Singh and Narasimha Murthy, J Community Med Health Educ 2013, 4:1
http://dx.doi.org/10.4172/2161-0711.1000259

Community Medicine & Health Education

Research Article Open Access

Lot Quality Assurance Sampling for Monitoring and Evaluation of Immunization Coverage in District Solan, Himachal Pradesh, India, 2011

Ajay Singh[1] and Narasimha Murthy B[2]*

[1]*Medical Officer, District Hospital, Solan, Himachal Pradesh, India*
[2]*Scientist 'F'& Head of the Department of Biostatistics, National Institute of Epidemiology, Chennai, India*

Abstract

Introduction: Immunization is one of the most cost effective interventions amongst 32 well understood prevention and treatment interventions that target the goals of the child health. Despite of overall high immunization coverage in Solan district, there are low performing immunization pockets present due to migrant labour dominant un-uniformly distributed industry in the district (a case of polio was detected in 2007). We conducted a study to assess whether the immunization coverage in each of the five health blocks of and the entire district Solan is at or below 80% using Lot Quality Assurance Sampling (LQAS).

Methods: A cross-sectional study was conducted in all the five health blocks of Solan district. The hypothesis that <80% coverage is 'unacceptable' was stipulated. The sample size, assuming binomial approximation, with 5% level of significance, required to test the null hypothesis, was computed as 36. Critical value (the number of unimmunized children) was chosen as 3. Immunization status of each child was assessed by interviewing the child's mother/guardian. If the number of unimmunized children in the sample exceeded the critical value 3, then the immunization coverage in the block was to be regarded as below 80%.

Results: Out of the five lots/blocks of the district Solan, only one lot/block has achieved acceptable immunization coverage of more than 80%.

Conclusion: This study demonstrated the utility of LQAS technique in identifying 'unsatisfactory' pockets at smaller area level and district health authorities were recommended to take remedial action to improve immunization coverage in these areas.

Keywords: Immunization coverage; Lot quality assurance sampling; Unsatisfactory

Introduction

Immunization is one of the most cost effective interventions amongst 32 well understood prevention and treatment interventions that target the goals of the child health [1,2]. Globally, Childhood Immunization averts more than 2.5 million deaths annually and 24 million infants do not receive immunization at all [3]. Global goal set by United Nations General Assembly Special Session (UNGASS), October 2002 is to "Ensure full immunization of children under one year of age at 90% coverage nationally with at least 80% coverage in every district or equivalent administrative unit by 2010" [4].

India has one of the lowest routine immunization rates in the world [5]. According to National Family Health Survey-3 (NFHS-3), 2005-06, only 43.5% of the eligible children in India have been fully immunized [5]. There is wide variation in the immunization coverage amongst the different states of India. According to District Level Household Survey-2 (DLHS-2), full immunization coverage in Himachal Pradesh (H.P.) was 79% [6]. NFHS-3 data shows that 74.2% of children are fully immunized in H.P.

The WHO recommended 30-cIuster sample survey [7] for estimating immunization coverages among infants has been found to be very useful by public health administrators in developing countries, because it is rapid, operationally convenient and cost- effective. Once a very high immunization coverage, say 90%, is attained at the level of a district/city, the public health administrator's concern should shift to the identification of unsatisfactory areas or pockets (e.g., urban slums, corporation divisions, villages) within this large area that have low coverages to initiate appropriate corrective action. Any conventional surveyor the WHO 30-cluster survey, undertaken on the large area, cannot detect them, and undertaking a separate survey in every sub-area would be too laborious and expensive. In these circumstances, the adoption of an alternative technique namely, Lot Quality Assurance Sampling (LQAS) [8], proved beneficial.

It has been demonstrated globally that Lot Quality Assurance Sampling (LQAS) is a useful technique for monitoring and evaluation of immunization program at small area level [9-13]. In India, twenty four out of thirty four LQAS surveys conducted from 1984 to 1996 were used to assess the level of immunization coverage [11].

An attempt is made here to demonstrate the usefulness of this technique in the context of immunization coverages in Solan, which had reported coverage of 100% (personal communication). More specifically, the aim was to identify blocks (amongst those that were actually included in the sample in the district) which had a coverage of less than 80% for any of the above vaccines.

Objectives

1. To assess the immunization coverage in each of the five health blocks and the entire district Solan.

2. To identify the factors that lead to low immunization coverage in

***Corresponding author:** Narasimha Murthy B, Head of the Department of Biostatistics, National Institute of Epidemiology, III Avenue, Ayapakkam, Ambattur, Chennai-600077, Tamil Nadu, India, Tel: 91-44- 26136206, 9444639715; E-mail: bnmurthy53@gmail.com

Received September 13, 2013; **Accepted** November 27, 2013; **Published** November 29, 2013

Citation: Singh A, Narasimha Murthy B (2013) Lot Quality Assurance Sampling for Monitoring and Evaluation of Immunization Coverage in District Solan, Himachal Pradesh, India, 2011. J Community Med Health Educ 4: 259. doi:10.4172/2161-0711.1000259

spite of implementation of Universal Immunization Programme.

Subjects and Methods

Our interest was to classify all the five blocks in the district as adequately covered or not. Two types of error can occur in this process. Type I error has serious implications and is therefore set at 5%. Type II error is not so serious and is usually set at or below 10%. Here, the Null Hypothesis is that the coverage in the block is less than 80% (Ho: P<0.8), and therefore 'unacceptable'. Critical value (d, the number of unimmunized children) is taken as 3, for reasons given below. The sample size required at 5% level of significance is deter- mined to be 36 children (in the age-group 12-23 months) using Lemeshow and Taber sampling plans [14]. If *d* exceeds 3 then the coverage in the divisions is to be regarded as less than 80%. The Alternative Hypothesis (HA) is P ≥ 0.8.

Selection of appropriate threshold 'd' for LQAS is crucial. If d=0 or 1 or 2 the sample size required may be smaller (12 or 20 or 28) but more of the adequately covered (good performance) areas will be classified as inadequately covered (low performance) areas. On the other hand if d takes values of 5 or above, the sample size required will be large (48 or above) resulting in excessive field work. The value of d was therefore chosen as 3.

Solan district has 5 blocks, with population ranging from 45,000 to 1,50,000. The expected number of children aged 12-23 months was 900 to 3000 per block with an average of 2000. All the five blocks formed the lots for study.

For each of the five blocks, lists of villages, number and names of streets within each village and approximate number of households per street were obtained from Census office. A comprehensive list of streets with the number and cumulative number of households was made, and 36 random numbers between 1 and the total cumulative number of households were chosen. These identified the streets for study, and the exact household was determined by simple enumeration of households from the first door number in the relevant streets.

The reason for choosing a household at random (and not a child aged 12-23 months) was that sampling frames of children were not available. From each selected household, in- formation was obtained for all eligible children; if the selected household did not have a child aged 12-23 months, the nearest eligible household (following a preordained search pattern) was chosen for study. Their immunization status was assessed by interviewing the child's mother/guardian or from immunization cards. Information regarding immunization status was obtained by well trained staff.

Assessing the age of the child was not a problem as 90% of the mothers provided birth certificates. Wherever more than one eligible child were present in the household, all were assessed (to avoid embarrassment for the mother and the family), but only the youngest was considered for analysis purposes. In five instances, where the door was locked or the mother unavailable, the household was excluded from consideration. The study was undertaken between January and June 2011. The approval of the study from the ethics committee of the National Institute of Epidemiology, Chennai, Chief Medical Officer of District Solan, and the community advisory board of the village prior to the start of the survey was taken. Voluntary participation ,Confidentiality and Privacy was ensured in the study. All the study populations were informed about importance of childhood immunization and its role in decreasing the childhood morbidity and mortality. Unimmunized children were facilitated to complete the immunization.

Results

A total of 180 children (12-23 months of age) were studied after surveying 651 households in all the five blocks of the district. The findings for each of the four vaccines are given in Table 1. All the five lots/blocks of the district Solan showed acceptable immunization coverage of more than 80% for BCG, DPT and Polio. Only the fourth block showed acceptable level of immunization coverage for measles and also for all the vaccines together i.e. for fully immunized. The LQAS results from the blocks were appropriately combined using standard stratified sampling theory to obtain overall estimates of immunization coverage among infants; these were 97% for BCG, 87% for DPT, 86% for Polio, and 77% for Measles vaccine (Table 2). Weighted fully immunization coverage for the entire district is 73%.

The most common reason cited by the respondents for unimmunization (Table 3) was the postponement the vaccination session (56%), followed by family problems including child illness and unavailability of the vaccine (52%). Inappropriate place and time of immunization was the next common reason cited by almost 48% of the respondents. About 29% had either no belief in immunization or were unaware of the need for immunization. A small fraction of people (about 10%) had apprehensions about the side reactions of the vaccines.

Discussion

There are no official figures for immunization coverage in district Solan except for the DLHS-3 data. Small area (district/block/Primary Health Centre) level estimates are needed for necessary intervention. In this study, all the five blocks of Solan district were assessed for satisfactory immunization coverage (≥ 80%); and all the blocks for BCG, DPT and Polio were accepted as satisfactory. However, only one block was accepted as satisfactory for fully immunization coverage.

The main point of interest that emerges from this study is the practical value of the LQAS technique to the public health administrator. Instead of being lulled into complacency by an extremely high overall coverage (e.g., 100%) as reported in the district, he has a tool by which problematic sub-areas can be identified and targeted for special action. Similarly as per the study by Murthy et al. [15] in Madras City, India, LQAS technique was useful in identifying 'unsatisfactory' pockets in the City, when the overall coverage was satisfactory. In 1995, a similar experience in India was also reported in 9 sub centers of Saharanpur district in Uttar Pradesh [16] and 27 sub centers of Alwar district in Rajasthan [17].

Lot no	BCG		DPT		OPV		Measles		Fully immunized	
	#	%	#	%	#	%	#	%	#	%
1	33	91.7	32	88.9	31	86.1	27	75.0	24	66.7
2	34	94.4	32	88.9	32	88.9	28	77.8	25	69.4
3	33	91.7	31	86.1	30	83.3	25	69.4	23	63.9
4	36	100.0	34	94.4	34	94.4	34	88.9	33	91.6
5	36	100.0	30	83.3	30	83.3	27	75.0	27	75.0
Total	172	95.6	159	88.3	157	87.2	139	77.2	132	73.3

Table 1: Vaccination status in each lot (Block) of district Solan, H.P.

Vaccine	Weighted estimate	Standard error
BCG	96.6	± 1.2
DPT	86.8	± 3.0
OPV	86.0	± 3.0
Measles	76.9	± 3.7
Fully immunized	73.1	± 3.7

Table 2: Weighted estimates of the vaccination in district Solan, H.P.

Factors	#	#	#	#	#	#	%
Unaware of need of immunization	0	5	2	3	4	14	29.1
Place of immunization	6	6	8	1	2	23	47.9
Time of immunization	6	6	8	1	2	23	47.9
Fear of reactions	1	3	0	1	0	5	10.4
No belief in immunization	0	5	2	3	4	14	29.1
Postponed	6	6	7	3	5	27	56.2
Vaccine unavailable	6	6	4	3	6	25	52.0
Vaccinator unavailable	0	0	0	0	0	0	0
Family problems including							
child illness	0	5	8	3	9	25	52.0

Table 3: Reasons for unimmunization as cited by the respondents of the five lots(Blocks) of district Solan, H.P.

The most important identifiable reasons for unimmunization are the parents' lack of knowledge about the vaccination schedule, fear of the side-effects of vaccination, and parent's, and sometimes health workers', reluctance to vaccinate infants during illness. Similar results were found in a study done by Tawfik et al. [10] in Dhaka, Bangladesh [10].

References

1. Global Health Council (2008) Child Health Report.
2. World Health Organization (2008) Global Immunization Data.
3. Burton A, Monasch R, Lautenbach B, Gacic-Dobo M, Neill M, et al. (2009) WHO and UNICEF estimates of national infant immunization coverage: methods and processes. Bull World Health Organ 87: 535-541.
4. Wolfson LJ, Gasse F, Lee-Martin SP, Lydon P, Magan A, et al. (2008) Estimating the costs of achieving the WHO-UNICEF Global Immunization Vision and Strategy, 2006-2015. Bull World Health Organ 86: 27-39.
5. International Institute for Population Sciences (2005-06) National Family Health Survey (NFHS-3).
6. Jat TR, Ng N, San Sebastian M (2011) Factors affecting the use of maternal health services in Madhya Pradesh state of India: a multilevel analysis. Int J Equity Health 10: 59.
7. Henderson RH, Sundaresan T (1982) Cluster sampling to assess immunization coverage: a review of experience with a simplified sampling method. Bull World Health Organ 60: 253-260.
8. Lemeshow S, Robinson D (1985) Surveys to measure programme coverage and impact: a review of the methodology used by the expanded programme on immunization. World Health Stat Q 38: 65-75.
9. Alberti KP, Guthmann JP, Fermon F, Nargaye KD, Grais RF (2008) Use of Lot Quality Assurance Sampling (LQAS) to Estimate Vaccination Coverage Helps Guide Future Vaccination Efforts. Trans R Soc Trop Med Hyg 102: 251-254.
10. Tawfik Y, Hoque S, Siddiqi M (1995) Using Lot Quality Assurance Sampling to Improve Immunization Coverage in Bangladesh. Journal of Tropical Pediatrics 41: 215-220.
11. Robertson SE, Anker M, Roisin AJ, Macklai N, Engstrom K, et al. (1997) The lot quality technique: a global review of applications in the assessment of health services and disease surveillance. World Health Stat Q 50: 199-209.
12. Murthy BN, Subbiah M, Boopathi K, Ramakrishnan R, Gupte MD (2001) Lot quality assurance sampling (LQAS) for monitoring leprosy elimination in an endemic district in Tamilnadu. Indian J Lepr 73: 111-119.
13. Robertson SE, Valadez JJ (2006) Global review of health care surveys using lot quality assurance sampling (LQAS), 1984-2004. Soc Sci Med 63: 1648-1660.
14. Lemeshow S, Taber S (1991) Lot quality assurance sampling: single- and double-sampling plans. World Health Stat Q 44: 115-132.
15. Murthy BN, Radhakrishna S, Venkatasubramanian S, Periannan V, Lakshmi A, et al. (1999) Lot quality assurance sampling for monitoring immunization coverage in Madras City. Indian Pediatr 36: 555-559.
16. Singh J, Sharma RS, Goel RK, Verghese T (1995) Concurrent evaluation of immunization programme by Lot Quality Assurance Sampling. J Trop Pediatr 41: 215-220.
17. Singh J, Jain DC, Sharma RS, Verghese T (1996) Evaluation of immunization coverage by lot quality assurance sampling compared with 30-cluster sampling in a primary health centre in India. Bull World Health Organ 74: 269-274.

Citation: Singh A, Narasimha Murthy B (2013) Lot Quality Assurance Sampling for Monitoring and Evaluation of Immunization Coverage in District Solan, Himachal Pradesh, India, 2011. J Community Med Health Educ 4: 259. doi:10.4172/2161-0711.1000259