

Socio-demographic determinants of Primary Immunization: A longitudinal study in a rural area of Amritsar, Punjab.

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Abstract:

Background: Immunization is a proven cost-effective and relatively inexpensive public health intervention for improving infant and child survival. Although, in the recent past, immunization coverage rates have improved considerably, wide variations still exist in India both inter and intra states. This coverage is affected by several socio-demographic characteristics such as literacy, gender of the child, socioeconomic status etc. Hence, this study was conducted to assess the primary immunization coverage among infants in the rural area of Amritsar district and to identify the various socio-demographic factors associated with it.

Materials and Methods: It was a longitudinal study on a cohort of 99 infants who were born in the village Nagkalan, Amritsar and were followed up for a period of one year through regular home visits. Using a pre-designed questionnaire, information regarding socio-demographic characteristics of the family and the vaccines administered to the child till 1 year of age were enquired upon.

Results: The immunization card was available for most (93.94%) of the infants. Majority 70.7% of the children were fully immunized, 26.3% were partially immunized and only 3.0% children were unimmunized. Father's education (AOR 3.08 (1.07- 8.91), P value = 0.03) and place of birth (AOR 7.89 (2.13- 29.19), P value = 0.0002) were significantly associated with immunization status.

Conclusion: Though the immunization coverage showed much improvement through intensive immunization campaigns in recent years, still a lot needs to be done to increase awareness among family members regarding importance of full immunization at the right time.

Key Word: Primary Immunization, infants, coverage, socio-demographic determinants, drop out.

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I. Introduction

Disease burden due to infectious diseases remains invariably high. This contributes to premature deaths, disability and malnutrition in young children. Globally, 3 million children die each year of vaccine preventable diseases and majority of these children reside in developing countries.¹ Immunization is a proven cost-effective and relatively inexpensive public health intervention for improving Infant and child survival. Smallpox eradication is one of the glaring examples illustrating the positive impact of immunization.

WHO formulated the Expanded Programme on Immunization (EPI) way back in 1974 which recommended the use of vaccines against six preventable diseases and advocated the completion of primary immunization series (BCG, DPT3, OPV3, and Measles) for all the children before they attain one year of age.² The Government of India also initiated its own Universal Immunization Programme (UIP) in 1985 which has made tremendous progress in expanding the Routine Immunization (RI) coverage throughout the country. This later got incorporated into RMNCH+A program in order to achieve the MDG Goals 4 and 5 focusing on maternal and child survival.

In the recent past, immunization coverage rates have improved considerably in developed countries, thereby conferring herd immunity, whereas most of the developing countries are still struggling with faltering rates.³ Infact, there is evidence of inequities in immunization in India with wide variations, both between and within Indian states. According to NFHS- 4 (2015- 16) survey, among children aged 12- 23 months, the percentage who received specific vaccines was 91.9% for BCG, 72.8% for polio (3 doses), 78.4% for DPT (3 doses) and 81.1% for Measles while percentage of fully immunized children was 62%, which is better than the NFHS- 3 data but still far from desirable.⁴ Slightly better scenario was depicted for immunization coverage in the prosperous state of Punjab where the percentage of fully immunized children was 68.42% and was almost same in the rural communities (67.2%).⁵

Immunization Coverage is affected by several individual demographic characteristics such as literacy, gender of the child and socioeconomic position. Several demand side (socioeconomic, lack of awareness and cultural beliefs and distance to health facility) as well as supply side factors (poor quality of services, inadequate

staffing and irregular supply of vaccines) have been suggested as potential reasons for the low immunization coverage in India.⁶ So, the progress towards the achievements of vaccination targets can be done by evaluation of the primary immunization status of the children as well as by exploring the various factors that determine the immunization coverage.

Hence, the present study was conducted in the rural field practice area of Punjab to know the current level of immunization coverage. The objectives of this study were to assess the primary immunization coverage among children in a rural area of Amritsar district and to identify the socio- demographic factors associated with it.

II. Material And Methods

Study Setting: Village Nagkalan, the rural field practice area of Department of Community Medicine, Government Medical College, Amritsar. The village falls under the Block Majitha and is located 15 KM towards North from District headquarters, Amritsar and having a population of 9352.⁷

Study design: Longitudinal study which included all infants born during the first 6 months of the year 2014, i.e. from January 2014 to June 2014. All these newborns were identified with the help of ASHA and constituted the birth cohort who were followed up to one year of age.

Study population: Infants of age 0 to 1 year were included in the study. The final sample size came out to be 99.

Data collection: During the initial visit, the investigator personally visited houses of the infants within 10 days of birth and collected information regarding the households, place of birth of the child, education and occupation of parents and other socio-demographic factors using a pre-designed and pre tested proforma. Enquiry was made regarding the vaccines given at birth (BCG, OPV-0 dose and Hepatitis B) and immunization card was checked, if available.

Later, the second visit was made after the child reached his/her first birthday to assess the receipt of the remaining vaccines and the status of primary immunization. The immunization status of child was verified on the basis of information on the immunization card. For children without immunization cards, information from the mother or any other reliable and responsible person in the family stating about immunisation of the child was considered. BCG vaccination was also confirmed by presence of scar at appropriate place. The OPV given during pulse polio rounds was not considered for classification.

Operational definitions⁸

Fully immunized: A child who has taken all the vaccines and their required doses as per national immunization schedule (one dose of BCG, 3 doses of DPT, hepatitis B and OPV, one dose of measles vaccine) up to age of 12 months.

Partially Immunized: A child who has taken some vaccines or doses as per national immunization schedule up to age of 12 months.

Non- immunized: A child who has not taken any vaccine up to age of 12 months.

Statistical analysis

Data was entered in the MS excel initially and then analyzed using SPSS (Statistical Package for Social Science) software for Windows version 22.0. Descriptive statistics used for socio- demographic details and vaccination coverage. Chi-square test of significance was applied to test the association between various variables and status of immunization coverage. Crude odds ratios (COR) with 95% confidence intervals were calculated for all the study variables. A p-value of less than 0.05 was considered as significant. Binary logistic regression was run to compute adjusted odds ratios for variables with significant association ($p < 0.05$) in univariate analysis. Model fit was assessed using the Hosmer-Lemeshow test.

III. Result

The present study showed that out of 99 infants evaluated for primary immunization, 53.54 % were males and 46.46% females. Among the mothers, majority 79.80% were in the age group of 21 to 30 years, 76.8% were Sikh by religion and 19.2% followed Christianity. Majority of the children belonged to SC/ST Category (72.7%). Regarding literacy status of parents, 33.33% of mothers while 32.32% of fathers were found to be illiterate. More than half of the fathers (57.58%) were unskilled labourers. In all, 71.71% children belonged to joint families and 66.67% households had more than 5 family members. Around three-fourths of families (74.75%) belonged to upper lower class according to Modified Kuppuswamy scale of socio-economic status. The birth order of majority of children (85.86%) were 2 or below and about 84.85% children were delivered at institutions. (Table 1)

Table no 1:Socio-demographic profile of study subjects (N=99)

Variables	Study Subjects	
	No.	%
Sex of infant		
Male	53	53.54
Female	46	46.46
Age of mother(years)		
≤20	15	15.15
21-30	79	79.80
31-40	5	5.05
Religion		
Sikh	76	76.8
Christian	19	19.2
Hindu	4	4.0
Caste		
General	9	9.1
OBC	18	18.2
SC/ST	72	72.7
Education of mother		
Illiterate	33	33.33
Primary	28	28.28
Middle	10	10.10
High	17	17.17
Intermediate	6	6.06
Graduate & above	5	5.05
Education of father		
Illiterate	32	32.32
Primary	16	16.16
Middle	14	14.14
High	12	12.12
Intermediate	21	21.21
Graduate & above	4	4.04
Occupation of father		
Unskilled	57	57.58
Semiskilled	1	1.01
Skilled	22	22.22
Clerical/farmer/shopkeeper	14	14.14
Semi-professional	5	5.05
Type of family		
Nuclear	28	28.28
Joint	71	71.72
Family size		
≤5	33	33.33
>5	66	66.67
Socio-Economic Status		
Lower	2	2.02
Upper lower	74	74.75
Lower middle	18	18.18
Upper middle	5	5.05
Birth order		
≤2	85	85.86
>2	14	14.14
Place of birth		
Home	15	15.15
Institutional	84	84.85

The immunization card was available for 93.94% of the infants. It was revealed that majority i.e.70 (70.7%) of the children were fully immunized against six vaccine preventable disease, 26 (26.3%) were partially immunized and only 3 (3.0%) children were not immunized by any of the vaccines (Table 2).

Table no2: Immunization status of Infants (0-1 years) (N=99)

Immunization status	No. of infants	Percentage
Fully immunized	70	70.7
Partially immunized	26	26.3

Unimmunized	3	3.0
Total	99	100.0

Regarding individual vaccine coverage, the coverage was highest for BCG (96.97%) while lowest for measles (77.78%). The third dose of DPT, Hepatitis B and OPV were received by 80.81%, 78.79%, and 79.8% of children respectively. (Table 3). Thus, the dropout rates for DPT, OPV and hepatitis B from first dose to third doses was 8.24 to 12.09%. The dropout rate for measles compared to BCG and DPT1 were 19.8% and 15.38% respectively (Table 4).

Table no3: Coverage level of different vaccines under National Immunization Schedule* (N=99)

S.No	Vaccine	Yes	Percentage
1.	BCG	96	96.97
2.	D.P.T-1	91	91.92
	D.P.T-2	85	85.86
	D.P.T-3	80	80.81
3.	OPV-0	78	78.79
	OPV-1	87	87.88
	OPV-2	81	81.82
	OPV-3	79	79.80
4.	Hepatitis B(Birth)	18	18.18
	Hepatitis B-1	85	85.86
	Hepatitis B-2	80	80.81
	Hepatitis B-3	78	78.79
5.	Measles	77	77.78

*Immunization coverage confirmed on basis of 3 criteria: history from mother/guardian, immunizationcard records and checking BCG scar mark.

Table no 4:Dropout rates of various vaccines

Dropout rate	No.	Percentage
OPV1-OPV3	8	9.20
DPT1-DPT3	11	12.09
HepB1-HepB3	7	8.24
DPT1-Measles	14	15.38
BCG-Measles	19	19.80

Table 5 demonstrates the univariate analysis performed to assess the effect of potential socio- demographic determinants on immunization coverage. Variables like education of parents, socio-economic status, type of family, place of delivery and availability of immunization cards were found to be significantly associated with immunization status of the infants in the study area. The odds of being unimmunized or partially immunized were higher for children born to illiterate mothers (COR=3.1) and illiterate fathers (COR=2.7), children in households belonging to lower Socioeconomic status (COR=3.46), those living in nuclear families (COR=3.7), home deliveries (COR=6.84) and among those who did not possess an immunization card (COR=4.04).

Table no 5: Association of Socio- demographic characteristics of subjects with the immunization status

Characteristics	Partial & Not immunized (n=29)	Fully immunized (n=70)	Crude Odds ratio (95% CI)	P-value
Age of mother(years)	≤25	47	0.69(0.28-1.69) 1	0.28
	>25	23		
Sex	Male	39	0.74(0.31-1.75) 1	0.33
	Female	31		
Religion	Sikh	54	0.93(0.34-2.58) 1	0.54
	Others	16		
Caste	General	7	0.67(0.13-3.42)	0.48

Others	27	63	1	
Mother's education				
Illiterate	15	18	3.10(1.25-7.65)	0.01*
Literate	14	52	1	
Father's education				
Illiterate	14	18	2.7(1.1-6.67)	0.02*
Literate	15	52	1	
Occupation of father				
Labor	26	54	2.57(0.69-9.60)	0.12
Business/Service	3	16	1	
Socio-Economic Status				
Lower	26	50	3.46(0.94-12.76)	0.04*
Middle	3	20	1	
Type of family				
Nuclear	14	14	3.7 (1.47-9.09)	0.005*
Joint	15	56	1	
Family size				
≤5	10	23	1.08(0.43-2.68)	0.53
>5	19	47	1	
Birth order				
≤2	25	60	1.04(0.30-3.64)	0.61
>2	4	10	1	
Place of birth				
Home	10	5	6.84(2.08-22.47)	0.001*
Institutional	19	65	1	
Availability of immunization card				
No	6	0	4.04(2.84-5.76)	0.000*
Yes	23	70	1	

*P<0.05-Significant

Table 6 describes the logistic regression model for the possible Socio-demographic predictors of the Immunization status. Father's education (adjOR: 3.08, 95% CI: 1.07–8.91) and place of delivery of infant (adjOR = 7.89, 95% CI: 2.13 – 29.19) were significantly associated with the immunization status. So, these two factors were found as independent determinants of primary immunization status after controlling for the possible confounding factors. The logistic regression model explained 36.8% (Nagelkerke R²) of the variance and correctly classified 79.8% of cases. Hosmer and Lemeshow Test showed a good fit of the model (Chisquare 0.037, p value = 0.98).

Table no 6: Logistic regression model for sociodemographic variables associated with Immunization status

Variables	Adjusted Odds Ratio (95% C.I.)	P value
Father's education	3.08 (1.07-8.91)	0.03
Place of birth	7.89 (2.13-29.19)	0.002

(Cox & Snell R square=0.258, Nagelkerke R square=0.368)
(Hosmer & Lemeshow Test- Chi square=0.037, df=2, P=0.981)

IV. Discussion

In the present study, 70.7% of infants were fully immunized which was somewhat greater than the immunization coverage reported by DLHS-4 Punjab data (2012-13) i.e. 67.2%.⁵ This has probably been due to increased intensification of immunization activities and special immunization drives as part of Mission Indradhanush which was launched in the same year. Also the study population was peri-urban and the Subsidiary Health Centre (where immunization sessions were conducted) was located in the study area itself. However, the coverage of full immunization was less as compared to the study in Haryana⁹ where around three-fourths (73.15%) and another study in Tamil Nadu¹⁰ where 76% of infants were fully immunized. This can be attributed to regional variation and different survey techniques. Further, the proportion of unimmunized / partially immunized children were found to be as high as 29.3% which is also similar to previous studies.^{9, 10} So, there is a constant threat to the outbreak of vaccine preventable diseases due to building up of this susceptible

population. Therefore, there is an urgent need to strengthen regular immunization and also the mop-up immunization by all agencies.

According to this study, among the individual vaccines, coverage was highest for BCG (96.97%) followed by DPT/OPV/Hepatitis B and lowest for measles (77.78%). Similar trend was reported by Murugesan D et al, Gupta PK et al and Pandey S et al.¹⁰⁻¹² The extent of BCG vaccination observed in the present study was found to be higher as compared to overall BCG coverage in Punjab (91.2%) which may be because of more institutional deliveries in the study area. However, coverage of the measles vaccine was slightly less as compared to the figures for state (80.5%).⁵

A consistent decline in coverage rate from the first to the third dose was observed in DPT, Hepatitis B and OPV vaccines. High dropout rates were seen from BCG to measles (19.8%) and DPT- 1 to measles (15.38%) in the current study. The dropout rate from DPT1 to DPT3 was also high in our study (12.09%). Infact, these dropout rates were consistently higher than other studies conducted across the country.^{9,11} This might be due to the long interval between third dose of DPT, OPV/hepatitis B to measles. Also, the pentavalent vaccine was introduced in Punjab during January 2015. The study period thus fell into the phase of replacement of DPT by pentavalent vaccine which could have resulted in erratic vaccine supply hence leading to higher dropouts.

Regarding the socio-demographic determinants of Immunization coverage, education of parents was found to be significantly associated with the immunization status which is congruent to several studies.^{3,6,9,12} The reason is evident since literate parents are often well informed about the importance and benefits of immunization as well as have greater awareness towards the need to complete the vaccinations. The odds of being partially or unimmunized was 3.5 times higher among the lower socioeconomic class which is similar to another study in Delhi⁶ where the odds of immunization were found to be 2.5 times higher among the less poor compared with the poorest. This emphasizes the need to identify the poorer section of society for various targeted interventions.

The present study revealed that the children residing in nuclear families were 3.7 times higher risk of remaining unimmunized/partially immunized which is comparable with the findings of Pandey et al¹² and Vohra R et al.¹³ The probable reason could be the busy schedule of parents in case of nuclear families and non-availability of other family member/guardian for availing full immunization services. Also, children born at home were either non-immunized or partially immunized than those born in hospital. Similar findings were obtained in the Lucknow study where the odds of risk of partial/non-immunization was 45.818 in home deliveries than in institutional deliveries ($P = 0.0001$)¹⁴ and the study in Kenya where it was observed to be 2.26 times.¹⁵ Availability of vaccination card also had a statistically significant association with the immunization status which is consistent with findings of other studies.^{12,13} This indicates the awareness about the importance of immunization card with respect to immunization of infants among the parents.

After performing adjusted analysis, primary immunization was mainly influenced by two factors- father's literacy and place of birth of infant amongst various socio- demographic determinants in our study. Although mother's literacy was also significantly associated with the immunization status in univariate analysis, but father's literacy came out to be a significant determinant in the final adjusted model. This is in contrast to other studies where mother's education was significantly associated with immunization coverage.^{6,12,16} The possible reason is that the father is often the head of the family who takes major decisions regarding his child's health, therefore education of the father alone could play a significant role in the uptake of immunization services. The second significant predictor of immunization was the place of birth of the child. This is in concordance with other studies using logistic regression analysis which also showed a strong association of hospital-based childbirths with future child immunization practices.^{6,12,15} Mothers who deliver at home are usually non-users of health services in general and thus should be targeted for utilization of immunization related activities.

V. Conclusion

Although a majority of the children were immunized in our study, we are still lagging behind the target of full Immunization. This study reflects towards a pressing need to accelerate our efforts in improving the immunization coverage in the area. Important socio- demographic determinants like literacy status and place of birth were significantly associated with full immunization of children. The study thus recommends increasing the awareness among family members especially fathers regarding complete primary immunization of all children in order to prevent childhood deaths and life- long disability, directing numerous Information, education and communication (IEC) services in the community towards improvement of the immunization coverage, reinforcement of the surveillance and referral systems in the area so as to reduce missed opportunities and drop outs, increase the retention of vaccination cards by the mothers and promotion of institutional deliveries. Hence, the need of the hour is to make routine immunization a "felt need" of the community for achievement of the goal of full immunization.

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