Coverage and Predictors of Vaccination Among Children of 1-4 Years of Age in A Rural Sub-District of Sindh

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ABSTRACT

Objective: To estimate the proportion of children 1-4 years of age vaccinated in the first year of their life and determine socio-demographic factors associated with vaccination in the rural sub-district Khairpur, Sindh, Pakistan.
Study Design: Cross-sectional study.
Place and Duration of Study: The study was conducted in 9 Union Councils of sub-district Gambat, district Khairpur, Sindh, from August to October 2008.
Methodology: A questionnaire based representative multi-stage cluster survey was conducted. A total of 549 children aged 1-4 years were assessed for coverage and predictors of vaccination. Univariate and multivariate analysis was done using logistic regression to determine the unadjusted and adjusted relationship between socio-demographic predictor and outcome (vaccination status).
Results: The coverage for complete vaccination was 71.9% (95%CI=68.1%-75.7%). Educational level of mother (p=0.042), father (p=0.001) and child birth at hospital (p=0.006) were significantly associated with the vaccination status. Mother's educational level of intermediate and above was the strongest predictor (OR=12.19, 95%CI=1.57-94.3) for vaccination.
Conclusion: Education of parents, particularly mother's education was important determinant of vaccination status of the children. In addition, distance from taluka health facility and misconception of parents were among the main reasons of not getting the children vaccinated. There is a need to educate the parents especially mothers about the importance of vaccination and organize EPI services at Basic Health Unit level to improve the vaccination coverage in rural areas of Pakistan.

Key words: Vaccination. Rural area. Children. Mother education. Hospital delivery.

INTRODUCTION

Expanded Program on Immunization (EPI) was launched in 1974 to prevent children from vaccine preventable diseases.[1] It is estimated that over two million deaths are averted through vaccination every year.[2] Since its inception, immunization programs led to eradication of poliomyelitis in most, and measles in many regions of the world.[3-5] Despite substantial reductions in vaccine preventable diseases over the past few decades, they still are responsible for considerable morbidity and mortality, especially in developing nations. Around 2.5 million deaths in children under 5 years of age are due to vaccine preventable diseases occurring mainly in Africa and Asia.[6] The recent annual report of UNICEF terms vaccination as a vital intervention for child survival and development to achieve the Millennium Development Goal 4 to reduce under-5 mortality by two thirds by the year 2015.[7]

The vaccination coverage varies in the developed and developing regions of the world. The average coverage of child immunization for all vaccines in Europe is more than 90% while it ranges from 50-80% in the African region.[8]

Expanded Program on Immunization (EPI) was launched in Pakistan in 1978.[9] EPI coverage in Pakistan has improved substantially since its launch. Accelerated Health Plan (AHP) of the Government in 1982 provided the impetus which improved the coverage from as low as 5% in 1982 to as high as 70% in 1984.[10] In the last decade and a half national immunization days (NIDs) and the 'mopping-up' campaigns (door-to-door vaccination in high-risk areas) have been introduced to improve the coverage further, particularly for polio. Few studies have been conducted in different areas of Pakistan regarding the factors affecting the immunization. Lack of education, poor incentives and restricted mobility of the vaccinating staff have been reported to hamper the immunization coverage in Pakistan.[11-13]

By 2012, EPI program aims to improve the overall coverage to 90% and achieve at least 80% coverage in all the districts of Pakistan. There is a need to gather more concrete information about the status of coverage and factors affecting the vaccination to achieve this target.

Gambat is a sub-district town in district Khairpur in the province of Sind. The administration of Gambat Institute

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of Medical Sciences, a model Taluka Health Unit wanted to assess the immunization coverage to upscale vaccination in their town. By assessing the immunization coverage and factors responsible for immunization in children of a rural setting of Pakistan, this study was aimed to provide guidance to the stakeholders.

The objective was to estimate the proportion of children 1-4 years of age vaccinated in the first year of their life and determine socio-demographic factors associated with vaccination in the rural sub-district Khairpur, Sindh, Pakistan.

METHODOLOGY

A cross-sectional survey was carried out in all the nine union councils in a rural sub-district of Gambat. A structured questionnaire (translated in the local language i.e. Sindhi) was used to assess the vaccination coverage of children in the age group of 1-4 years. The survey questionnaire obtained information about demographic and socioeconomic factors of the household and the status of vaccination. From those who did not vaccinate their children, an open ended question was asked to inquire about the reason of non-vaccination. The parent (mother/father) of the child present at home at the time of survey was interviewed. Six data collectors received training on survey methods, interviewing skills and the objectives of the study. They collected the data and were supervised on the field during data collection. Informed consent was obtained from the parents. Information about one child in the age group of 1-4 years was obtained.

Sample size was calculated by estimating the difference between population proportions using the software, "sample size determination in health studies" of the World Health Organization. At estimated proportion of 50%, confidence level of 95% and power of 80%, the minimum sample required was 384. After adjusting for design effect of 1.5, sample size of 576 children was included. Multi-stage cluster sampling was used to obtain a representative sample from the whole sub-district. Proportionate sampling was done for the nine union councils calculated according to their population sizes. The nine union councils were taken as clusters and three villages were randomly selected from each union council for the survey. The household within the selected village were numbered and every fourth household with the child in the target age group was surveyed. The required sample for a particular union council was equally distributed among the three randomly selected villages.

The main outcome variable was the vaccination status of the child in the age group of 1-4 years. The definitions for vaccination status were based on reception of injectable vaccines (BCG, DPT-Hep B combo and measles) because oral polio vaccine is provided on special polio days. No vaccination was defined as reception of no injectable vaccine included in the EPI schedule. Incomplete vaccination was defined as reception of at least one injectable vaccine but having not received all vaccines included in the EPI. Complete vaccination was defined as reception of all the vaccines included in EPI in the first year of life. The complete schedule of vaccines under the EPI program Pakistan include BCG vaccine for childhood tuberculosis at birth, three doses of Combo vaccine and Polio drops at 6, 10 and 14 weeks and a dose of measles at 9 months.

Descriptive statistics of socio-demographic variables was calculated as mean with standard deviation for continuous variables and frequency with percentages for categorical variables. For extrapolation of population estimates, confidence intervals were also estimated. Percentages for the vaccination coverage were obtained for all the vaccines as well as for the individual vaccines in the taluka and in individual union councils. Univariate and multivariate analysis was done using logistic regression to determine the unadjusted and adjusted relationship between predictor variables (age, gender, place of birth, mother's level of education, father's level of education, level of income, total household items and place of residence) and outcome (vaccination status). Odds ratios with their 95% confidence intervals were determined for each independent variable. Predictor variables with p-value of less than 0.25 on univariate analysis were retained in the multivariate model which included all predictor variables mentioned above except level of income. A p-value of < 0.05 was considered as statistically significant. The data was analyzed on SPSS version 16.

RESULTS

Of the 576 questionnaires, 27 (4.6%) were excluded from the analysis due to missing and incomplete information. Table I shows the socio-demographic features of the study population. Among the remaining 549 children of 1-4 years of age in the sub-district Gambat, 57.4% (n=314) were males and 42.5% (n=235) were females. The mean age of the children was 2.5 ±1.1 years. Almost half of the children (43.2%) were born at home. Around two thirds (63.8%) of mothers and one third among fathers (33.9%) of the children were illiterate.

The coverage of complete vaccination was 71.9% (95%CI=68.1%-75.7%). Around four fifths of the children (82.9%) had received at least one injectable vaccine in the first year of life. Figure 1 shows that the coverage of complete vaccination in different Union Councils was variable ranging from 56.5% (95%CI=44.1%-68.7%) to 84.4% (95%CI=75.4%-93.2%).

The coverage of third dose of oral polio vaccine was 92.9% (95%CI=90.5%-94.8%) while for BCG, it was 82.9% (95%CI=78.9%-85.3%). The majority i.e. 73.6% (95%CI=69.9%-77.2%) children had received three doses DPT/Hep B combo and 73.4% (95%69.7%-77.1%) were vaccinated with measles (Figure 2).

Table II shows the association of independent variables with the outcome variable (vaccination status). Education level of mother and father (p=0.042 and 0.001 respectively) were found to be significantly associated with the vaccination. Mother's education level of intermediate and above showed a strong association (OR=12.19, 95%CI=1.57-94.3). Also, the birth of child at hospital was significantly associated with vaccination (OR=1.72, 95%CI=1.02-2.91, p=0.006). The children in the remote union councils of 7-9 were less likely (OR=0.54, 95% CI=0.32-0.92, p=0.008) to be vaccinated as compared to the union councils near the taluka health unit. The age, gender and socioeconomic variables (monthly income and total household items) showed no significant association with the vaccination status.

On response to the open ended question regarding the reason of not getting the child vaccinated (n=94), almost half (45.74%) believed that vaccine is harmful for their children. The other three main reasons for not getting their children vaccinated included personal careless-ness (18.0%), distance from facility (15.95%) and lack of awareness about vaccination (14.89%).

Table I: Socio-demographic characteristics of children 1-4 years of age of Taluka Gambat, district Khairpur (n=549).

Variable	Percentage (n)
Age (years) mean: 2.5 SD: 1.1	
≥ 1 < 2	20.8 (114)
≥ 2 < 3	28.1 (154)
≥ 3 < 4	30.6 (168)
≥ 4 < 5	17.9 (113)
Sex	
Males	57.5 (314)
Females	42.5 (235)
Mother tongue	
Sindhi	88.8 (485)
Siraiki	8.4 (49)
Punjabi	1.9 (10)
Others	0.9 (5)
Family size (number of people) mean: 9.66 SD:4.31	
4-6	23.5 (126)
7-9	35.2 (193)
10-12	21.9 (120)
13 or more	20.0 (110)
Place of birth	
Home	43.2 (237)
Hospital	26.2 (144)
Private clinic	30.6 (168)
Status of mother's education	
Illiterate	63.8 (350)
Ability to read and write	3.5 (19)
Madressa education only	4.6 (25)
Formal school education	28.2 (155)
Status of father's education	
Illiterate	33.9 (186)
Ability to read and write	1.9 (11)
Madressa education only	0.5 (3)
Formal school education only	63.7 (349)
Monthly income (rupees)	
3000 and less	35.5 (195)
> 3000 - 4000	13.1 (72)
> 4000 - < 8000	18.9 (104)
8000 and above	26.4 (145)
No reply	6.0 (33)
Type of house	
Mud house	26.6 (146)
Concrete	18.9 (104)
Semi-concrete	54.5 (299)

Table II: Unadjusted and adjusted relationship of independent variables with outcome variable (complete vaccination*).

	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	p-value
Gender			
Male	1.00		
Female	0.77 (0.53-1.12)	0.84 (0.56-1.26)	0.40
Age group			
≥ 1 and < 2	1.00	1.00	
≥ 2 and < 3	1.05 (0.60-1.83)	1.47 (0.81-2.69)	
≥ 3 and < 4	0.75 (0.44-1.27)	0.88 (0.49-1.58)	0.268
≥ 4 and < 5	0.94 (0.52-1.69)	1.18 (0.62-2.24)	
Mother's level of education			
Illiterate	1.00	1.00	
Primary	1.17 (0.37-3.73)	0.84 (0.45-1.54)	
Matriculate	2.68 (1.11-6.46)	1.96 (0.78-4.92)	0.042
Intermediate and above	17.39 (2.76-109.21)	12.19 (1.57-94.30)	
Father's level of education			
Illiterate	1.00	1.00	
Primary	0.76 (0.45-1.28)	0.91 (0.52-1.61)	
Matriculate	2.22 (1.14-4.31)	2.60 (1.39-4.86)	0.001
Intermediate and above	2.35 (1.12-4.98)	2.24 (1.25-4.01)	
Place of birth			
Home	1.00	1.00	
Hospital	1.01 (0.64-1.68)	1.72 (1.02-2.91)	0.006
Private clinic	0.51 (0.31-0.88)	0.80 (0.47-1.38)	
Number of household items			
1-4	1.00	1.00	
5-7	1.61 (0.82-3.16)	1.25 (0.72-2.19)	
8-10	1.28 (0.74-2.22)	0.89 (0.46-1.74)	0.173
11 and above	0.81 (0.46-1.43)	0.67 (0.40-1.13)	
Place of residence			
Union Council 1-3	1.00	1.00	
Union Council 4-6	0.74 (0.45-1.20)	1.11 (0.64-1.90)	0.008
Union Council 7-9	0.42 (0.26-0.68)	0.54 (0.32-0.92)	

*Complete vaccination was defined as reception of all the vaccines included in EPI in the first year of life.
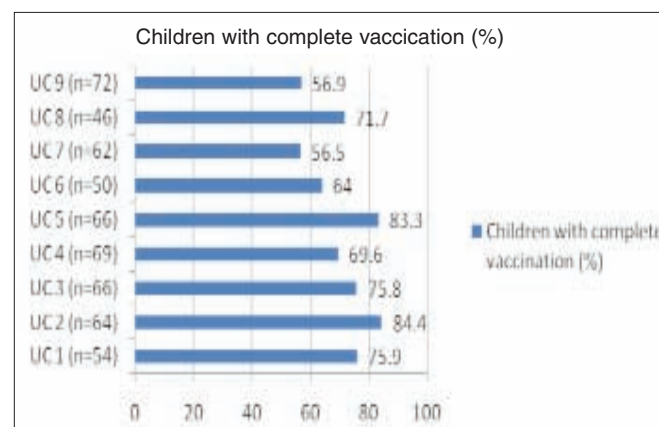

Figure 1: Total percentage of children of age 1-4 years vaccinated in the 9 Union Councils of Taluka Gambat.
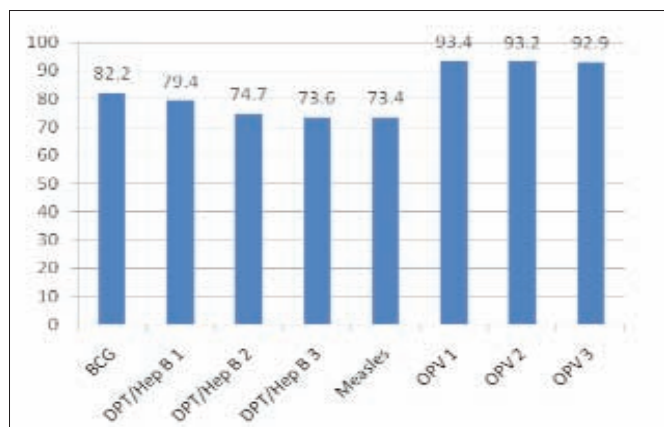
Figure 2: Total percentage of children of age 1-4 years vaccinated with individual vaccines included in the EPI in Taluka Gambat.

DISCUSSION

The coverage of complete vaccination of more than 70% is consistent with the coverage evaluation survey of Ministry of Health in 2006,[14] and is better than the reported 47% of Pakistan Demographic and Health Survey 2006-07.[15] This high coverage in a rural setting could be due to better health service provision in the study area (Gambat) because it is considered as state of the art taluka health unit in the area. However, there is a wide variability in the coverage within taluka Gambat among the different union councils. Some union councils had coverage of more than 80% while others covered only around 50% of the children.

The findings of this study make some important recommendations which can help in scaling-up the vaccination coverage. The coverage varied among different Union Councils of the Taluka. The union councils 1-6 which were closer to Taluka Health Unit were more likely to achieve higher coverage of vaccination as compared to the remote Union Councils 7-9.

Distance from the health facility has been previously identified as a major factor for not getting the children vaccinated.[16] Specific strategies are required to be adopted for these areas. There is a need to bridge the gap in supply of adequate vaccines and their utilization at Basic Health Unit (BHU) level. Services at BHU level must operate smoothly and health care workers should be given special support for accessing the hard to reach areas. This includes provision of adequate transport and security facilities. This will ensure greater reach of the villages of Union Councils that are away from the main Taluka health unit. Previously education of parents especially maternal education has been reported to be significantly associated with vaccination.[17,18] The results of this study establish that education of parents and birth of the child in a hospital setting were major determinants for getting the child vaccinated which could be explained by awareness and better health seeking behaviour in the educated parents. However, primary education did not show significant association with the vaccination status, the vaccination of the children improved remarkably if the parents had acquired education beyond primary level. Specially, mothers with education level of intermediate and above were twelve times more likely to vaccinate their children compared to less or no education. This emphasizes the importance of educated mothers who are more aware and careful about the health of their children.

Low socioeconomic status and being a female child have also been previously documented to be associated with non-vaccination.[19,20] However, there was no significant difference between male and female children and socioeconomic status had a little bearing on the status of vaccination in this study. These results suggest that awareness on gender discrimination has improved in rural areas or it does not apply for children under 5 years of age. Moreover, majority of the rural people belong to low socioeconomic group but since EPI provides free vaccines, socioeconomic status had no effect on the status of vaccination.

Fear of side effects of vaccination has been reported as a barrier for vaccination.[21] The results of this study suggest that there is still some resistance and misconception about vaccination among the local community. Some people still associate vaccination as a painful and harmful intervention that could be dangerous to the health of their child while others show careless attitude towards importance of vaccination. Health education about the benefits of vaccination should be incorporated in the routine cultural and religious rituals. Mosques, schools and other community gathering places could be used where misconceptions of the communities could be clarified and the resistance can be reduced.

These results confirm that around one fourth of the children under 5 years of age are not vaccinated against hepatitis B, the proportion of this population should be targeted to be vaccinated against hepatitis B because it is an emerging epidemic in Pakistan.

This study has a few limitations. Some remotely placed villages had to be excluded from the survey because of security reasons. It is expected that due to remoteness and illiteracy, vaccination coverage would be low in those areas which may have overestimated the actual coverage. However, majority of the areas of all the Union Councils were covered, the overestimation would be of minor proportions. The evidence of vaccination status was response-based as only 5.71% of the respondents possessed vaccination cards. Some quality checks were kept to address this issue and BCG scar was checked in the children who were vaccinated. And finally, because it was a community based survey, factors related to service delivery (staff, supply and demand) could not be explored.

The strengths of this study include consistency in data collection and constant supervision of data collectors by the principal investigator during the survey. A detailed questionnaire was designed to obtain comprehensive information about various aspects of immunization and its content was validated by public health experts. The multi-stage cluster sampling technique ensured that a representative sample was taken from the taluka, Gambat. Moreover, it has been indicated in the past that the data on vaccination coverage collected through household surveys is more authentic than routine reporting system.[22]

CONCLUSION

The coverage of EPI vaccines was more than 70% in this study. Parent's education, particularly of mothers was important determinant of vaccination status of the children. There is a need to improve general status of education of rural population, especially women. The findings also suggest that children living in distant union councils are less likely to be vaccinated. There is a need of organizing EPI services at BHU level to improve reach and increase the vaccination coverage. There is a need to educate people more about the benefits of vaccination. Moreover, those children who have not been vaccinated should be targeted for vaccination especially against emerging epidemics like hepatitis B.

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