

## Original Research Article

# Determinants of delayed vaccination among children under 2 years attending an immunisation clinic of a tertiary care hospital, Kolkata

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### ABSTRACT

**Background:** Immunization is one of the most effective public health measures for disease prevention and when administered timely leads to substantial reduction in child mortality and morbidity. However, timely administration of vaccines remains neglected putting the children at risk of acquiring the infections.

**Methods:** The study is a cross-sectional, observational study, conducted in the immunization clinic of KPC Medical College and Hospital from January to March 2019 among children below the age of 2 years. The sample size was 332. The mothers were interviewed with a pre-designed and pre-tested schedule regarding socio-demographic details and records were reviewed for scheduled date of immunization and to find any delay.

**Results:** Total 33.7% children had some delay in receiving vaccines. The delay was found to be more in mothers <20 years of age, female children, children belonging to Hindu religion, children from joint family, children belonging to class 4 SES, children where maternal education is up to primary level and children with birth order  $\geq 3$ . Significant association was found between vaccine delay birth and order. ( $p < 0.05$ ). Sickness of the child accounted for 41% of the delays followed by both parents working, which accounted for 25.9% of delays.

**Conclusions:** Delay in vaccination was found in approximately one-third of children. Thus more awareness generation is required among mothers regarding the timeliness of vaccinations and risk it poses on the children making them more susceptible to diseases in the period of delay.

**Keywords:** Vaccination, Vaccine delay, Vaccination schedule, Under 5 children

### INTRODUCTION

Worldwide, immunization has emerged as the most effective public health tool for prevention of diseases and that too, at a low and affordable cost to the countries and communities.<sup>1</sup> Apart from focussing on individual protection, the vaccination schedules recommended by the World Health Organization, offers community protection by achieving the herd immunity.<sup>2</sup>

India has introduced the expanded immunization programme in 1978 and the universal immunization program (UIP) in 1985-86.<sup>3,4</sup> These programmes mainly targeted safe and effective delivery of vaccines to

children and antenatal women with the recommended vaccines at the correct time with the recommended number of doses.<sup>5</sup> However, inspite of these efforts, 20% of the children still remain unimmunized, and another 10-20% are not vaccinated at a scheduled time.<sup>6</sup> According to NFHS 4 data, 62% of children were found to be fully immunized upto the age of 1 year which shows an increase from the NFHS 3 data where this proportion was only 44%.<sup>7,8</sup> The burden of diseases like Diphtheria, Pertussis, Japanese encephalitis and Measles remain quite high in India.<sup>9-11</sup>

To increase the immunization coverage, mission indradhanush has been launched by the Government of

India in December 2014 following which intensified mission indradhanush was launched in order to enhance the coverage by more than 90% by December 2018.<sup>12</sup>

Vaccines, when delivered timely, can achieve a significant reduction in the childhood mortality and morbidity.<sup>13</sup> Studies have revealed that adherence to the vaccination schedules and timely administration of vaccines, if, neglected, makes the child more vulnerable to the disease in that period.<sup>14</sup> Few studies have been found highlighting these problems. Thus, the present study was undertaken to assess the proportion of children receiving delayed vaccination and their reasons and the determinants of the delay among the children under 2 years of age attending the Immunization Clinic of a Tertiary Care Hospital, Kolkata, West Bengal.

## METHODS

The present study is a descriptive, observational, cross-sectional study, done in the Immunization Clinic of KPC Medical College and Hospital during January to March 2019. The study population included children up to 2 years of age (0-23 months), attending the immunization clinics, accompanied by the parents or caregivers. Purposive sampling with total enumeration was done. 332 children attended the Immunization Clinic during this period and the response rate being 100%, total sample size was 332.

After being approved by the institution ethics committee, and obtaining informed consent from the parents or caregivers, they were interviewed using a pre-designed and pre-tested schedule. Information regarding socio-demographic characteristics like age, sex, religion, type of family, socio-economic status (B.G. Prasad), education of mother, and birth order were collected. Records as well as mother and child protection card were used to assess the scheduled date of vaccination and whether it was delayed or not. In addition, parents or caregivers were also asked for the reason of the delays. The following vaccines viz. BCG, OPV (oral polio vaccine), Hepatitis B, Pentavalent vaccine, injectable polio vaccine (IPV), Rotavirus vaccine, pneumococcal vaccine (PCV), measles rubella (MR), Japanese encephalitis (JE) and diphtheria, pertussis, tetanus (DPT) vaccines are given to under-five children according to National immunization schedule.<sup>15</sup> Vaccine delay refers to administration of scheduled dose of the vaccine being delayed by 28 days or more.<sup>16</sup>

The data were interpreted using proportions and Chi-square tests and statistical software SPSS 16 was used for analysis.

## RESULTS

Majority (60.2%) of the study population were  $\leq 1$  year of age while 39.8% were more than 1 year of age. 8.4% of the mothers were  $<20$  years of age, 19.9% were between

20 to 24 years, 29.5% were between 25-29 years, 25.9% were between 30-34 years of age while 16.3% were  $\geq 35$  years of age. 54.2% of the study population were males whereas the remaining 45.8% were females. 70.2% of the study subjects were of Hindu religion and 29.8% were Muslims. Most (50.6%) of the children were from joint family while 49.4% were from nuclear family. 25.9% of the children belonged to class 3 socio-economic status, 23.2% belonged to class 4, whereas 22%, 19% and 9.9% belonged to class 5, class 2 and class 1 socio-economic status respectively.

Again, majority of the mothers (47.0%) have studied up to higher secondary level and above, whereas 28.3% and 15.1% studied up to secondary and primary levels and 9.6% were illiterate or did not have any formal education. 50.6% of children were of birth order 1, 39.5% were of birth order 2 and another 9.9% were of birth order 3 (Table 1).

**Table 1: Distribution of the study subjects according to socio-demographic characteristics.**

Socio-demographic characteristic	No (%)
<b>Age of child</b>	
$\leq 1$ year	200(60.2)
$>1$ year	132(39.8)
<b>Age of mother (years)</b>	
$<20$	28(8.4)
20-24	66(19.9)
25-29	98(29.5)
30-34	86(25.9)
$\geq 35$	54(16.3)
<b>Sex</b>	
Male	180(54.2)
Female	152(45.8)
<b>Religion</b>	
Hindu	233(70.2)
Muslim	99(29.8)
<b>Type of family</b>	
Nuclear	164(49.4)
Joint	168(50.6)
<b>Socio-economic status</b>	
Class 1	33(9.9)
Class 2	63(19.0)
Class 3	86(25.9)
Class 4	77(23.2)
Class 5	73(22.0)
<b>Education of mother</b>	
Illiterate/no formal education	32(9.6)
Primary	50(15.1)
Secondary	94(28.3)
Higher Secondary and above	156(47.0)
<b>Birth order</b>	
1	168(50.6)
2	131(39.5)
$\geq 3$	33(9.9)

Delayed immunization was found in 33.7% of children attending the immunization clinic. In some cases, the delay occurred multiple times in a particular child.

Vaccines scheduled to be taken at birth viz. BCG, OPV and hepatitis B was delayed in 3.1% children. Vaccines scheduled at 6 weeks (pentavalent-1, OPV-1, rota-1, IPV-1 and PCV-1), 10 weeks (pentavalent-2, OPV-2, Rota-2) and 14 weeks (pentavalent-3, OPV-3, rota-3, IPV-2 and PCV-2) were delayed in 8.1%, 11.1% and 10.2% children respectively. Vaccines viz. MR-1, JE-1 and PCV Booster which is usually scheduled at 9 months was delayed in 25.7% children (Table 2).

Vaccine delay was found to be more in mothers <20 years of age, female children, children belonging to Hindu religion, children from joint family, children belonging to class 4 SES, children where maternal education is upto primary level and children with birth order ≥3. Significant

association was found between vaccine delay and birth order (p<0.005) (Table 3).

**Table 2: Proportion of delay according to vaccine schedules.**

Vaccine	Delayed (%)
<b>At birth (n=332)</b> BCG, OPV 0, Hepatitis B	10 (3.0)
<b>At 6 weeks(n=332)</b> Penta-1, OPV-1, Rota-1, IPV-1, PCV-1	27 (8.1)
<b>At 10 weeks (n=261)</b> Penta-2, OPV-2, Rota-2	29 (11.1)
<b>At 14 weeks (n=225)</b> Penta-3, OPV-3, Rota-3, IPV-2, PCV-2	23(10.2)
<b>At 9 months (128)</b> MR-1, JE-1, PCV Booster	33(25.7)

**Table 3: Association between socio-demographic characteristics and vaccine delay.**

Socio-demographic characteristic	Delayed vaccination No. (%)	
<b>Age of mother (years)</b>		
<20	11 (39.3)	X <sup>2</sup> =0.805, d.f.=4, p=0 .938
20-24	22 (33.3)	
25-29	30 (30.9)	
30-34	30 (34.5)	
≥35	19 (35.2)	
<b>Sex</b>		
Male	59 (32.8)	X <sup>2</sup> =0.161, d.f.=1, p=0.688
Female	53 (34.9)	
<b>Religion</b>		
Hindu	82 (35.2)	X <sup>2</sup> =0.743, d.f.=1, p=0.389
Muslim	30 (30.3)	
<b>Type of family</b>		
Nuclear	51 (31.1)	X <sup>2</sup> =1.008, d.f.=1, p=0.315
Joint	61 (36.3)	
<b>Socio-economic status</b>		
Class 1	6 (18.2)	X <sup>2</sup> =6.806, d.f.=4, p=0.146
Class 2	19 (31.1)	
Class 3	29 (33.7)	
Class 4	33 (43.4)	
Class 5	25 (34.2)	
<b>Education of mother</b>		
Illiterate	13 (40.6)	X <sup>2</sup> =3.139, d.f.=3, p=0.371
Primary	21 (42.0)	
Secondary	31 (33.0)	
Higher Secondary and above	47 (30.1)	
<b>Birth order</b>		
1	56 (33.3)	X <sup>2</sup> =36.85, d.f.=2, p=0.000
2	30 (22.9)	
≥3	26 (78.8)	

Total 41% of the delays occurred due to sickness of the child, whereas, in 25.9% children, both parents being

working could not bring the child for immunization. Lack of awareness of the parents regarding timeliness of

vaccinations, parents forgetting the dates and migration accounted for 16.9%, 13.4% and 1.8% of the delays respectively (Table 4).

**Table 4: Reasons for delayed immunization (n=112).**

Reasons for delay	No. (%)
<b>Sickness of the child</b>	46 (41.0)
<b>Did not remember the date</b>	15 (13.4)
<b>Unaware</b>	19 (16.9)
<b>Working parents</b>	29 (25.9)
<b>Migration</b>	2 (1.8)

## DISCUSSION

Delayed immunization was found in 33.7% of the children attending the immunization clinic. The results were similar to the studies by Norona E et al in Goa and Holambe et al in Maharashtra, where delayed immunization was found in 31% and 34% of children respectively.<sup>17,18</sup> However, another study by Ukey et al revealed delayed immunization was present in only 12.8% children which is much lower than the present study.<sup>19</sup> The most common causes of delayed immunization were sickness of the child (41%) followed by working parents (25.9%) who were not able to bring their children to immunisation clinic on week days. Study by Holambe et al found the most common cause of delay to be family being not there on the day of immunization while forgetfulness was the most common cause of delay reported by Norona E et al, Patel et al, Rahman et al, Sood et al and Singh et al.<sup>17,18,20-23</sup>

Delay in vaccination was found more in female children. Similar findings were reported by Norona E et al, Dyavarishetty et al, Tiwari et al and Ughade et al where delayed vaccination was more in female child.<sup>6,14,17,24</sup>

Timely vaccination is more in mothers who have studied upto Higher Secondary level and above in this study. Similar results were observed by Dyavarishetty et al and Patra et al in their studies.<sup>14,25</sup>

The delay was more (78.8%) in children with birth order  $\geq 3$ . Dyavarishetty et al also found delayed vaccination was more (21.4%) in higher birth orders ( $>2$  births), in comparison to those with birth order 1 and 2 where delayed vaccination was only 16%.<sup>14</sup> Similar results were also found in studies by Patel et al and Patra et al where immunization was delayed more in case of children with higher birth orders.<sup>20,25</sup>

Delayed vaccination was more in children belonging to class 4 socio-economic status followed by those belonging to Class 5 socio-economic status and least in children in class 1 socio-economic status. This can be explained by the fact people belonging to wealthier classes can access and afford private healthcare systems for treatment as well as for other health care services

including immunization thus being reluctant to take the vaccines on scheduled time whereas people belonging to lower classes primarily depend on Government health facilities and the vaccines given under UIP as these are provided free of cost.

Again, vaccine delay was more in joint family in comparison to nuclear family. This may be due to the traditional cultural beliefs and practices present in the joint families causing hindrance to adherence of immunization schedule at correct time.

Contrary to other studies, it was found in the present study that, vaccine delay was found to be more in children belonging to Hindu families in comparison to the Muslim families. The lower proportion of children of Muslim religion among the study participants may be a cause of such findings.

Delayed immunization of children was found to be maximum in mothers aged below 20 years. It was also higher in mothers of 30-34 years of age and  $\geq 35$  years of age. However, a study by Patra et al observed vaccination delay was more common after the age of 26 years of mothers.<sup>25</sup> Again Rahman et al found delay in vaccination to increase in mothers above 28 years of age.<sup>21</sup>

Though the association between vaccine delay and birth order was found to be statistically significant ( $p < 0.005$ ), no significant association was found between delay and age of mother, sex of child, religion, type of family, socio-economic status and maternal education.

## CONCLUSION

Delayed vaccination was observed in 33.7% of children. Thus, inspite vaccines being provided free of cost under UIP many parents are not aware of the importance of timeliness of the vaccinations rendering the child vulnerable to diseases during the gap. Thus, adherence to the schedules should be ensured and for that the mothers should be educated and counselled regarding the risk of diseases the child may suffer due to non-adherence to immunization schedules.

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