Prevalence and Predictors of Incomplete Immunization among Children Residing in the Slums of Kathmandu Valley: A Community Based Door-to-Door Survey

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Citation

Manandhar K, Bajcharya K, Prajapati R, Shrestha NC. Prevalence and Predictors of Incomplete Immunization among Children Residing in the Slums of Kathmandu Valley: A Community Based Door-to-Door Survey. *Kathmandu Univ Med J.* 2018; 61(1):8-13.

ABSTRACT

Background

Expanded program on immunization is one of the most cost-effective and widely applied public health interventions in worldwide. It is priority program for government of Nepal.

Objective

To estimate the incomplete immunization and identify predictors of incomplete immunization among age of 12-60 months children residing in the slum areas of Kathmandu Valley.

Method

This cross sectional, community based door-to-door survey was carried out in slum areas of Kathmandu Valley in months of January to February, 2017. Among nine squatters; having more than 100 households, five were selected by using stratified random sampling. The total 505 children age of 12-60 months was included for study. The face-to-face interview with selected mothers was performed using the structured questionnaire. Mean and standard deviation was calculated for continuous variables and proportions with 95% confidence interval level for categorical variables. The chi-square analyses were used to evaluate association between selected variables with incomplete immunization. The p-value <0.05 was considered as statistically significant.

Result

The mean age of children was 34.7±17.8 months. Nearly half of the children (43.6%) were within age of 12-24 months. The mean age of mothers was 27.1±5.3 years and more than three quarters (82.2%) were literate. The incomplete immunization was 13.0%; it was found higher among female (14.7%) than male children (11.4%). The incomplete immunization was highly associated with poor knowledge on immunization schedule of mothers (p=0.001).

Conclusion

The incomplete immunization was higher than national mean. It was found association with poor knowledge on immunization schedule of mothers. So, the immunization program should be more strengthen in slum areas and need to expand the education program focusing on immunization schedule.

KEY WORDS

Children, Door-to-door survey, Incomplete immunization, Slums

INTRODUCTION

Immunization is one of the most cost-effective public health interventions for prevention of Child mortality and morbidity in worldwide.[1,2] WHO initiated the expanded program on immunization (EPI) in May 1974 with the objective to vaccinate children throughout the world.[2,3] In 1984, the WHO established a standardized vaccination schedule for the original EPI vaccines which included four vaccines: Bacillus Calmette-Guérin (BCG), Diphtheria-Pertussis- Tetanus (DPT), Oral Polio, and Measles.[3]

Nepal is among the poorest nations in the world, with high infant and child mortality rate due to childhood communicable diseases.[4] Since 1989, EPI as a priority program has been covered all 75 districts of Nepal. The overall goal of this program is to reduce child mortality, morbidity and disability associated with vaccine preventable diseases.[5]

The status and factors associated with incomplete immunization among children residing in the slum areas even though they are close to the necessary services are issues for research in Nepal because of two reasons. Firstly, they are one of the vulnerable but neglected groups. Secondly, very few studies on immunization had been done among children of slum areas in Kathmandu valley, Nepal.[6,7] Recently, a case control study was performed to find out the predictors of incomplete immunization among children but it was silent on representative sample of valley.[7]

The objective of this study was to estimate the incomplete immunization and identify the predictors of the incomplete immunization among age of 12-60 months children residing in the slum areas of Kathmandu Valley.

METHODS

The Institutional Review Committee of Kathmandu University School of Medical Sciences, Dhulikhel Hospital approved the study protocol. All participants were informed about the nature and purpose of the study and verbal consent was taken before the data collection.

This cross sectional, community based door-to-door survey was carried out in slum areas of Kathmandu Valley. Among 9 squatters; having more than 100 households, 5 were selected by using stratified random sampling techniques. The sample size: 505 children were determined by the formula: Z^2pq/d^2. Where, Z is taken 1.96, p is taken 16.0% and d is 20.0% of p. Among 505 children, 162 (32.0%), 92 (18.0%) and 251(50.0%), were selected from Bhaktapur, Lalitpur and Kathmandu respectively. The face-to-face interview with mothers of selected children was performed for data collection. The vaccination card was taken as evidence for immunization otherwise recall of mothers was used to determine the immunization status of children. The Nepali-version questionnaire already used in Nepal Demographic Health Survey (NDHS) in 2011 was used with minor modification in this study.[8] The questionnaire consists four parts: part I consists questions related to socio-demographic information of child and mother, part II consists questions on mother's knowledge on immunization and part III includes questions related to health system factors affecting immunization. The last part includes set of questions related to immunization status. All data were collected in the months of January to February; 2017.

The data were entered into IBM SPSS Statistics version 20 in the same day of data collection. We calculated mean and standard deviation (SD) for continuous variables while proportions for categorical variables. The proportions were presented with 95% level of confidence interval (CI). The chi-square analyses were used to evaluate association between selected variables with incomplete immunization. The p-value <0.05 was considered as statistically significant.

Operational definition of variables

Incomplete immunization

The child who had not received any one of recommended vaccines or dose of these vaccines: BCG, three doses of pentavalent (DPT, Hepatitis B [Hep B], and Haemophilus influenza type b [Hib]), three doses of polio and measles vaccines by the age of 12 months.

Knowledge on immunization of mothers

Knowledge about vaccine-preventable diseases (VPDs)

Mothers who knew four or more VPDs (≥50%) were considered to have good knowledge. Otherwise, they were considered to have poor knowledge about the VPDs.

Knowledge about the vaccination schedule

Mothers who knew the time schedule of BCG, pentavalent 3, polio 3 and measles vaccinations were considered as good knowledge. Otherwise, they were considered to have poor knowledge about the schedule of vaccination.

RESULTS

Socio-demographic characteristics of children and mothers

The descriptions of socio-demographic characteristics of children are presented in Table 1. The mean age was 34.7±17.8 months. Nearly half of the children (220; 43.6%) were within age of 12-24 months. Among total children, almost half of them (240; 47.5%) were female and just above half (276; 54.6%) were first baby. About two-third of children (326; 64.6%) were given birth in government facility/hospitals, nearly one-fifth (91; 18%) were delivered in private institutions/hospital and almost same proportions (88; 17.4%) were delivered at home.

The socio-demographic characteristics of mothers are presented in Table 2. The mean age of mothers was 27.1±5.3 years. Regarding education status, more than

Table 1. Socio-demographic characteristics of children n=505

Variables	Number (%)
Age (in months)	
12–24	220 (43.6)
25–36	82 (16.2)
37–48	83 (16.4)
49–60	120 (23.8)
Sex	
Male	265 (52.5)
Female	240 (47.5)
Birth order	
First	276 (54.6)
Second	168 (33.3)
≥Third	61(12.1)
Place of delivery	
Home	88 (17.4)
Government health facility/hospital	326 (64.6)
Private institution/hospital	91 (18.0)

Table 2. Socio-demographic characteristics of mothers

Variables	Number (%)
Age (in year) (n = 505)	
≤20	38 (7.5)
21–25	193 (38.2)
26–30	163 (32.3)
31–35	77 (15.2)
36–40	21 (4.2)
≥41	13 (2.6)
Education (n = 505)	
Literate	415 (82.2)
Illiterate	90 (17.8)
Level of education (n = 415)	
Just read and write	75 (18.0)
Primary	30 (7.2)
Lower secondary	154 (37.0)
Secondary	92 (22.1)
Higher secondary	46 (11.1)
Bachelor	19 (4.6)
Occupation (n = 505)	
Service	43 (8.5)
Business	51 (10.1)
Farmer	48 (9.5)
Daily wages	27 (5.4)
Housewife	336 (66.5)

three quarters (415; 82.2%) were literate. Among the literate, nearly two-fifth of them (154; 37%) completed lower secondary level (grade of 6-8) and just few of them (19; 4.6%) had completed bachelor study.

Among the total mothers, two-third of them (336; 66.5%) were housewife and just above one-tenth (51; 10.1%) were engaged in business.

Knowledge on immunization of mothers

Among the total 505 mothers, just above one-tenth of them (59; 11.7%) had good knowledge on VPDs and nearly one-quarter (114; 22.6%) had good knowledge on immunization schedule.

Immunization related health system factors

All the selected slum areas had facility of immunization services. Almost all mothers (498; 98.6%) perceived that the opening hour of health facility for immunization was to be convenient for them. More than ninety percent (463; 91.7%) mothers reported it reasonable amount of time to wait for getting the child immunized.

More than half of the mothers (273, 54.1%) had experiences of adverse effect of immunization in their children. Among them, majority (240; 87.9%) experienced fever, more than one-tenth (42; 15.4%) observed swelling and just few of them (20; 7.3%) mentioned pain as adverse effects of immunization in their children.

Immunization status of children

The immunization status of 205 (40.5%) of children was recorded based on immunization card and for others; it was recorded based on maternal recall. The status of immunizations is presented in table 3. Among total children, around one percent of them (4; 0.8%) didn't receive any vaccines. The coverage of BCG vaccine was 95.6% (95.8% in male; 95.4% in female) whereas coverage of pentavalent, polio, and measles were 95% (95.8% in male; 94.2% in female), 96% (96.2% in male, 95.8% in female) and 89.6% (90.2% in male; 87.9% in female) respectively. Only 67.3% (67.9% in male; 66.2% in female) were given Japanese encephalitis (JE) vaccination. In each vaccination, the coverage was found lower among females than males. The differences of coverage between males and females were gradually increasing from the birth-administered BCG to measles given at age 9 months vaccinations (0.4% in BCG versus [Vs] 2.3% in measles).

Among 501 children, who had at least one vaccine in the age of 12 months, 13.0 % of them were incomplete. The prevalence of incomplete immunization among females (14.7%) was higher than males (11.4%).

The association between incomplete immunization and socio-demographic variables of children and mothers, knowledge on immunization of mothers and health system factors are presented in Table 4. This study showed that the risk of defaulting vaccine series was higher in child of mothers aged below or equal to 25 years than those age of above 25 years (14.3% Vs 11.9%). Illiterate mothers were likely to partially immunize their children than literate mothers (16.7% Vs 12.2%). Similarly, the children of housewife mothers were found higher

Table 3. Status of immunization of children

Vaccination status	Coverage of vaccinations		
	Total%[95%CI]	Males%[95% CI]	Females%[95%CI]
At least one vaccine (n = 505 [265males; 240 females])			
Non vaccinated	0.8 [0.2-2.0]	0.8 [0.2-1.7]	0.8 [0.3-1.9]
Vaccinated	99.2 [98.0-99.8]	99.2[98.2-100.2]	99.2 [98.1-100.3]
Vaccination (n = 505 [265 males; 240 females])			
BCG	95.6 [93.8-97.4]	95.8 [93.4-98.2]	95.4 [92.7-98.1]
Pentavalent	95.0 [93.0-97.0]	95.8 [93.4-98.2]	95.2 [91.2-97.1]
Polio	96.0 [94.0-98.0]	96.2 [93.9-98.5]	95.8 [93.3-98.3]
Measles	89.1 [86.3-91.8]	90.2 [86.6-93.7]	87.9 [83.7-92.0]
JE	67.3 [63.2-71.4]	67.9 [62.3-73.5]	66.2 [60.7-72.6]
Among vaccinated (n = 501[263 males; 238 females])			
Incomplete vaccination	13.0 [10.0-16.0]	11.4 [7.5-15.2]	14.7 [10.2-19.2]

CI: confidence interval; BCG: Bacillus Calmette-Guérin, JE: Japanese encephalitis

proportion of incomplete immunization as compared to the mothers who were engaged in any occupation (14.2% Vs 10.7%). However, these socio-demographic variables were not found statistically associated with incomplete immunization.

Children born second or more had highly likelihood to incomplete immunization than the first child (14.6% Vs 10.9%). Similarly, the children delivered at home were fund higher proportion of the incomplete immunization as compared to those delivered at institutions (13.8% Vs 12.8 %). However, the statistical associations were not observed between these socio-demographic variables of children and incomplete immunization.

The mothers with poor knowledge on VPDs had higher proportion of incompletely immunized children as compared to mothers with good knowledge (13.6% Vs 8.2%). Mothers with poor knowledge on immunization schedule were found to have higher proportion of incompletely immunized children as compared to the mothers with good knowledge (15.8% Vs 3.5%,). But, the later one: knowledge on immunization schedule, only found statistical associated with incomplete immunization (p=0.001).

The mothers who perceived that the time of opening immunization center was inconvenient for them were more likely to incompletely immunize their children as compared to the mothers who perceive the time of opening to be convenient (14.3% Vs 13.0%). Similarly, the mothers who perceive that waiting time to get their child immunize was not reasonable or they had to wait longer for getting child immunized are more likely to incompletely immunize their children than those mothers who find it reasonable amount of time to wait for getting their child immunized (19.0% Vs 12.4%). However, none of these variables were found statistically associated with incomplete immunization.

Table 4. Association between incomplete immunization and socio-demographic variables of children and mothers, knowledge on immunization of mothers and health system factors n=501

Variables	Incomplete immunization n (%)	95% CI	p value
Socio-demographic variables of children			
Birth order (n = 501)			
First	41 (15.0)	11.0–19.8	0.14
Second or more	24 (10.5)	6.9–15.3	
Place of delivery			
Home	12 (13.8)	7.3–22.9	0.80
Institutional delivery	53 (12.8)	9.7–16.4	
Socio-demographic variables of mothers			
Age (in year)			
≤25	33 (14.3)	10.0–19.5	0.42
>25	32 (11.9)	8.2–16.3	
Education			
Literate	50 (12.2)	8.5–14.7	0.25
Illiterate	15 (16.7)	9.6–26.0	
Occupation			
Housewife	47 (14.2)	10.6–18.4	0.27
Other than housewife	18 (10.7)	6.4–16.3	
Knowledge on vaccine preventable disease (VPDs)			
Good knowledge	5 (8.2)	2.7–18.1	0.23
Poor knowledge	60 (13.6)	10.6–17.2	
Knowledge on immunization schedule			
Good knowledge	4 (3.5)	1.0–8.7	0.001
Poor knowledge	61 (15.8)	11.8–18.7	
Perceived extent of waiting (n = 501)			
Reasonable	57 (12.4)	9.5–15.8	0.22
Not reasonable	8 (19.0)	8.6–34.1	
Perception on convenient time of opening immunization center			
Yes	64 (13.0)	10.1–16.2	0.92
No	1 (14.3)	0.4–57.9	

CI: Confidence interval

DISCUSSION

Prevalence of incomplete immunization

In our study, incomplete immunization was reported at 13.0 % among children; it seems to be much improved as compared to study done same area in 2014.[7] It is also much better than prevalences reported from slums areas of different states of neighbored country India as well as reported from other developing countries.[9-14] The possible explanations could be successful implementation of immunization focusing in needy areas with targeting

marginal people in Nepal.

However, the prevalence of the incomplete immunization among children still found slightly higher than national figures.[15] The reasons of higher prevalence of incomplete immunization might be still difficulty in access of immunization services in these areas and indicates the need of improvement of primary health care services in the slum areas. The higher proportion of incomplete immunization as compared to national figures is also could be lack good perceptions on important of immunization among the people living in slum areas. But these are just our speculations behind the higher prevalence of incomplete immunization in slum areas of Kathmandu valley.

Sex of the child is found as an important factor of childhood immunization by many studies.[13,14,16,17] However, this present study is not able to achieve statistically significant differences of the incomplete immunization between genders. In line with studies done in other developing countries, the prevalence of incomplete immunization among females found higher than males.[9,12,18] This might be because of lack of awareness and advocacy about gender equality in the country to reduce the social differences. There might have still male preference in health seeking including immunization service.

Associations between incomplete immunization and selected variables of children, mothers and health system factor

We discovered no association with socio-demographic variables of mother and perception toward the health care system for immunization services that might offer an explanation of the relation with incomplete immunization. But we found that children whose mothers have not good knowledge about the schedule of immunization were more likely to remain incompletely immunized. This finding is in line with studies carried out in India, and in Ethiopia.[19,20] The possible explanation could be that if the mothers have the knowledge about the schedule of the vaccination, their children are less likely to miss the immunization; it is an important independent predictor for failure to complete recommended vaccines among children.

Immunization service delivery related factors: convenient time of opening and waiting time, are important determinates of utilization and continuation of vaccination services. In this study, none of these variables were found associated with the incomplete immunization. The possible explanation could be the huge majority of mothers, have good perception toward the existing immunization services in their areas.

Strengths and limitations

We note that our study used standard tool which had already been tested and applied in nationwide health survey in Nepal. Door-to-door survey was used to encourage participation in the study. Face-to-face interviews were conducted carefully to ensure there were no missing data. These were considerable strengths of the study.

The main limitation of this study is we estimated the status of immunization of children based on mothers' recall in cases where vaccination cards were not available. Some degree of over reporting of vaccinations might be expected. However, in previous studies, maternal recall provides accurate information for population-level estimates of immunization coverage of children.[21]

Public health implication

Prevalence of incomplete immunization among children in slum area found higher than national figure. The incomplete immunization was found strongly associated with poor knowledge on immunization schedule of mothers. This new evidence will inform national health policy, and provide a basis for public health care intervention strategies in Nepal. The results have implications that policy makers need to be aware of present status of incomplete immunization and implement the public health program focusing on raising awareness on immunization schedule through existing primary health care services in under serve areas especially in slum areas of Nepal.

CONCLUSION

The incomplete immunization among children residing slum areas of Kathmandu valley is satisfactory level. But it is still higher than national mean. The incomplete immunization is found associated with poor knowledge on immunization schedule of mothers. So, the national immunization program should be more strengthen in slum areas and need to expand the education program to mothers focusing on immunization schedule.

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