A Study to Find Out the Full Immunization Coverage of 12 to 23-month old Children and Areas of Under-Performance using LQAS Technique in a Rural Area of Tripura

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ABSTRACT

Introduction: It is very important to analyze the factors which acts as obstacle in achieving 100% immunization among children. Lot Quality Assurance Sampling (LQAS) is one of the effective method to assess such barriers.

Aim: To assess the full immunization coverage among 12 to 23-month old children of rural field practice area under Department of Community Medicine, Agartala Government Medical College and identify the factors for failure of full immunization.

Materials and Methods: A community based cross-sectional study was conducted from November 2013 to October 2014 on children aged 12 to 23 months old of area under Mohanpur Community health centre. Using LQAS technique 330 samples were selected with multi-stage sampling, each sub-centre being one lot and two calculated to be the decision value. Data was collected using pre-designed pre-tested questionnaire during home visit and verifying immunization card and analysed by computer software SPSS version 21.0.

Results: The full immunization coverage among 12 to 23 months old children of Mohanpur area was found as 91.67%. Out of all the 22 sub-centres, 36.36% was found under performing as per pre-fixed criteria and the main reasons for failure of full immunization in those areas are unawareness of need of subsequent doses of vaccines and illness of the children.

Conclusion: LQAS is an effective method to identify areas of under-performance even though overall full immunization coverage is high.

Keywords: Agartala, Lot quality coverage survey, National Family Health Survey, Vaccine preventable diseases

INTRODUCTION

Immunization is the process of development of protective response of an individual's body to a specific disease by introducing an immunizing agent. Immunizing agents may be classified as vaccines, anti-sera and immunoglobulins (Igs).

Vaccine is an immuno-biological substance designed to produce specific protection against a given disease. It stimulates the production of protective antibody [1].

Immunization coverage is the most important strategy adopted by child survival programs throughout the world. Roughly 3 million children die each year of vaccine preventable diseases, with a dis-proportionate number of these children residing in developing countries [2].

Various studies have also shown that, Lot Quality Assurance Sampling (LQAS) technique has few advantages over WHO EPI 30-cluster sampling technique. For example, in 30-cluster sampling the low performing clusters cannot be identified but performance at the level of individual lot can be identified by LQAS technique. Again LQAS technique allows interpreting data as soon as data are collected whereas, in EPI 30-cluster sampling technique data from all units have to be collected. Moreover, in LQAS technique level of accuracy and confidence can be set as per requirement unlike EPI 30-cluster sampling technique [3].

Universal Immunization Programme in India reveals a coverage below 50 percent in most populous states of the country (Bihar, Uttar Pradesh, West Bengal) and most of the health indicators to be low in states where immunization coverage is low [4]. Whereas, National Family Health Survey-3 (NFHS-3) [5] and presentation to National Programme Coordination Committee on state PIP of Tripura [6] reveals that percentage of children fully immunized in Tripura is 49.7% and 75% respectively. Again DLHS-4 (2012-13) shows, full immunization coverage of West Tripura district (where the present study has been conducted) is 38.5% overall and in rural areas, 28.6% [7] showing heterogeneity of state and national figures demanding a study like present one. So this study was conducted to assess immunization coverage among 12 to 23-month old children of rural field practice area in Agartala.

MATERIALS AND METHODS

The present study was a community based cross-sectional study conducted in area under Mohanpur Community Health Centre (CHC), the rural field practice area of Department of Community Medicine, Agartala Government Medical College. All 22 sub-centres were selected for the purpose of the study and the study population comprised of children between 12 to 23 months, residing in area under Mohanpur Community Health Centre (CHC). The study was conducted for a period of one year (November 2013 to October 2014).

Sample size calculation: Sample size was calculated by following methods-

i. At ±5% level of accuracy and 95% Confidence Interval (CI), the first estimate of total sample size was made as 384, using Lemeshow and Taber LQAS table [3].

ii. Estimation of target population= total population× birth rate of state in rural×(1 – infant mortality rate of the state, rural) ÷1000

    Total population under Mohanpur CHC area is 1, 04,830.

(Birth rate of Tripura, rural areas= 15.6 per 1000 population

Infant mortality rate of Tripura, rural areas=29 per 1000 live births) [8]

Therefore, target population = 104830×15.6×(1-29÷1000) ÷1000 = 1588.

iii. Sampling fraction (%) = 384÷1588 ×100= 24.181%.

Revised total sample size = 384÷ 1.241 = 309.4 (approximately 310).

iv. Minimum lot sample size = revised total sample size÷ number of lot = 310÷ 22 = 14.09.

Therefore, 15 children have been selected from each lot.

Final sample size = 15× 22 = 330.

v. A low threshold level set as 65%, which means the lots showing full immunization coverage less than 65% are under-performing.

vi. A high threshold level set as 95% which is near to desirable level of coverage.

A decision value of 2 was calculated from pre-designed standard statistical table from WHO guideline [3].

Informed consent: A duly explained, written consent, translated by trained personnel into local language (Bengali) was taken from all the parents before including them in the study.

Ethical consideration was taken from the Institutional Ethics committee, Agartala Government Medical College before commencement of the study.

Sampling technique: Out of all the eight districts in Tripura, West Tripura district was selected for the purpose of the present study. Out of total three sub-divisions under West Tripura, Mohanpur sub-division was selected using lottery method. Again by lottery method 15 children of 12 to 23 months age from each sub-centre were selected from the immunization register available at each sub-centre. And information regarding their immunization status was verified by visiting their homes.

Operational definitions

Full immunization: Defined as immunization of a child with one dose of Bacille Calmette Guerin (BCG), 3 doses of Diphtheria Pertussis and Tetanus (DPT), Oral Polio Vaccine (OPV), Hepatitis B Vaccine and one dose of Measles vaccine within the age of one year.

Lot: Each Sub-centre within Mohanpur CHC area was considered as one Lot in the present study.

Data collection

Data was collected by using a pre-designed and pre-tested, semi-structured questionnaire and immunization cards have been verified physically to confirm appropriate date of vaccination. In those patients where immunization card was not available verification was done based on examining BCG scar and interviewing the respondent during the home visit for every child.

STASTICAL ANALYSIS

Analysis was done using software SPSS version 21.0. Chi square test, Fisher's-Exact test have been used to see the significant association between different variables as and when required.

RESULTS

The present study showed that, out of the total 330 children between 12-23 months age group, 197 (59.7%) were male and 133 (40.3%) were female. Mother was the respondent in 319 (96.7%) cases (father was interviewed where mother was not available at the time of home visit). Among them, 230 (69.7%) were Hindu by religion and 188 (57%) belonged to Scheduled Tribe (ST) caste. Majority of the fathers (163, 49.40%) had primary education and

mothers, secondary education (156, 47.30%). Father's occupation for majority of them (133, 40.30%) was farmer/fisherman/agriculture, followed by unskilled labourer (85, 25.80%) whereas, 258 (78.20%) of their mothers were housewives. According to modified B G Prasad's scale, maximum (189, 57.30%) children belonged to Socio-Economic Status (SES) class IV. The birth order of majority (190, 57.60%) of the children were first and 251 (76.1%) of them were delivered at institution.

[Table/Fig-1] shows that out of the total 22 lots under Mohanpur CHC, eight (36.36%) were rejected. It also reveals that the total estimated coverage of full immunization for children under Mohanpur CHC was, 0.9167 x 100% = 91.67%.

Main reasons for failure of full immunization as shown in [Table/Fig-2] were, unawareness of need to return for second and third dose of vaccines (26.7%), illness of the child- not brought for immunization (26.7%), followed by fear of side reactions (20%) etc. The variables, found to have significant association with full immunization status of children in univariate analysis were religion of the child, social caste, Father's literacy status, Father's occupation and place of delivery of child [Table/Fig-3]. Multivariate logistic regression analysis [Table/Fig-4] with the variables found significant in univariate analysis showed that, children who belonged to General caste, had poor educational status of father (primary education) and were delivered at home have significantly lesser odds of being fully immunized then those belonging to Scheduled Caste (SC) and Other Backward Caste (OBC) caste, whose father's education were secondary level and above and those who are institutionally delivered respectively.

DISCUSSION

This present study revealed that out of the total 330 study children, majority (59.7%) were males unlike a previous similar study conducted in Iran [9]. Mother was the respondent in 96.7% of cases in the present study, similar to the study by Karinagannanavar A et al., in Bellary district [10]. In their study, majority of the children were hindu (85.30%), similar to the present study, but 14.3% were muslims which is none in case of the present study, probably because of very less muslim population in the study area and difference in ethnicity of the study population. Educational status of the respondents in the present study was found to be better than similar other studies.

In this study, most of the children belonged to SES class IV (57.30%) as per modified BG Prasad's scale, still institutional delivery was found to be much higher (76.1%) than that in the study by Karinagannanavar A et al., in Bellary District [10].

The present study showed that under Mohanpur CHC, 36.36% lots were under-performing even though full immunization coverage was 91.67% whereas, similar other studies [11-15] revealed, full immunization coverage to be 62.7%, 63.3%, 44.1%, 75% and 84.21% respectively which clearly shows that the full immunization coverage of area under Mohanpur CHC assessed by using LQAS technique is much higher than the overall state, national figures and similar various other studies done throughout the country. To assess the application of LQAS technique to measure immunization coverage identify the areas of high and low coverage, the study conducted by Pradeep BS et al., in Bangalore concluded that LQAS can be used as an effective tool to monitor routine immunization activity and it would decrease the time taken for evaluation of immunization coverage [15]. Punith K et al., in their study at Mathikere Urban Health Centre of Bangalore, have showed that, considering the time and resources required, LQAS was better in evaluating primary immunization coverage than cluster sampling [16].

The principal reasons for failure of full immunization found in the present study were, unawareness of need to return for second and third dose of vaccines (26.7%) and illness of the child (26.7%), similar to what Vohra et al., and Bholanath et al., revealed in their studies [11,13]. Again similar results were cited by Prabhakaran Nair

Lot name	Lot population (a)	Weightage factor (b)*	Lot sample size (c)	No. of fully immunized children (d)	Proportion immunized (e)#	Estimated coverage (f)‡
Rangachara	9401	0.0871	15	15	1	0.0871
Taranagar East	7740	0.0717	15	15	1	0.0717
Taranagar West	9725	0.0901	15	15	1	0.0901
Kamalghat	5120	0.0474	15	15	1	0.0474
Laxmipara	6014	0.0557	15	15	1	0.0557
Damdamia	2451	0.0227	15	15	1	0.0227
Nepalibasti	2141	0.0198	15	12 (R)	0.8	0.0158
Rajghat	2410	0.0223	15	12 (R)	0.8	0.0178
Lefunga	3466	0.0321	15	14	0.9333	0.03
U.D. Nagar	1880	0.0174	15	13	0.8666	0.0151
Tulabagan	2882	0.0267	15	14	0.9333	0.0249
Tamakari	8652	0.0802	15	12 (R)	0.8	0.0642
Gopal Nagar	4107	0.038	15	15	1	0.038
Budhjung Nagar	2447	0.0226	15	15	1	0.0226
Abhicharan	5029	0.0466	15	12 (R)	0.8	0.0373
Barkathal	3730	0.0345	15	12 (R)	0.8	0.0276
Balurband	4641	0.043	15	12 (R)	0.8	0.0344
Hezamara	5509	0.051	15	14	0.9333	0.0476
Gamchakobra	6298	0.0584	15	15	1	0.0584
Kambukchara	1315	0.0122	15	12 (R)	0.8	0.0098
Chachubazar	10332	0.0958	15	12 (R)	0.8	0.0766
Tairajbari	2540	0.0235	15	14	0.9333	0.0219
Total Estimated Coverage						0.9167

[Table/Fig-1]: Lot Quality Coverage Survey 3 of Full Immunization of Mohanpur area.
* Weightage factor (b) = Lot population (a) ÷ Total population
# Proportion immunized (e) = Number of fully immunized (d) ÷ Lot sample size (c)
‡ Estimated coverage (f) = Weightage factor (b) x Proportion immunized (e)
(R) = Lot rejected (number of children not fully immunized > 2).

Variables	Frequency	Percent
Unawareness of need of immunization	1	3.3%
Unawareness of need to return for second and third dose	8	26.7%
Fear of side reactions	6	20%
Wrong ideas about immunization	1	3.3%
Postponing until another time	2	6.7%
Child was ill- not brought	8	26.7%
Child was ill- brought but vaccine was not given	4	13.3%
Total	30	100.0%

[Table/Fig-2]: Reason for failure of full immunization of the child.

Variables	Category of variables	Full immunization Yes	Full immunization No	Total	Significance
Sex of the Child	Male	182	15	197	0.256
	Female	118	15	133	
Respondent	Mother	291	28	319	0.286
	Father	9	2	11	
Religion of the Child	Hindu	215	15	230	0.003
	Christian	77	11	88	
	Buddhist	8	4	12	
Social Caste	General	41	3	44	0.004
	ST	162	26	188	
	SC	50	1	51	
	OBC	47	0	47	
Literacy Status of Father	Illiterate	14	0	14	0.002
	Literate	15	5	20	
	Primary Education	142	21	163	
	Secondary Education	113	4	117	
	Higher Secondary Education	16	0	16	
Literacy Status of Mother	Illiterate	13	2	15	0.889
	Literate	6	0	6	
	Primary Education	137	14	151	
	Secondary Education	142	14	156	
	Higher Secondary Education	2	0	2	
Occupation of the Father	Unskilled Labourer	80	5	85	0.011
	Skilled Labourer	8	0	8	
	Farmer/Fisherman/ Agricultural Enterprise	112	21	133	
	Business	79	4	83	
	Service	21	0	21	
Occupation of the Mother	Household Work	232	26	258	0.212
	Unskilled Labour	28	0	28	
	Farmer/Fishing/ Agricultural Enterprise	40	4	44	
Socio-economic status	Class III	92	8	100	0.125
	Class IV	167	22	189	
	Class II	39	0	39	
	Class V	2	0	2	
Birth Order of the Child	1	170	20	190	0.488
	2	125	10	135	
	3	5	0	5	
Place of Delivery	Home	58	21	79	<0.001
	Institutional	242	9	251	

[Table/Fig-3]: Distribution of socio-demographic variables and variables of full immunization coverage assessment according to full immunization status of the children under study.
SES- Socio-Economic Status

et al., Punith et al., and Saxena et al., in their respective studies [14,16,17]. General caste, poor educational status of father and home delivery are the risk factors found significantly associated with failure of full immunization of the child in the present study. This shows even though study settings are different, the primary reasons for failure of full immunization status remains similar all over

Variables	p value	Odds Ratio	(95% Confidence Interval)
Religion of the child			
Hindu	0.09	2.377	(0.85 – 6.644)
Christian and Buddhist*	-	-	-
Social Caste			
General	**0.043**	0.078	**(0.007 – 0.92)**
ST	0.249	0.275	(0.031 – 2.47)
SC and OBC*	-	-	-
Literacy Status of Father			
Illiterate and Literate	0.061	0.149	(0.02 – 1.088)
Primary Education	**0.04**	0.187	**(0.038 – 0.926)**
Secondary Education and above*	-	-	-
Occupation of Father			
Unskilled and Skilled Labourer*	0.119	4.553	(0.676 – 30.660)
Farmer/fisherman/agriculture	0.859	1.155	(0.234 – 5.712)
Business and Service*	-	-	-
Place of Delivery of child			
Home	**<0.001**	0.093	**(0.034 – 0.252)**
Institution	-	-	-

[Table/Fig-4]: Multivariate logistic regression analysis of factors found to be significant in univariate analysis.
* Variables which are merged together to avoid 'nil' entries in various cells of the table.
"–" Reference variable

the country.

LIMITATION

The target population was not adequate as per the precision set for this study using LQAS technique as the revised sampling fraction was more than 10% (usually in LQAS technique <10% sampling fraction is taken). To overcome this, a larger target population has to be considered in future for similar studies. Another limitation was the sampling frame of different lots were designed based on the immunization register available at each sub-centre and not by home visit, which might have led to bias if children without full immunization were not registered properly and could have overestimated the coverage of full immunization. Recall bias from the respondents who could not produce immunization card and no BCG scars found was another limitation that could be identified.

CONCLUSION

This present study shows that although the overall full immunization coverage among the children of Mohanpur CHC area is high, there are many (36.36%) pockets of under immunization, the primary

reasons being unawareness of need to return for second and third dose of vaccines and illness of the child. This reveals that LQAS method is an effective one to identify specific areas of under-performance even if the overall performance is satisfactory to evaluate health programmes at community level.

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