

Original Research Article

Assessment of timely immunization in an urbanized agglomeration of East Delhi, India

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ABSTRACT

Background: The under-5 mortality rate in India has shown a decline in the last few decades. However, there is still a lot of work to be done for our country to achieve sustainable developmental goals. One of the factors contributing to child survival is immunization coverage, but high coverage does not mean timely vaccination. 'On time' immunization is an important yet little researched factor shielding a child from susceptibility to vaccine preventable diseases. This study aims at assessing the extent of timely immunization and predictors of intentional delay in vaccination of children.

Methods: A cross-sectional study was conducted in East Delhi among caregivers having a child in the age group of 13-24 months. Sample size was calculated at 95% confidence limit and 3.5% absolute precision. The final sample size obtained was 350.

Results: The percentage of fully and timely vaccinated children is 67.1%, whereas children fully vaccinated but with a delay of 4 weeks from the recommended age of administration is 19.7%. Partial vaccination was found in 11.2% of children and 2% of children were found to be not vaccinated. The most common reason for delay in immunization was pain at the time of administration leading baby cries and fear of needles (26.1%), followed by bad experience with previous vaccination (11.6%). Fear of side effects (14.5%) and being denied vaccination without card (11.6%) were other reasons.

Conclusions: The immunization program should include timely completion of vaccination as a quality indicator. Delayed immunization can lead to epidemics in the community and threaten the goal of elimination of vaccine preventable diseases. Improving timeliness can be successfully achieved if the reasons for delay are taken into account.

Keywords: Timely immunization, Immunization coverage, Delay

INTRODUCTION

The under-5 mortality rate in India has shown a decline in the last few decades. However, there is still a lot of work to be done for India to achieve sustainable developmental goals. One of the factors contributing to child survival is immunization coverage, but high coverage does not mean

timely vaccination.¹ A delay in administration of one vaccine will lead to a ripple effect in catching up of all the other vaccines. Age appropriate immunization is important for disease prevention, but if children are not administered vaccines in a timely manner, they will be at risk of never completing their vaccination course and become vulnerable to vaccine preventable diseases.²

Various research groups have repeatedly studied immunization coverage in the past but very few studies have looked at timeliness of immunization.

WHO, defined 'fully and timely vaccination' as those children or infants who have received, for a given age, all recommended vaccinations according to the official vaccination schedule.

UNICEF has been promoting the campaign "timely immunization is your child's bodyguard" in Georgia since 2007 and this has resulted in an average 16% increase of timely vaccination of children at 2, 3 and 4 months. Determining the reasons why parents intentionally delay vaccines for their children is an important aspect that ought to be addressed.^{2,3}

METHODS

A cross-sectional descriptive study was conducted in Dallupura, an urbanized agglomeration in East Delhi from November 2015 to April 2017. At present, there are 21 anganwadis in this village, each covering an approximate population of 1400. The prevalence (p) of fully immunized children in East Delhi was reported to be 87.8% based on the result of a previous cross sectional study conducted by Yadav et al.⁴ Sample size (n) was calculated at 95% confidence limit and 3.5% absolute precision (d). The value was put into Epi Info 7 and the sample size was calculated to be 331. Assuming a non-response rate of 5% and after rounding off, the final sample size obtained was 350. A list of all children in the age group of 13-24 months residing in the area was obtained from the anganwadi Survey register. Seventeen children from each anganwadi were randomly selected from the same list to obtain sample size of 350 for the study. The age group of 13-24 months was selected to determine the number of children who had completed their primary immunization within 12 months of life. Caregivers of these selected children were interviewed at their own homes. Written informed consent was taken and each interview lasted an average of 15 minutes. Caregivers who could not be contacted despite 3 consecutive visits and those caregivers who refused to be part of the study were excluded and the next eligible child was selected.

The required information was obtained from the caregiver of these children by administering a pretested, interviewer administered questionnaire. The mother of the child was preferred as the primary respondent. In the absence of the mother, the father was taken as the respondent. In case of absence of both of them, the adult in the household who remained with the child for most of the time was taken as the respondent. If the household was locked on 3 consecutive visits, another child replaced the sampled child randomly. Data on immunization history was collected either from the vaccination cards or by mother's verbal report when a vaccination card was not available.

For coverage evaluation, the primary immunization schedule followed by the Delhi government was used for children immunized in Delhi; whereas for children immunized outside Delhi, the National Immunization Schedule was used. Place of birth was taken as the criteria of immunization to be followed in case the child shifted location.

The following definitions were used for the purpose of this study.²

Fully and timely vaccinated

For children vaccinated in Delhi

If the child had received one dose of Bacillus Calmette-Guerin (BCG) vaccine, three doses of polio vaccine, three doses of pentavalent vaccine, three doses of hepatitis B vaccine and one dose of measles vaccine during or within four weeks of recommended age of vaccination.

For children vaccinated outside Delhi

If the child had received one dose of BCG vaccine, three doses of polio vaccine, three doses of hepatitis B vaccine, three doses of DPT vaccine and one dose of measles vaccine during or within four weeks of recommended age of vaccination.

Fully vaccinated but with delay

If the child had received all recommended vaccines but a delay of more than four weeks was present from the recommended age of vaccination for any one or more vaccines.

Partially vaccinated

A child who had missed one or more dose of the recommended vaccines given under the immunization schedule.

Not vaccinated

A child that who had not received even a single vaccine.

RESULTS

The age of the caregiver ranged from 18-65 years with the mean (SD) age being 27.2 (3.9) years. Mother was the primary caregiver in 93.4% of families assessed, while the remaining 6.6% of families had the father fulfilling this role. Primary immunization status was assessed and divided into those who were fully immunized, partially immunized and unimmunized. Those who were fully immunized were further divided into those who were timely immunized or with delay. Table 1 shows the socio-demographic details of the caregivers. Timeliness of immunization was considered if the next vaccine was given within 4 weeks from the scheduled date. 67.1% of

children were found to be fully immunized within 4 weeks of the recommended date, whereas 19.7% of children were fully immunized but with a delay of more than 4 weeks. Therefore, the proportion of fully

immunized children was 86.8% (67.1+19.7%). Partial immunization was found in 11.2% of children and 2% of children were non-immunized (Figure 1).

Table 1: Socio-demographic variables of caregivers (N=350).

Parameters		Immunization status		Total	P value
		Fully and timely vaccinated N (%)	Others* N (%)		
Age of mother (in years)	≤25	142 (67.0)	70 (33.0)	212	0.936
	>25	93 (60.4)	45 (60.9)	138	
Educational status of mothers	Literate	177 (70.5)	74 (29.6)	251	0.032
	Illiterate	58 (58.6)	41 (41.4)	99	
Occupation status of mothers	Home-maker	220 (67.9)	104 (32.1)	324	0.286
	Employed	15 (57.7)	11 (42.3)	26	
Socio-economic status (SES)	Lower SES	1231 (66.1)	63 (33.9)	186	0.667
	Middle and upper SES	112 (68.3)	52 (31.7)	164	
Family type	Joint	41 (75.9)	13 (24.1)	54	0.135
	Nuclear	194 (65.5)	102 (34.5)	296	
Religion	Hindu	218 (68.6)	100 (31.4)	318	0.077
	Non-hindus	17 (53.1)	15 (46.9)	32	
Migration status	>5 years stay in Delhi	102 (69.9)	44 (30.1)	146	0.359
	≤5 years stay in Delhi	133 (65.2)	71 (34.8)	204	
ANC received by mother	Yes	225 (69.4)	99 (30.6)	324	0.001
	No	10 (38.5)	16 (61.5)	26	
Place of delivery	Hospital	192 (70.6)	80 (29.4)	272	0.010
	Home	43 (55.1)	35 (44.9)	78	
Place of birth	Delhi	140 (69.7)	61 (30.3)	201	0.246
	Outside Delhi	95 (63.8)	54 (36.2)	149	
Gender	Males	117 (66.5)	59 (33.5)	176	0.790
	Females	118 (67.8)	56 (32.2)	174	
Birth order	≤2	191 (67.3)	93 (32.7)	284	0.927
	>2	44 (66.7)	22 (33.3)	66	
Time taken to reach health facility (minutes)	≤30	228 (68.7)	104 (31.3)	332	0.009
	>30	07 (38.9)	11 (61.1)	18	

*Others include fully vaccinated but with delay, partially vaccinated and not-vaccinated children.

Table 2: Responses by caregivers that are not fully and timely vaccinated.

Reason	Fully vaccinated but with delay n=69 (%)	Partially vaccinated n=39 (%)	Not vaccinated n=7 (%)
Pain at the time of vaccination (baby cries) and fear of needles	18 (26.1)	06 (15.4)	-
Fear of side-effects	08 (11.6)	09 (23.1)	03 (42.8)
Unpleasant experience with previous vaccination	10 (14.5)	10 (25.6)	-
Denied vaccination at hometown (village) without vaccination card	08 (11.6)	01 (2.6)	-
Child not brought to vaccination centre due to physical illness	12 (17.4)	01 (2.6)	-
Lack of support	05 (7.2)	02 (5.1)	-
Timings of the centre	04 (5.8)	02 (5.1)	-
Child not given vaccine by health worker due to physical illness	02 (2.9)	02 (5.1)	-
Forgetfulness	02 (2.9)	02 (5.1)	-
Lack of knowledge	-	04 (10.3)	02 (28.6)
Family against vaccination	-	-	02 (28.6)

The most common reason for delay in immunization was concerns by the mother regarding pain at the time of administration of vaccination and the fear of needles itself (26.1%), followed by bad experience with previous vaccination (11.6%). Fear of side effects (14.5%) and being denied vaccination without card (11.6%) were also reasons found for children who were fully immunized but with delay. Other reasons include lack of support, mother being busy, timings of the vaccination centre, forgetfulness and child not been given vaccine due to physical illness. On multivariate analysis, three predictors came out to be significant ($p < 0.05$).

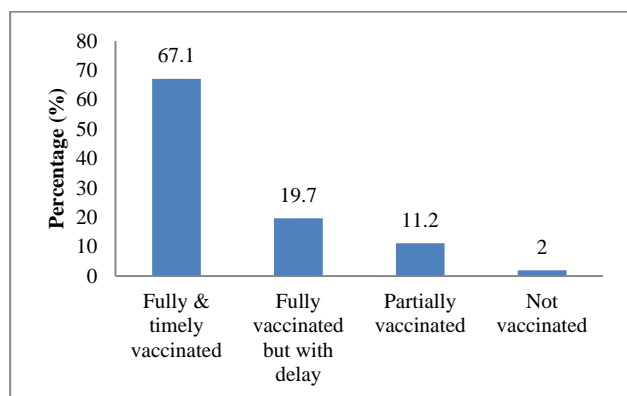


Figure 1: Immunization status of children aged 13-24 months (N=350).

DISCUSSION

The proportion of fully immunized children in our study was 86.8% and was in agreement with the prevalence of 87.8% found in a study done by Yadav et al in East Delhi in the year 2006.⁴ Similar results have also been found among studies conducted in the national capital region, Delhi. A study by Sharma et al found immunization coverage to be 89% and incidentally a study in Delhi conducted by Kusuma et al, also found immunization coverage among settled migrants to be 80.8%.^{5,6} Of the remaining children in our study, eleven percent of children were partially immunized and only 2% were non-immunized.

In contrast, in NFHS-4 (2015-2016) fully immunized children in East Delhi were only 64.0%. District wise variations of immunization coverage according to NFHS-4 were present ranging from 51.1% in South Delhi to 86.8% in South-West Delhi.⁷

In the present study, the higher proportion of fully immunized children was probably because of better functionality of the immunization services. The urban health-training centre of the college provides immunization services once a week along with health talks on the importance of immunization. The robust network of community health workers (CHW), accredited social health activists (ASHA) and anganwadis could be a

reason for better immunization coverage in our study area.

Various studies conducted in different parts of India have reported a wide range of proportion of fully immunized children. Studies in the states of Maharashtra, Kerala and Karnataka have coverage similar to our study whereas in some studies from Lucknow in Uttar Pradesh, immunization coverage ranged from 44.1% in 2005 to 74.7% in 2012.⁹⁻¹³ Heterogeneity of immunization coverage among various studies highlights the importance of periodic local surveys and targeted interventions as pockets of low immunization coverage in an area with an overall good coverage can lead to outbreaks of vaccine preventable diseases.¹⁵

Although many studies have measured immunization coverage, studies on timely immunization are infrequent in developing countries. As of now, indicators of timeliness are not utilized in evaluating the effectiveness of an immunization program. International studies which sought to measure timeliness, found proportions of full and timely immunization to be as low as 46% in a suburb of New York, USA (Chien et al). A similar study by Buenlow et al found complete and timely immunization to be 41% in the same city.^{16,17} In comparison, 67.1% of our study population was found to be fully and timely immunized. This observation may be attributed to the active role of CHWs in our study area. CHWs play a dynamic role in effectively engaging both community members and health service personnel and in reminding the caregivers when the next vaccine is due.¹⁸ Moreover, our study area is also the field training area of the department of community medicine, university college of medical sciences, one of the major medical colleges in the state. The department conducts various health talks periodically leading to increased health awareness among the people residing here.

Pain at the time of vaccination was one of the major reasons for delay in vaccination in our study (Table 2). Pain from immunization injections is a source of distress for both children and their caregivers. In a study conducted in the United States by Smith et al, thirty percent of parents reported concern for their child experiencing pain at the time of vaccination.¹⁹ Procedure being painful for the baby was also a concern among more than one third of parents (34.9%) in a study by Luthy et al.²⁰

Fear of side effects was also a reason for delay in our study. Parents commonly mention being fearful of the side effects of vaccines as a reason for not vaccinating their children. If an older sibling or a neighbor's child developed an adverse effect following vaccination, parents tended to refuse vaccination for their younger children.^{21,22} Fear of side effects, particularly fever, was also one of the main barriers to immunization among migrants living in Thailand.²³ In our study, among those

who had fear of side effects, concern about possibility of fever (66.7%) was cited as the most common reason followed by fear of swelling at the vaccination site (26.6%). Unpleasant experience from previous vaccination included fever (42.3%), swelling around the injection site (11.5%), combination of both fever and swelling (38.5%) and vomiting (7.7%).

Reasons for partial immunization were also assessed. In our study, the important reasons for partial immunization were fear of side effects (48.8%) followed by lack of knowledge regarding next dose (17.9%). Fear of needles was also found to be a reason for partial immunization. Reasons for non-immunization were fear of side effects (42.8%), followed by lack of knowledge (28.6%) regarding vaccines and the role of family members advocating against vaccination (Table 2).

In contrast, other studies observed lack of knowledge regarding the second and third dose of vaccination. This was not as high in our study probably due to the strong network of CHWs in our study area. Increases in immunization coverage rates are seen where community health workers aid in immunization compared to areas where there is no help from CHWs.²⁴⁻²⁶

In our study, a majority (94.8%) of people received all the scheduled vaccinations in a health facility less than 30 minutes away and at no cost. A study by Okwaraji et al observed that a longer travel time to the health centre for immunization made it less likely that a child would receive vaccination on time.²⁷

Based on our study, we would like to recommend that periodic coverage evaluation surveys be carried out in vulnerable areas in order to identify poorly performing pockets, because state averages often paint a misleading picture. Immunization is designed to offer protection early in life, when infants are most vulnerable, and any delay is likely to render them susceptible to diseases. We thereby propose that timeliness should be included as a quality indicator in immunization programmes. Protocols for mitigating painful vaccination should be introduced as concerns about injection procedure being painful were found to be a common reason for delay in immunization. Innovations to improve access to health facilities should be implemented as time taken to reach the health centre was found to be a significant factor for delay among caregivers.

CONCLUSION

The immunization program should include timely completion of immunization as a quality indicator. Delayed immunization can lead to epidemics in the community and threaten the target of elimination of vaccine preventable diseases. Improving timeliness can be successfully implemented if the reasons for delay are taken into account.

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