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RESEARCH ARTICLE

SOCIO-DEMOGRAPHIC FACTORS AFFECTING IMMUNIZATION STATUS OF PRE-SCHOOL CHILDREN IN JAMSHEDPUR

Asit Kumar Mishra., Mubashir Hasan Shah., Reashma Roshan and Nibedita Mishra

Department of Pediatrics, Tata Main Hospital, Jamshedpur.

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ABSTRACT

Context: Immunization coverage of pre-school children remains sub-optimal in some socio-demographic subgroups, more so for newer vaccines.
Aims: To determine the immunization status of pre-school children in Jamshedpur.
Settings and Design: School based cross-sectional study,
Methods and Material: Immunization status of 300 children, up to 5 years of age in one year period, sub-grouped on socio-demographic variables using cluster sampling and survey methodology, was analysed.
Statistical analysis used: Chi-square test, p value, GraphPadinStat software
Results: Overall immunization status - 80% fully immunized, 20% partially immunized. Children of mothers, who were post-graduates and professionals, were protected 100%. Immunization coverage of 88.46% and 81.07% was observed in children from socio-economic class of I and II, respectively. Children with malnutrition of grade I and grade II had full immunization coverage of 66.67% and 64.71% respectively. Coverage of various vaccines were, BCG 94%, OPV-0 81%, DPT-1/OPV-1 96.67%, DPT-2/OPV-2 96.33%, DPT-3/OPV-3 94%, measles vaccine 92.33%, booster DPT/OPV vaccine 88%, MMR vaccine 82.67%, chickenpox vaccine 61.67%, hepatitis-A vaccine 59.67%, typhoid vaccine 52%, pneumococcal conjugate vaccine 9.33% and rotavirus vaccine 5.33%. Children with co-morbid conditions had full immunization coverage of 52.94%.
Conclusions: Lower socioeconomic status, low maternal education levels, higher birth order, female gender and co-morbid conditions were significantly associated with low vaccination coverage.

INTRODUCTION

Vaccine preventable diseases such as pneumonia, diarrhea, meningitis, and measles, still account for about a quarter of child deaths in low-income countries [Orin S Levine, 2011]. Control of these diseases depends on maintaining high levels of immunization coverage. However, immunization coverage among preschool children remains suboptimal in some areas and socio-demographic subgroups, leaving susceptible young children vulnerable to complications from vaccine-preventable diseases. The Global Immunization Vision and Strategy (GIVS) developed in 2005 by WHO and UNICEF, assists countries in strengthening immunization programs and vaccinating more persons. GIVS aims to achieve 90% national 3-dose DTP (DTP3) coverage by age 12 months in all countries and 80% coverage in every district or equivalent administrative unit by 2010 and to sustain these levels through 2015 [Centres for Disease Control and Prevention, Global routine vaccination coverage, 2009]. According to NFHS- 3, only 51% children in the age group of 12 to 23 months were fully immunized in the state of Jharkhand [National family health survey-3 (2005-06)].

The present study is undertaken to assess the status of immunization and to analyze the various factors that affect the coverage of UIP and optional vaccines in preschool children in Jamshedpur, Jharkhand, India.

Subjects and Methods

Study setting: This school based cross-sectional study was conducted by the Department of Pediatrics, Tata Main Hospital, Jamshedpur, Jharkhand, India, for a period of 1 year from January 2014 to December 2014. The target population of 300 children enrolled in pre-schools in different areas of urban Jamshedpur. Inclusion and exclusion criteria: Children between 30-60 months of age enrolled in the selected pre-schools of urban area of Jamshedpur, Jharkhand, were included while children without immunization cards, residing in non-urban areas and whose parents did not give consent were excluded from the study.

Methods: A cross-sectional study using immunization cards of children enrolled in selected pre-schools in urban Jamshedpur was performed. The school teachers were part of the study. They requested the parents to provide the copy of the

immunization cards of their children. The detailed immunization history of each child was taken by reviewing the immunization records. Demographic and socioeconomic data was recorded using a questionnaire as well as by interviewing the parents. Anthropometry (weight, height, mid-arm circumference) was recorded for each selected child along with associated co-morbid condition, if any. Details of optional vaccines received were noted down in the study proforma. Socioeconomic status of family was calculated according to modified Kuppuswamy's classification which includes education, occupation and income of the household [Kumar N, 2012]. Malnutrition found in some children was noted and classified in grades as per Indian Academy of Pediatrics classification for malnutrition [Indian Academy of Pediatrics, Nutritional subcommittee. 1972]. The standard practice is to calculate immunization rates for children ages 12-23 months; however, in the Indian context where children are often immunized at later ages, restricting the sample to this age group would exclude children who were immunized later and thus could bias the results [Duclos P, 2009]. As optional and newer vaccine coverage was also included in this study, some of them are usually given after 24 months of age, the age group of 30 to 60 months, was considered.

The schools have a program for health check-up of their students twice yearly in the months of April and November. Subsequently during the parent-teacher meetings, parents were counseled about the deficiencies in the immunization status of their children, if any.

Definition of coverage: Children were categorized as fully immunized, defined as per the 1998 World Health Organization (WHO) guideline viz. receipt of one dose of BCG vaccine, three doses of DPT and OPV vaccines, and one dose of measles vaccine by infants in the age group 12-23 completed months. Children were considered partially immunized if they were missing one or more recommended vaccines and unimmunized if they have not received any of the recommended vaccines for the age by the time of the study.

Survey method: We conducted a pre-school based survey according to WHO's EPI cluster survey methodology for estimating immunization coverage [1995]. The target population for the survey was children enrolled in pre-schools in different areas of urban part of Jamshedpur. The survey was approved by the Research Ethics Committee of Tata Main Hospital.

WHO 30 Cluster sampling method [Murthy BN, Ezhil R *et al*, 1995], with some modifications, was employed for this survey. Instead of 30 clusters as recommended by WHO, we selected 15 clusters because Jamshedpur urban area is divided in 15 subdivisions. From each cluster, we selected two pre-schools both lying at the opposite ends of that cluster. To compensate for sample size we selected 10 children from each school starting from roll number 1 to 10, thus the final sample size was 300 instead of 210 as usually taken in WHO cluster sampling technique. Children who did not provide immunization cards were excluded from the sample and the next available child was included.

Statistical analysis: The analysis of immunization coverage uses a number of demographic and socioeconomic variables. The selected variables in this study were sex of the child (male, female), number of siblings (0, 1 and 2), type of family [K Park, 2005] (joint and nuclear), mother's education (middle school complete, high school complete, 10+2 complete, graduate, post graduate and professional), socio-economic class (depends on education, occupation and income as per modified Kuppuswamy's classification), malnutrition (depends on weight, height and mid-arm circumference) and grades of malnutrition and presence of any co-morbid condition.

Analysis of data was done by using software "GraphPadInStat" downloaded from website www.graphpad.com. Significance of factors associated with immunization coverage was compared and its statistical significance was determined by Chi Square test and test of significance between two proportions.

Table 1 Immunization coverage in different socio-demographic subgroups

	Variable	Fully Immunized		Partially Immunized	
Overall Immunization status	Total Population	Total	Percentage	Total	Percentage
	n=300	240	80	60	20
Gender	Male – 161	132	81.99	29	18.01
	Female – 139	108	77.7	31	22.3
Number of siblings	0	43	79.63	11	20.37
	1	181	83.03	37	16.97
	2	16	57.14	12	42.86
Mother's education	Professional	15	100	0	0
	Post graduate	9	100	0	0
	Graduate	144	88.89	18	11.11
	SSC	52	75.36	17	24.64
	High school	16	41.03	23	58.97
	Middle school and less	4	66.67	2	33.33
Socio-economic status	Class – I	69	88.46	9	11.54
	Class – II	167	81.07	39	18.93
	Class – III	4	25	12	75
	Class – IV	0	0	0	0
	Class – V	0	0	0	0
Type of family	Joint, n=231	180	77.92	51	22.08
	Nuclear, n=69	60	86.96	9	13.04
Degree of malnutrition	Grade – I	14	66.67	7	33.33
	Grade – II	11	64.71	6	35.29
	Grade – III	1	50	1	50
	Grade – IV	0	0	0	0
Co-morbid conditions	Present	9	52.94	8	47.06
	Absent	231	81.63	52	18.37

Probability ('p' value) and confidence interval at 95% was calculated from the software mentioned and 'p' value considered to be significant when it was less than 0.05.

RESULTS

The observations recorded are shown in the tables 1, 2 and 3.

Table 2 Coverage of individual UIP Vaccines

Vaccine	Coverage	
	Total	Percentage
BCG	282	94.00%
OPV_0	243	81.00%
DPT_1 / OPV_1	290	96.67%
DPT_2 / OPV_2	289	96.33%
DPT_3 / OPV_3	282	94.00%
Measles	277	92.33%
Booster (OPV / DPT)	264	88.00%

The high risk children with co-morbid conditions unfortunately did not get the much required vaccines as observed in this study. Out of 9 children with haemolytic anaemia requiring blood transfusions and thus at high risk of acquiring hepatitis B infection, only 4 (44.44%) had received Hepatitis B vaccination at the time of study.

A relative difference of 4.29% between boys and girls was found in this study with a preference for male immunization as shown in table I. Percentage of fully immunized boys compared to girls was found to be 87.61% and 85.57% [Gupta PK, 2013], 58.0% and 55.1% [Coverage Evaluation Survey-2002], 45.3% and 41.5% [NFHS-3 2008], 61.9% and 59.9% [UNICEF 2009] respectively. Gender disparity with male preference even with optional vaccines which are usually given to children with higher socioeconomic background as illustrated in table 3.

Table 3

Vaccine	Coverage of optional vaccines					
		Male (n=161)	Female (n=139)	Socio-economic Class		
		Total (%)	Total (%)	Class - I	Class - II	Class -III
Hep B vaccine (n=261)	87.00%	142 (88.20%)	119 (85.60%)	93.59%	86.89%	56.29%
Hib vaccine (n=249)	83.00%	136 (84.47%)	113 (81.29%)	96.15%	81.55%	37.50%
MMR vaccine (n=248)	82.67%	135 (83.85%)	113 (81.29%)	94.87%	80.58%	50.00%
Chickenpox vaccine (n=185)	61.67%	104 (64.60%)	81 (58.27%)	65.39%	64.08%	12.50%
Hep A vaccine (n=179)	59.67%	100 (62.11%)	79 (56.83%)	75.64%	56.80%	18.75%
Typhoid vaccine (n=156)	52.00%	86 (53.42%)	70 (50.36%)	66.67%	49.03%	18.75%
Pneumococcal vaccine (n=28)	9.33%	19 (11.80%)	9 (6.47%)	17.95%	6.80%	NIL
Rotavirus vaccine (n=16)	5.33%	10 (6.21%)	6 (4.32%)	14.10%	2.43%	NIL

DISCUSSION

As per district level household survey (DHLS-3) data [District Level Household Survey, India. Mumbai: International Institute for population Sciences (IIPS) [2014], the corresponding figures are 100% for BCG, 82.7% for 3 doses of OPV, 88.7% for 3 doses of DPT and 98% for measles in East Singhbhum district of Jharkhand state, Jamshedpur being part of it. Fully immunized children constituted 81.5% in this study. Similar observations were noted in our study where the coverage for UIP individual vaccines is much higher than the proportion of fully vaccinated children as seen in observation table 1 and 2, suggesting significant decline in coverage for 3rd dose of DPT/OPV with dropout rates of 2.67%. Accessibility to health care services, higher socioeconomic status of surveyed children, high literacy rates of mothers and easy availability of vaccines are responsible for higher vaccine coverage in this study as shown in table 1.

The coverage of optional vaccines, recommended by Indian Academy of Pediatrics Committee on Immunization (IAPCOI) was fairly good as observed in table 3. Better economic conditions, high maternal education level and easy access to health facilities can explain high immunization coverage for optional vaccines in this study. Hepatitis B vaccination is given free of cost by Jamshedpur Utilities and Services company (JUSCO) can also explain the high coverage rates for this vaccine. Coverage Evaluation Survey [UNICEF Coverage Evaluation survey, [2009] reported 58.9% coverage of Hepatitis B vaccination in 16 states/union territories. MadhuriInamdar *et al* [2011] recorded coverage of hepatitis B vaccine as 32.3% in males and 19.8% in females, Hib 3.7% in males and 2.2% in females, MMR 36.0% in males and 20.0% in females, typhoid vaccine as 22.7% in males and 14.7% in females, chickenpox as 7.4% in males and 3.7% in females, and hepatitis A as 2.9% in males and 2% in females.

The highest boy-girl gap of 6.33% was seen with chickenpox vaccine followed by 5.33% for pneumococcal vaccine.

The complete immunization coverage for birth order 1, 2 and 3 was 80.28%, 83.78% and 63.44% respectively as observed in table 1, signifying that the coverage decreased after 2nd birth order (p value < 0.05). Coverage Evaluation Survey, [2009] has recorded complete vaccination coverage of 67.4%, 64.7% and 53.7% in children with birth order 1, 2 and 3 respectively. Lowest vaccine coverage in children with 3rd birth order in this study can be explained by the fact that more the number of children lesser will be the socioeconomic status of the family which in turn leads to lower vaccine coverage as seen in case of optional vaccines in observation table 3. The effect of birth order beyond 3 could not be evaluated in this study as such variable was not available among the surveyed population.

Children having two siblings had lowest full immunization coverage (57.14%) than those having one (83.03%) or no (79.63%) sibling. Children with malnutrition comprised of 13.33% of the surveyed population size. All grades of malnutrition found in this study had low complete vaccination coverage and the coverage worsened as the grade increased. Children with co-morbid conditions like nephrotic syndrome, thalassemia, sickle cell disease, atrial septal defect and asthma although comprised of only 5.67% of the surveyed population size but complete immunization coverage was significantly low in this group (p value < 0.05).

Complete vaccination coverage was strongly associated with maternal education as noted from observation table I (p value < 0.05). Children of professional and post-graduate mothers had 100% complete immunization coverage while it was 88.89% for children with graduate mothers. Vaccine coverage decreases as maternal education level decreases with only 41.03% children being fully immunized in mothers with high school level education.

Socioeconomic status of children has a direct effect on both UIP and optional vaccine coverage. This observation is significant as it shows the relative gap of 63.46% between Class I and Class III vaccination coverage (p value < 0.05). UNICEF survey [2009] has reported complete vaccination coverage of 76.5% in children belonging to highest wealth quintile, 70.0% belonging to fourth wealth quintile and 66.4% belonging to middle wealth quintile. Dalal A and Silveira MP, [2005] recorded 100% vaccination coverage in children belonging to Class I, 95.8% in Class II and 92.1% in class III. NFHS-3 survey [2008] have also shown lower vaccination coverage in children belonging to lower socioeconomic families.

Similarly, coverage decreased from Class I through Class II and Class III subgroups of socioeconomic strata for each of the optional vaccines, with no coverage at all for some vaccines in Class III subgroup as shown in observation table 1. Results could not be compared with other studies as enough literature is not available in India. Complete vaccination coverage in joint and nuclear families was 77.92% and 86.96% in this study was not found to be statistically significant (p value > 0.05). Nath B *et al* [2007] has also observed lesser vaccine coverage in joint families. Chhabra P *et al* [2007] did not find any difference in vaccine coverage among the two subgroups. High vaccine coverage in this study can be attributed to higher socioeconomic status and education level of parents in nuclear families.

SUMMARY AND CONCLUSION

A total of 300 urban preschool children aged 30-60 months, comprising 53.67% boys and 46.33% girls were assessed for immunization status and the various socio-demographic factors associated with vaccination coverage. Complete immunization coverage was 80% while partially immunized children were 20% and none was found to be unvaccinated. Partially vaccinated and unvaccinated groups need to be identified to interrupt the vaccine-preventable disease transmission. This study found lower socioeconomic status; low maternal education levels, female gender and co-morbid conditions were significantly associated with low vaccination coverage (p value < 0.05). Gender discrimination was responsible for further lowering of immunization coverage in girls. It can be expected that more stress on identified risk factors in the study will indirectly help in improving the immunization coverage.

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