

## Research Article

# Immunization status of children 12 to 18 months of age presenting to tertiary care center at Aurangabad, Maharashtra: an observational study

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## ABSTRACT

**Background:** India is off track from set immunization coverage targets. Coverage data helps identify and address weak links. Study conducted to determine the primary immunization status of children and the factors, reasons affecting it.

**Methods:** Cross sectional observation study at tertiary care center, Aurangabad Maharashtra. 12 to 18 months' age children presenting to pediatric outpatient department from September 2012 to August 2014 were enrolled consecutively and assessed for completion of primary vaccination series as per National immunization schedule; sociodemographic details, reasons for partial or non-immunization noted. Chi square test of independence was performed to examine relation between sociodemographic variables and immunization status.

**Results:** Of 900 children, male to female ratio was 1.4:1, urban to rural 4:1, Hindu to Muslim 2.4:1. 69.2% were fully, 27.8% partially, 3% non-immunized. Coverage for vaccines: BCG 96.6%, 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> doses of OPV and DPT 95.5%, 94.2% and 91.2%, Hepatitis B 93.6%, 84% and 70.8% respectively, measles 82.2%. Vaccine dropout BCG to Measles was 14.84%. Immunization status was better in urban population, Hindus, hospital delivered children, lower birth orders, higher socioeconomic classes, older mothers, higher parental education and occupation, with immunization card (all with  $p < 0.001$ ). 277 children were not fully immunized as postponed due to child's illness, lack of knowledge of schedule/ subsequent doses and lack of motivation.

**Conclusions:** DTP3 coverage is on target, completion of primary immunization series and measles not. Rural, Muslim, lower socioeconomic status populations likely to miss or do not receive primary vaccine series. Knowledge of vaccine schedule is poor.

**Keywords:** Immunization coverage, Socio-demographic factors, Dropout rate, Primary vaccine series

## INTRODUCTION

Worldwide 5.9 million children under age five died in 2015 and of these 20% were from India.<sup>1</sup> One proven effective tool to reduce the under 5 mortality rate (U5MR) is immunization against vaccine preventable

diseases (VPD). Maharashtra has better immunization coverage<sup>2</sup> compared to other States but a big gap still remains.<sup>2</sup> Additional vaccines against hemophilus influenzae B (HiB), polio (inactivated polio vaccine) and rota virus are being introduced in National immunization schedule (NIS) to reduce the child mortality further.

Knowledge of immunization coverage and the reasons which favour and hinder immunization would help identify vulnerable populations and put in place interventions to ensure improved coverage and reduction in the burden of VPDs. This study was conducted to determine (1) Coverage of primary vaccination series as per NIS in the age group of 12 to 18 months; (2) Factors which influence the immunization status; (3) Reasons for partial and non-immunization.

## METHODS

This cross sectional hospital based observational study was carried out at MGM MCH, a tertiary level teaching hospital at Aurangabad, Maharashtra. Consecutive 900 children, 12 to 18 months of age presenting to the outpatient department (OPD) from September 2012 to August 2014 were included. Children revisiting the OPD were not included again. Institutional ethics committee approval and parents' written informed consents were taken. A structured pretested questionnaire was used. Where immunization card was available, data was collected as in the card. For vaccinations not recorded on the card, the mother's report was accepted. If the mother did not have the card, she was asked whether the child had received any vaccinations, had received a vaccination against tuberculosis, diphtheria, pertussis, tetanus, polio, Hepatitis B and measles in their own language and the number of doses of DPT, Hepatitis B and polio vaccines. For those who did not have an immunization card the BCG scar was used to decide whether BCG was given. Children who had received BCG, measles, and three doses each of DPT, Hep B and polio (excluding zero dose of polio given at birth) vaccine were considered to be fully immunized, those who had received some but not all the doses as mentioned above, partially immunized, and children who had not received a single dose of any vaccine as non-immunized. HiB vaccine was not introduced in Maharashtra during the study period hence its coverage was not considered. Those partially or non-immunized were enquired about reasons for the same. Sociodemographic information of parents, socioeconomic status as per modified Kuppuswamy scale was noted. Data was entered on Microsoft Excel sheet. Statistical analysis was done using the software IBM SPSS 20. Chi square test was used for correlation between immunization status and various factors at 5% level of significance. 'P value' of less than 0.05 was considered significant.

## RESULTS

Out of 900 children, there were 525 males and 375 females; 722 from urban area and 178 from rural; 634 were Hindus, 264 Muslims and 2 Christians. 69.2% were fully, 27.8% partially and 3% were non-immunized. Relation between sociodemographic variables and immunization status is shown in Tables 1 and 2. Coverage of BCG was 96.6%, OPV and DPT 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> doses was 95.5%, 94.2% and 91.2% respectively, Hep

B 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> doses 93.6%, 84% and 70.8% respectively, measles 82.2%. Vaccine dropout from BCG-Measles was 14.84%, DPT3-Measles 9.87% and BCG-DPT3 5.53%. Immunization status was better in urban than rural  $X^2 (2) = 15.69$ ,  $p < 0.001$ , in Hindu children than Muslim  $X^2 (4) = 15.16$ ,  $p = 0.001$ , hospital delivered than home  $X^2 (2) = 190.43$ ,  $p < 0.001$ , lower birth orders than higher  $X^2 (6) = 64.78$ ,  $p < 0.001$ , higher socioeconomic class than lower  $X^2 (8) = 256.63$ ,  $p < 0.001$ , older mothers than young  $X^2 (6) = 82.18$ ,  $p < 0.001$ , higher maternal education than illiterate  $X^2 (10) = 350$ ,  $p < 0.001$ , higher paternal education  $X^2 (12) = 333$ ,  $p < 0.001$ , professional skilled mothers than housewives  $X^2 (6) = 68.87$ ,  $p < 0.001$ , professional father than unskilled  $X^2 (8) = 136$ ,  $p < 0.001$ , with immunization card than without  $X^2 (2) = 276.63$ ,  $p < 0.001$ . No relation was found with gender,  $X^2 (2) = 3.1$ ,  $p = 0.213$  and type of family. 277 children were not fully immunized as vaccine got postponed due to illness of child (28.9%), lack of knowledge of immunization schedule and/or subsequent doses (28.15%) and lack of motivation (19.86%).

**Table 1: Relation between sociodemographic variables and immunization status.**

| Variable                    | Fully immunized<br>Number (%) | Partially immunized<br>Number (%) | Non immunized<br>Number (%) | Total |
|-----------------------------|-------------------------------|-----------------------------------|-----------------------------|-------|
| <b>Sex</b>                  |                               |                                   |                             |       |
| Female                      | 254 (68)                      | 113 (30)                          | 8 (2)                       | 375   |
| Male                        | 369 (70)                      | 137 (26)                          | 19 (4)                      | 525   |
| <b>Domicile</b>             |                               |                                   |                             |       |
| Rural                       | 102 (57)                      | 64 (36)                           | 12 (7)                      | 178   |
| Urban                       | 521 (72)                      | 15 (26)                           | 186 (21)                    | 722   |
| <b>Religion</b>             |                               |                                   |                             |       |
| Hindu                       | 435 (70)                      | 188 (30)                          | 11 (2)                      | 634   |
| Muslim                      | 186 (71)                      | 62 (24)                           | 16 (6)                      | 264   |
| Christian                   | 02 (100)                      | 0 (0)                             | 0 (0)                       | 02    |
| <b>Socioeconomic status</b> |                               |                                   |                             |       |
| I                           | 0 (0)                         | 0 (0)                             | 0 (0)                       | 0 (0) |
| II                          | 170 (93)                      | 13 (7)                            | 0 (0)                       | 183   |
| III                         | 357 (74)                      | 122 (25)                          | 2 (0)                       | 481   |
| IV                          | 96 (41)                       | 115 (49)                          | 22 (9)                      | 233   |
| V                           | 0 (0)                         | 0 (0)                             | 03 (100)                    | 03    |
| <b>Mother's age</b>         |                               |                                   |                             |       |
| 16-20                       | 13 (26)                       | 27 (54)                           | 10 (20)                     | 50    |
| 21-25                       | 496 (71)                      | 185 (27)                          | 16 (23)                     | 697   |
| 26-30                       | 107 (74)                      | 38 (26)                           | 01 (01)                     | 146   |
| 31-35                       | 07 (100)                      | 0 (0)                             | 0 (0)                       | 07    |

**Table 2: Relation between variables and immunization status.**

| Variable                 | Fully immunized Number (%) | Partially immunized Number (%) | Non-immunized Number (%) | Total |
|--------------------------|----------------------------|--------------------------------|--------------------------|-------|
| <b>Type of family</b>    |                            |                                |                          |       |
| Joint                    | 142 (16)                   | 47 (05)                        | 09 (01)                  | 198   |
| Nuclear                  | 481 (53)                   | 203 (23)                       | 18 (2)                   | 702   |
| <b>Birth order</b>       |                            |                                |                          |       |
| 1                        | 261 (71)                   | 92 (25)                        | 16 (4)                   | 369   |
| 2                        | 315 (72)                   | 115 (26)                       | 06 (01)                  | 436   |
| 3                        | 47 (51)                    | 42 (46)                        | 03 (03)                  | 92    |
| 4                        | 0 (0)                      | 01 (33)                        | 02 (67)                  | 03    |
| <b>Place of delivery</b> |                            |                                |                          |       |
| Home                     | 38 (40)                    | 33 (35)                        | 24 (25)                  | 95    |
| Hospital                 | 585 (73)                   | 217 (27)                       | 03 (0)                   | 805   |
| <b>Immunization card</b> |                            |                                |                          |       |
| Available                | 552(84)                    | 103 (16)                       | 0 (0)                    | 655   |
| Not available            | 71 (29)                    | 147 (60)                       | 27 (11)                  | 245   |

## DISCUSSION

The immunization schedule outlined by Government of India and the World Health Organization (WHO) requires all primary vaccinations including measles to be administered by the time a child is 12 months old in order to reduce the U5MR contributed by VPD.<sup>3</sup> In this study, 900 children between 12 to 18 months of age coming to the pediatric OPD of a tertiary care teaching hospital at Aurangabad district, Maharashtra were evaluated for their immunization status and the immunization coverage determined. This charitable private hospital provides health services to all socioeconomic classes throughout the city and neighbouring rural areas. A robust sample was ensured to make the study population representative of Aurangabad city and its surrounding rural areas. According to the 2011 census there were 532659 children in the age group of 0 to 6 years of age.<sup>4</sup> Of the 900 children evaluated, 58% were males, 42% females, 80% urban, 70% Hindus and 30% Muslims. 623 (69%) were immunized fully, 250 (28%) partially and 27 (3%) not at all. Gender did not have an impact on immunization status in our study. Urban area, higher maternal age, parental education and occupation, socioeconomic status, lower birth order, hospital delivery had a statistically significant positive correlation with immunization coverage.

WHO has recommended the 30 cluster sampling method for coverage evaluation.<sup>5</sup> This study was conducted in a hospital setting and not in the field. This is a limitation of the study as parents using health resources are more likely to be aware of immunization, to have an immunization card and to immunize their children. In

those not having an immunization card or with a missing entry in the card the mothers' report of having given the vaccine had to be accepted with possible reduction in data accuracy. We did not include questions on health care delivery systems in our questionnaire.

The target for full immunization coverage is more than 90% at nation level and more than 80% at district level by 2020 for all vaccines in national program and at least DTP3 by 2015 as a midpoint target as per the Decade of vaccines (DoV)/ Global Alliance for vaccines and immunization (GAVI) Strategic Advisory Group of Experts on immunization (SAGE) report.<sup>6</sup> As seen in Table 3, the full immunization coverage is more than that seen in Coverage Evaluation Survey (CES) 2009 and rapid survey of children (RSOC) 2013-2014 but it is very less compared to the studies done in similar period in Pune and Wardha, the former a peri urban setting and the latter a rural.<sup>7-10</sup> It should be noted though that the definition of fully immunized in our study included the three doses of HepB vaccine whereas that in the Pune and Wardha study excluded HepB coverage. HepB vaccine is an important tool in prevention of chronic liver disease and liver malignancy and hence we have included its coverage in our study. The DPT3 coverage is much better in the present study, Gupta et al and Wagh et al.<sup>9,10</sup> Proportion of 1-year-old children immunized against measles is one of the MDG4 targets.<sup>11</sup> A child who has received the measles vaccine is likely to have received the previous vaccines too. With the highest birth cohort in the world, highest number of measles deaths and relatively poor vaccine coverage, India poses a challenge for the Global Measles Eradication goal.<sup>12</sup> The measles vaccine coverage in our study was 82% which is better in comparison to CES and RSOC but lacking behind the 90% target and much behind the above studies from Pune and Wardha.<sup>9,10</sup> There was no significant difference in the immunization status amongst the gender. This is similar to recent studies by Sharma et al<sup>13</sup> and Lodha et al<sup>14</sup> with increase in people making use of the free health services for their girls. Gupta et al and Wagh et al both found males to have better immunization.<sup>9,10</sup> Since ours is a hospital based study there could be a selection bias and hence no difference between the two sexes. This study showed that children delivered at hospital had double the immunization coverage to those delivered at home. Malkar V et al, Sharma B et al, Yadav J et al and the present study have found literacy and higher education to favor good immunization.<sup>13,15,16</sup> Children with mothers less than 21 years of age had poor immunization as compared to those with older mothers in our study. Nath et al got an O.R. of 4.3 for Muslim children to be not immunized.<sup>17</sup> This is similar to our study as we had a dropout rate more with the muslim children. 86% children with an immunization card were fully immunized with a dropout of only 14%. Chhabra P et al observed that only 27.7% children without a card were fully immunized as compared to 68.2% children having the card.<sup>18</sup>

**Table 3: Parental education and occupation and relation with immunization status.**

| Variable                   | Fully immunized Number (%) | Partially immunized Number (%) | Non-immunized Number (%) | Total |
|----------------------------|----------------------------|--------------------------------|--------------------------|-------|
| <b>Mother's education</b>  |                            |                                |                          |       |
| Illiterate                 | 20 (27)                    | 46 (61)                        | 09 (12)                  | 75    |
| Primary                    | 55 (52)                    | 10 (09)                        | 41 (38)                  | 106   |
| Middle school              | 142 (61)                   | 86 (37)                        | 04 (02)                  | 232   |
| High school                | 219 (76)                   | 65 (23)                        | 04 (01)                  | 288   |
| PUC                        | 57 (86)                    | 09 (14)                        | 0(0)                     | 66    |
| Graduate                   | 130 (98)                   | 03 (02)                        | 0(0)                     | 133   |
| <b>Father's education</b>  |                            |                                |                          |       |
| Illiterate                 | 0 (0)                      | 1 (17)                         | 5 (83)                   | 06    |
| Primary                    | 12 (19)                    | 48 (74)                        | 05 (08)                  | 65    |
| Middle school              | 34 (42)                    | 34 (42)                        | 13 (16)                  | 81    |
| High school                | 180 (67)                   | 87 (32)                        | 02 (01)                  | 269   |
| PUC                        | 85 (76)                    | 25 (22)                        | 02 (02)                  | 112   |
| Graduate                   | 271 (83)                   | 55 (17)                        | 0 ( )                    | 326   |
| Post graduate              | 41 (100)                   | 0 (0)                          | 0 (0)                    | 41    |
| <b>Mother's occupation</b> |                            |                                |                          |       |
| Professional               | 28 (100)                   | 0 (0)                          | 0 (0)                    | 28    |
| Skilled                    | 179 (86)                   | 29 (14)                        | 01 (01)                  | 209   |
| Unskilled                  | 30 (42)                    | 36 (51)                        | 5 (07)                   | 71    |
| Housewife                  | 386 (65)                   | 185 (31)                       | 21 (04)                  | 592   |
| <b>Father's occupation</b> |                            |                                |                          |       |
| Professional               | 198 (84)                   | 37 (16)                        | 0 (0)                    | 235   |
| Business                   | 139 (85)                   | 23 (14)                        | 01 (01)                  | 163   |
| Skilled                    | 195 (64)                   | 105 (34)                       | 06 (02)                  | 306   |
| Agriculture                | 56 (49)                    | 43 (37)                        | 16 (14)                  | 115   |
| Unskilled                  | 35 (43)                    | 42 (52)                        | 04 (05)                  | 81    |

There was a significant drop (3.44%) in the number of birth cohort to those going on to receive BCG, the rate of dropouts fell to 0.69 for BCG - DPT1. There was subsequent increase in the dropouts from BCG to measles vaccination. Maximum dropout was during DPT3-Measles (9.86%). Chhabra P et al observed similarly that dropout rate increases with subsequent vaccination.<sup>18</sup> Over all dropout rate (Birth - Measles) in our study was 18.91 % which is less than study done in urbanized villages of Delhi where it was 49%.<sup>18</sup>

In our study common reasons for partial/non immunization were postponed due to illness of child (29%), lack of knowledge of immunization schedule/subsequent doses (28%) and lack of motivation (20%). Similar findings are noted by Kar M et al in their study, common reasons being un well child, lack of knowledge of immunization schedule and migration to native village.<sup>19</sup> In the Study by Nirupam et al, common reasons for non-immunization were obstacles, lack of information and lack of motivation.<sup>20</sup>

**Table 4: Comparison of immunization coverage of present study with recent studies.**

|                 | Present study (2012-14)     | Gupta et al <sup>9</sup> (2011) | Wagh et al <sup>10</sup> (2009-10) | CES <sup>7</sup> (2009)    | RSOC <sup>8</sup> (2013-14) |
|-----------------|-----------------------------|---------------------------------|------------------------------------|----------------------------|-----------------------------|
| Setting         | Hospital based              | Field survey                    | Field survey                       | Survey                     | Survey                      |
| Sampling        | Continuous                  | Cluster                         | All available                      | Systematic random sampling | Systematic random sampling  |
| Region          | Aurangabad, urban and rural | Pune, Periurban                 | Wardha                             | Nation wide                | Nation wide                 |
| Fully immunized | 69%                         | 86.67%                          | 84.9%                              | 61%                        | 65.3%                       |
| BCG             | 96.6%                       | 98.57%                          | 96.7%                              | 86.9%                      | -                           |
| DPT3            | 91.2%                       | 92.38%                          | 89.9%                              | 72%                        | 74.8%                       |
| Measles         | 82.2%                       | 87.62%                          | 84.9%                              | 74.1%                      | 78.9%                       |
| Hep B3          | 70.8%                       | 84.76%                          | -                                  | 58.9%                      | -                           |

Our study setting and population distribution is primarily an urban population with a good distribution of different socioeconomic classes making the results valid and useful in a similar setting. Girl child education, delayed marriage age, lower birth orders, antenatal registrations, hospital deliveries have an impact on immunization status. Every mother should be explained about utility of immunization card to ensure the baby's full immunization. The Integrated Management of childhood and neonatal illnesses (IMNCI) provides a checklist for the immunization status. Every visit to a health center by a mother and child should be an opportunity to check the immunization status and provide vaccines to the child. All pediatric OPD case sheets should have an immunization status check to ensure this. A written due date should be given to the parents about next immunization and it should be confirmed that they have



understood it, particularly at the time of DTP3; incentives like providing free iron, public awareness campaigns about measles vaccine at end of 9 months may help reduce the dropout rate from DTP3 to measles.

Mothers who are young, illiterate and uneducated, coming from villages, having more than 2 children, belonging to poor socioeconomic status are vulnerable to VPDs and also to lack of immunization hence should be counselled about the importance of immunizing their child and the easy availability of free health services.

## CONCLUSION

69% of children 12 to 18 months of age were fully immunized. Birth to measles drop out was 18% with 82% receiving measles vaccine which is less than the SAGE DoV/GVAP target. DTP3 target of more than 90% was achieved in the study population. Postponement due to minor illnesses, lack of knowledge of schedule and the subsequent doses were the major reasons for partial of non-immunized status.

### *What is already known*

Immunization coverage is off track of the designated targets

### *What this study adds*

Full immunization coverage by 1 year of age could be achieved by giving an immunization card to mother at the time of delivery, explaining her schedule and the use of the card with the information that minor illnesses are not a contraindication for immunization.

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