of unavailability of immunization card, the mothers were asked for immunization history.

The questionnaire for study was adopted from Demographic Health Survey (DHS), WHO immunization coverage survey and from the prior researches done in other places, and then it was modified and developed according to the need of this study.

Statistical analysis and data management

The data was entered in Epi. Data 3.1, and transferred to the IBM-SPSS version 21 for further analysis. For continuous variables, mean and SD was calculated while the rate and proportions were calculated for categorical variables. Pearson Chi Square test was used to compare categorical variables.

Bivariate analysis was performed to examine the association of JE vaccination with various independent variables. Significant variables observed in bivariate analysis were included in multivariate analysis. Logistic regression model was applied to assess the strength of association between dependent and independent variables. 'p' values less than 0.05 was considered as statistically significant.

Ethical considerations

Ethical clearance was obtained from institutional review board of Institute of Medicine, Maharajgunj Medical Campus, Kathmandu. (Ref no. 115/74/75). The participants were informed about the objectives of the study, and were asked to participate voluntarily after written consent. Confidentiality of participant's information and identity was maintained.

RESULTS

More than half (55.8%) of mothers were in the age group of 25-34 years, followed by 15-24 years. The mean age of mothers was 26.2 years with SD 4.4 years and 65.1% of them were housewives. More than two third of the respondents had achieved secondary or higher education while more than 50% of the fathers had attained secondary and higher education and 37.4% of them were engaged in service sectors. All other socio-demographic characteristics of mothers and family are as depicted in Table 1.

Table 1| Distribution of socio-demographic characteristics of respondents (n=321)

Characteristics	Number	Percent
Age group (in years)		
15-24	125	38.9
25-34	179	55.8
35-44	17	5.3
Mean age ± SD	26.2 ± 4.4 years	
Educational status		
No or Informal	33	10.3
Primary	42	13.1
Secondary	149	46.4
Higher	97	30.2
Occupational status		
Housewife	209	65.1
Business	46	14.3
Agriculture	28	8.7
Job	26	8.1
Labour	12	3.7
Ethnicity		
Dalit	49	15.3
Janajati	59	18.4
Muslim	35	10.9
Brahmin/Chhetri	147	45.8
Others	31	9.7
Educational status of father		
No or Informal	10	3.1
Primary	38	11.8
Secondary	164	51.1
Higher	109	34.0
Occupational status of father		
Job	120	37.4
Business	77	24.0
Labour	46	14.3
Foreign	44	13.7
Agriculture	17	5.3
Others	17	5.3
Sex of child		
Male	176	54.8
Female	145	45.2
Continued....		

Table 1| Continued....

Birth Order		
First	158	49.2
Second	123	38.3
Third and above	40	12.5
Place of delivery		
Health Facility	298	92.8
Home	23	7.2
Family type		
Nuclear	187	58.3
Joint	121	37.7
Extended	13	4.0
Religion		
Hindu	265	82.6
Muslim	36	11.2
Christian	16	5.0
Buddhist	4	1.2

Table 2 shows the knowledge of mothers regarding JE immunization. Only 1.2% of the mothers could recall the name of all the vaccines provided by Government of Nepal (GoN). Only 7.5% of the mothers knew about the JE vaccine and only 20.9% (n=67) of the mothers had heard about JE vaccine where in 70.1% (n=47) knew that JE was preventable. Around 81% (n=38) of participants who reported to have knowledge, reported mosquito bite as the mode of transmission. More than two third of the mothers reported FCHV and health workers as the major source of information related to JE vaccination.

Table 3 shows the immunization status of children. Nearly, 44% of the children were fully immunized, 56 percent were partially immunized and no children were unimmunized. Health posts were the main place of immunization (58.5%), followed by EPI clinic (30.8%) and hospital (8.8%). Average age of child receiving JE vaccine was 13±1.4 months. Moreover, regarding their perception on behaviour of health worker, they perceived 23.98%, 57.32% and 18.69% of health workers to have good, fair and bad behaviour respectively.

Education of mother as well as engagement in any paid occupation by mothers was not found to be significantly associated with JE vaccination status. Further, age of mother and ethnicity were also not found to be associated with JE vaccination.hre was no significant difference in vaccination status across occupation and education of father. Likewise, sex of children and place of delivery was also not found to

Table 2| Recall by mother of children aged 24-59 months about vaccines under immunization (**n=321)**

Characteristics	Number	Percent
All vaccines	4	1.2
No any vaccine	190	59.2
Individual vaccine		
BCG	102	31.8
DPT1	86	26.8
DPT2	32	10.0
DPT3	34	10.6
IPV	7	2.2
PCV	15	4.7
Measles	96	29.9
JE	24	7.5
Heard about JE		
Yes	67	20.9
No	254	79.1
Among those who had heard of JE		
Knowledge about transmission of JE (n=67)		
Yes	47	70.1
No	20	29.9
Know about modes of transmission (n=47)		
Mosquito bite	38	80.9
Polluted food	4	8.5
Personal contact	2	4.3
Others	3	6.4
Know about JE preventable (n=67)		
Yes	49	73.1
Sometime	3	4.5
Don't know	15	22.4
Know about ways to prevented JE (n=52)		
Vaccination	25	48.1
Others method	27	51.9
Know about JE vaccine		
Yes	48	15.0
No	273	85.0
Age of vaccination of JE (n=77)		
Under 6 month	4	5.2
6-11 months	11	14.3
12-23 months	32	41.6
When HW says	10	13.0
Don't know	20	26.0
Number of JE vaccine to be given (n=48)		
1	33	68.8
2	14	29.2
3	1	2.1
Place for JE vaccine (n=48)		
Government health facility	40	83.3
Private clinic	8	16.7
Source of information		
FCHV	123	38.3
Health worker	112	34.9
Audio/visual aids	58	18.1
Friends/relatives	28	8.7

Table 3| Immunization status of children aged 24-59 months

Characteristics	Number	Percent
Vaccination		
All Vaccines received (n=321)	142	44.2
No any vaccine received (n=321)	0	0.0
BCG	315	98.1
Polio 1	286	89.1
Polio 2	268	83.5
Polio 3	231	72.0
DPT1	283	88.2
DPT2	271	84.4
DPT3	236	73.5
Measles	301	93.8
JE		
Card availability (n=321)		
Yes	142	44.2
Card not available	156	48.6
Never had a card	23	7.2
Immunization status (n=321)		
Fully Immunized	142	44.2
Partially Immunized	179	55.8
Unimmunized	0	0.0
Place of immunization (n=321)		
Hospital	28	8.8
PHCC	4	1.3
HP	186	58.5
EPI Clinic	98	30.8
Private clinic	2	0.6
JE vaccine Coverage		
Yes	168	52.3
No	153	47.7
Average age while receiving JE vaccine		13±1.4 months
Time taken to reach vaccination site		
Up to 30 min	269	83.8
More than 30 min	52	16.2
Average time (minutes)	21.64	
Regularity of service		
Yes	258	80.4
No	63	19.6
Perceived behavior		
Good	77	23.98
Fair	184	57.32
Poor	60	18.69

have association with their vaccination status. All the other associations between JE vaccination and various characteristics are highlighted in Table 4.

Table 5 reveals that maternal knowledge was not found significantly associated with JE vaccination of children. However, mothers whose major source of information regarding JE vaccination were FCHV and health worker were 3.584 (CI: 1.443-8.722) and 2.897 (CI: 1.169-7.179) times more likely to vaccinate their child as compared to those who received information from friends and relatives. This model reveals that the distance to immunization center, perceived regularity of services, perceived behaviour of health workers and counselling of side effects are significantly associated with JE vaccination.

Table 4| Relationship between socio-demographic characteristics and JE vaccination status of children

Characteristics	JE Immunization		p-value	Odds Ratio	95% CI	
	Yes	No			Lower	Upper
Education of mother						
No or Primary education	99 (51.8)	92 (48.2)		1		
Secondary or above	53 (54.6)	44 (45.4)	0.652	1.119	0.686	1.828
Occupation of mother						
Paid	58 (51.8)	54 (48.2)		1		
Unpaid	110 (52.6)	99 (47.4)	0.885	1.034	0.653	1.638
Age of mother						
≥30 years	130 (52.8)	116(47.2)		1		
<30 years	38 (50.7)	37 (49.3)	0.741	0.916	0.546	1.537
Ethnicity						
Relatively advantaged	81 (55.1)	66 (44.9)	0.362	0.815	0.525	1.266
Relatively disadvantaged	87 (50.0)	87 (50.0)		1		
Occupation of father						
Formal sector	106(53.8)	91 (46.2)		1		
Informal sector	62 (50.0)	62 (62.0)	0.506	0.858	0.547	1.346
Education of father						
No or primary education	103 (51.0)	99 (49.0)		1		
Secondary or above	60 (55.0)	49 (45.0)	0.494	1.177	0.737	1.878
Sex of Child						
Male	94 (53.4)	82(46.6)		1		
Female	74 (51.0)	71(49.0)	0.672	0.909	0.585	1.412
Birth order						
First and Second	155(55.2)	126(44.8)	**0.007**	2.555	1.266	5.156
Third or later	13 (32.5)	27 (67.5)		1		
Place of delivery						
Health Facility	158 (53.0)	140 (47.0)	0.377	1.467	0.624	3.451
Home	13 (56.5)	10 (43.5)		1		
Family type						
Nuclear	99 (52.9)	88 (47.1)	0.798	0.944	0.605	1.471
Joint/Extended	69 (51.5)	65 (48.5)		1		
Religion						
Hindu	143 (54.0)	122 (46.0)	0.205	0.688	0.385	1.228
Non-Hindu	25 (44.6)	31 (55.4)		1		
Wealth quintile						
Highest	34 (56.7)	26 (43.3)	0.484	1.578	0.777	3.208
Second	40 (59.7)	27 (40.3)		1.788	0.894	3.576
Middle	33 (50.0)	33 (50.0)		1.207	0.606	2.404

Fourth	32 (50.0)	32 (50.0)		1.207	0.603	2.417
Lowest	29 (45.3)	35 (52.3)		1		
Level of Knowledge						
Poor	145 (50.3)	143 (49.7)		1		
Satisfactory	23 (69.7)	10 (30.3)	**0.035**	2.268	1.042	4.936
Source of information						
FCHV	72 (58.5)	51 (41.5)	**0.019**	3.529	1.442	8.637
Health Worker	62 (55.4)	50 (44.6)		3.100	1.260	7.629
Audiovisual aids	26 (44.8)	32 (55.2)		2.031	0.770	5.356
Friends/relatives	8 (28.6)	20 (71.4)		1		
Distance to immunization center						
≤30 min	161(59.9)	108 (40.1)	**<0.001**	9.583	4.167	22.040
> 30 min	7 (13.5)	45 (86.5)		1		
Regularity of services						
Regular	163(63.2)	95 (36.8)	**<0.001**	19.903	7.713	51.356
Irregular	5 (7.9)	58 (92.1)		1		
Behaviour of health worker						
Good/Fair	158(60.5)	103 (39.5)	**<0.001**	7.670	3.373	15.803
Poor	10 (16.7)	50 (83.3)		1		
Counselling of side effects						
Yes	119(68.8)	54 (31.2)	**<0.001**	4.452	2.784	7.122
No	49 (33.1)	99 (66.9)		1		

Table 5| Factors associated with JE vaccination based on logistic regression model

Characteristics	Unadjusted			Adjusted			p-value
	Odds ratio	95% CI		Odds Ratio	95% CI		
		Lower	Upper		Lower	Upper	
Knowledge about JE							
Poor	1			1			0.058
Satisfactory	2.268	1.042	4.936	2.164	0.973	4.816	
Source of information							0.034
FCHV	3.529	1.442	8.637	3.584	1.443	8.722	0.006
Health Worker	3.100	1.260	7.629	2.897	1.169	7.179	0.022
Audio-visual aids	2.031	0.770	5.356	2.133	0.805	5.656	0.128
Friends/relatives	1			1			
Distance to immunization center							
≥30 min	9.583	4.167	22.040	8.930	3.629	21.979	<0.001
> 30 min	1			1			
Regularity of services							
Regular	19.903	7.713	51.356	14.323	5.295	38.746	<0.001
Irregular	1			1			
Behavior of health worker							
Good/Fair	7.670	3.373	15.803	4.198	1.782	9.889	0.001
Poor	1			1			
Counselling of side effects							
Yes	4.452	2.784	7.122	2.244	1.236	4.071	0.008

No	1			1			
Birth order							
First and Second	2.555	1.266	5.156	1.590	0.627	4.032	0.329
Third or lower	1			1			
Knowledge about JE							
Poor	1			1			
Satisfactory	2.268	1.042	4.936	3.123	1.027	9.499	0.045
Distance to immunization center							
≥30 min	9.583	4.167	22.040	8.976	3.590	22.443	<0.001
> 30 min	1			1			
Regularity of services							
Regular	19.903	7.713	51.356	17.037	6.040	48.054	<0.001
Irregular	1			1			
Behavior of health worker							
Good/Fair	7.670	3.373	15.803	3.959	1.634	9.593	0.002
Poor	1			1			
Counselling of side effects							
Yes	4.452	2.784	7.122	2.256	1.216	4.188	0.010
No	1			1			
Source of information							0.023
FCHV	3.529	1.442	8.637	5.153	1.759	15.083	0.003
Health Worker	3.100	1.260	7.629	4.110	1.382	12.225	0.011
Audiovisual aids	2.031	0.770	5.356	2.980	0.927	9.578	0.067
Friends/relatives	1			1			

DISCUSSION

The present study reveals that the JE vaccine coverage of 52%, which was very low than the target immunization (90%) as per the immunization protocol. Different studies showed the association of socio demographic and economic factors with immunization status of children [8,9]. The mother age at child birth was not associated with JE vaccination of children in this study. Similar findings were also found in different countries. However, the study done in rural Bangladesh and Nairobi found that children of younger mother had higher immunization rate compared to the mothers aged 30 and older [10, 11].

This study revealed that child gender was not a significant factor in immunization status which is consistent with findings of some countries [9, 12]. However, studies from semi urban village of Nepal and Bangladesh found that male child was more likely to be immunized than female child [10, 13]. The present study lacks the association between ethnicity and JE vaccination which is contrast to the finding of many countries such as Mali, Niger, Senegal, US where racial and ethnic differences reflected in vaccination of child [14]. Similarly, children from dalit, madhesi and religious minorities were four times more likely to be non-immunized compared to janjati/uppercaste children [11,15].

Bivariate analysis showed a significant association between birth order and JE vaccination. Children with birth order first and second were 2.5 times more likely to be JE vaccinated than children with birth order third or later. Similar findings were documented in studies conducted in Ghana, Nairobi and Nepal [11, 15]. The possible reasons of such association may be due to more attention from parents for child of 1st and 2nd order. This study showed no significant difference in risk between children living in a nuclear family or joint/extended family. Similar result was observed in a study done in urban slum of Nepal [15]. Religion of household had no significant relation with child vaccination which was also observed in a study done in rural Nigeria [16]. However, another study showed that

religion was highly predictive of a child vaccination status, relative to Hindu, Muslim children had 2.2 times greater odds of being non vaccinated versus fully vaccinated [17]. This study showed no significant association between education of parents and JE vaccination in bivariate analysis. However many studies conducted in developing countries revealed parent's literacy (husband and wife both) plays an important role in children's immunization ($p<0.001$) [10, 13, 18].

The bivariate analysis between occupation of both father and mother with JE vaccination shows no significant association which is similar to the findings of study done in Libya and Nepal respectively [12, 15]. Similarly this study showed no significant association between wealth quintile and JE vaccination, however many study showed relationship of wealth quintile with vaccination [10, 18]. This inconsistency may be due to the different methods used to measure socio-economic condition of households. Maternal knowledge about JE disease and vaccination showed strong association with JE vaccination status of children aged 24-59 months. Multivariate analysis of this study also shows that the likelihood of child being JE vaccinated is 3.123 times (95% CI: 1.027-9.499) higher among children whose mother had satisfactory level of knowledge about JE vaccination as compared to poor knowledge. Studies from Ethiopia, Nigeria and Japan also reported similar findings [19, 20, 21].

Multivariate logistic regression analysis of this study revealed FCHV as the major source of information on vaccination was highly effective (AOR=5.153, 95% CI: 1.75-15.08). However, in a study done in Libya, paramedical workers were the major source of information on vaccination [12]. A study from south western Nigeria shows that the role of health facility as source of awareness should be strengthened [7]. Other studies conducted in countries such as Japan, Nepal, Nairobi on similar topic showed a significant association between immunization and source of information [11,13, 21]. Multivariate analysis of this study showed that the likelihood of child being vaccinated was 8.97 times higher among those whose distance to immunization centre was less than or equal to 30 minutes as compared to more than 30 minutes. Similar results were documented in study of Assam, India and Sudan [18,22].

In multivariate analysis, children whose mother's perceived health worker behaviour as good/fair were more likely (AOR=3.95, 95% CI: 1.63-9.5) to be JE vaccinated. Similar finding was documented in a study done in Nigeria [23]. Children whose mothers received counselling service during previous immunization visits were 2.25 times more likely to be JE vaccinated then children of the non-counselled mothers. The finding of this study was consistent with finding from Ghana and Mozambique [24]. Multivariate regression analysis of this study showed that the regularity of immunization service was a significant factor for JE immunization. The study was conducted only in 8 wards of Birendranagar Municipality, Surkhet Nepal among total of 16 wards, which may not represent the district as a whole.

CONCLUSIONS

The study concluded the JE vaccination coverage was 52.3% below the official coverage of district. Among socio-demographic variables only birth order was significant in bivariate analysis but in multivariate analysis it was found not to be associated with JE vaccination. Satisfactory knowledge of mothers on JE vaccination and FCHV as a major source of information regarding JE vaccination were found significant predictors of likelihood of being JE vaccinated. Those mothers who perceived that immunization service was regular and service provider's behaviour was good/fair were more likely to vaccinate their child was outcomes of this study. Female Community Health Volunteer and Health worker should be encouraged as major source of information for vaccination. Conducive environment during immunization to child should be maintained by effective counselling of side effects and good behaviour to mothers.

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