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### A systematic review of influencing factors on vaccine uptake in children aged 0-2 years

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#### Abstract

In the present pandemic era, it has been once proven again that one of the major defense that can protect or less the effect of the disease is Vaccination <sup>[1]</sup>. In 1974, WHO has taken an initiative and launched Expanded Program on Immunization (EPI) global wide to increase childhood immunization against the six basic infections such as measles, poliomyelitis, diphtheria, pertussis, tetanus, and tuberculosis. Global Alliance on Vaccines and Immunizations (GAVI) was launched with aim to accelerate the coverage of basic vaccines and to introduce the new vaccines in low-income and middle-income countries <sup>[5]</sup>. In spite of many national and international Initiatives launched to immunize globally, still there were reports in 2008 stating that 826,000 of children aged 1-59 due to vaccine-

preventable diseases. Common factors that were observed associated with partial vaccination in this study was time of vaccination inconvenient and long waiting time for vaccination, same factors were highlighted in the previous studies done. Keeping in view about the low % of full vaccinated children of age below 24 months, it is the need of the hour to strengthen vaccination coverage by taking few measure like making people understand the importance of vaccination and also the drawbacks if the vaccine is not taken on and before the deadline, increase the health education, get in contact with the families of children's who are not coming to vaccination place at appropriate age, keep a track record of the status of vaccination based on area wise.

**Keywords:** Vaccines, EPI, Cross-sectional study, UIP, Preventable Disease, Vaccination Card, Questionnaire

#### 1. Introduction

In the present pandemic era, it has been once proven again that one of the major defense that can protect or less the effect of the disease is Vaccination <sup>[1]</sup>. In 1974, WHO has taken an initiative and launched Expanded Program on Immunization (EPI) global wide to increase childhood immunization against the six basic infections such as measles, poliomyelitis, diphtheria, pertussis, tetanus, and tuberculosis <sup>[2]</sup>. In 1984, UNICEF in partnership with other stake-holders launched Universal Childhood Immunization (UCI) with the target of 80% coverage in childhood immunization by 1990 <sup>[3]</sup>. In 1985 Government of India has started a programme called UIP (Universal Immunisation Programme) that has clearly set its object to target Vaccine Preventable Disease <sup>[5]</sup>. In 1999, Global Alliance on Vaccines and Immunizations (GAVI) was launched with aim to accelerate the coverage of basic vaccines and to introduce the new vaccines in low-income and middle-income countries <sup>[5]</sup>. In spite of many national and international Initiatives launched to immunize globally, still there were reports in 2008 stating that 826,000 of children aged 1-59 due to vaccine-preventable diseases <sup>[6]</sup>. Survey Another survey conducted in 2008 by District level Household and Facility, India has reported that only 54% of children aged 12-23 months were fully vaccinated, 41% were under-vaccinated, and the remaining 5% were non-vaccinated <sup>[7]</sup>. Recent data received by WHO in 2012, 22 million infants worldwide have not yet received the vaccine properly or they have discontinued the dose <sup>[8]</sup>. Based on the previous analysis and social experiments done, few reason have been highlighted that might have led to such situation such as Myth on vaccination, believing that vaccines cause short- or long-term side-effects are ineffective, lack of access to vaccination, children receive too many vaccinations and that vaccines overload the immune system, family characteristics such as low education, literacy and socio-economic status, conflict with religious beliefs and negligence to take the next dose. WHO launched the Immunization Agenda 2030 strategy in 2020 to accelerate progress towards equitable access and use of vaccines over the new decade <sup>[9]</sup>.

## 2. Methodology

Present research Cross-sectional study conducted at Primary health centre, Mustabad and community health centre, Gannavaram infield practice reattached to Dr. Pinnamaneni Siddardha institute of medical sciences and research foundation near Guntur Andhra Pradesh.

Status of vaccination survey has been conducted by choosing family members whose families have children less than 0-2 years. Based on the data of NRHM of GOI, 2013-14 the prevalence of fully immunized children is 65.3%. In order to estimate prevalence in the study population, with a margin of error of 5%, at 95% confidence level, a sample size of 345 children are needed. To allow for loss of a child to be included in the study, a 10% increase is planned: the sample size for this study, rounded up to higher ten, is a total of 380 children. For analysis as mentioned children were brought by mothers and other family members along with their vaccination card, to PHC mustabad and CHC gannavaram and sub-centres of PHC mustabad. Sampling was done for a period of 04 months from September 2021 to December 2021. Before collecting the data, the informants were given a small session explaining the importance of the study in detail.

The data was collected from the vaccination records and reasons for partial vaccination through structured questionnaire by interview of family members. Question included are Age and proof was revealed by taking consideration into birth certificate/ vaccination card, Sex (Male/Female), Birth order (First/ Second/ Third/ Fourth), Total number of members in the family, Religion (Hindu/Muslim/Christian/Other), Type of family (Nuclear family, Joint family, Three generation family), Occupation of Parent (Unskilled, Semi-skilled, Skilled), Socioeconomic status. Modified BG Prasad's Classification was used to assess the social class of the study subjects<sup>[10]</sup>. Presence of vaccination card<sup>[11]</sup>, Proof of vaccination, Immunization status (Fully Immunized, Partially Immunized, Non-Immunized)<sup>[12]</sup>, Reasons for Partial or Non-Immunization, Place of vaccination (Anganwadi Centre/Sub-Centre/PHC/CHC)<sup>[13, 14]</sup>.

### 2.1 Ethical clearance

Ethical committee approval was obtained prior to the start of the study from institutional ethical committee, Dr PSIMS&RF, Chinna Avutapalli and an informed oral consent was obtained from all the parents.

### 2.2 Data analysis

Statistical analysis was done using Epi Info TM 7.1.5.2 of centre for disease control, USA61 and Medcalc15.11.4, Belgium62. Numerical continuous variables were summarized as mean or median with corresponding 95% confidence limits, standard deviation and range. Normality of distribution is tested by D'Agostino-Pearson test which computes a single P-value for the combination of coefficient of skewness and kurtosis. If the continuous variables were having non-normal distribution despite logarithmic transformation, median and corresponding 95% confidence limits were considered for further statistical analysis. The Mann-Whitney-U or Kruskal-Wallis test were used to determine the statistically significant differences in a numerical variable group. Categorical variables were summarized by frequency, percentage and its 95% confidence limits. Degree of association between categorical

variables is evaluated by chi-squared test or Fisher exact test. A test statistic was considered significant if the resulting P-value is small ( $P < 0.05$ ). The risk factors for obesity in our study are finally identified by multivariable logistic regression which avoids confound

## 3. Results

The summarized survey Information collected for this study is majorly obtained from 380 informants, out of then 332 were Mothers, 40 other /guardian and 08 fathers. Information about the family members, occupations etc were presented in Table 1. Questionnaire survey was conducted and information were collected from 380 informants.

Mostly mothers are home makers followed by daily wage workers and tailor, comparing the number of children family with single child are more followed by 2, 3 and 4. All children were born in hospital and were vaccination first dose with proper proof of vaccination card from ANM centre followed by CHC and PHC as shown in Table 2.

According to the primary data, Children were vaccinated with 100% with BCG, OPVzero, OPV1, OPV2, OPV3, Hepatitis B1, B2, B3, 1B, DPT 1,2,3, Hib 1,2,3 followed by DPT 3 vaccine (99.74%), Japanese Encephalitis JE (92.1%), DPT3 (87.37%), Measles and MMR (85-89%), Rotavac 1,2 and 3 (47%), IPV 1 and 2 (21%), whereas very less % was reported in Pneumococcal 1, Hepatitis A and Thyroid. Pneumococcal vaccine 1, 2, 3 has not been taken by any child as shown in Table 3.

Looking into the data drawn, the % of vaccination was more or less equal when compared in terms of the Social Group of the family (Graph 1) Religion of the family (Graph 2). Data states that the vaccination status of the child is not associated with gender of the child, religion or social group the family belongs to. Considering the % of vaccination, in family containing 2 members the partial vaccinations is up to the mark but the rate of full vaccination is nil due to many factors in comparison with the families containing more than two. The vaccination % is more in CHC in comparison with ANM and PHV. When comparing the % of vaccination in terms of vaccination center distance, more are recorded in Sub-centers indicating the efficiency of vaccination is more when the distance is not much from the place of stay (Graph 3-10).

Many reasons and factors have been stated by the family person why vaccination has not been taken few are 45% (95% ci 40% to 50%) are due to Lack of information & unaware of need for vaccination are observed in most of families, Place & time of vaccination know to all families, fear of side effects, 12.4% (95% CI 9% to 16%) Misconception about, 0.5% (95% ci 0.1% to 0.5%) people do not have in vaccines, 18% (14.5% to 22.4%) felt that the place of vaccination is too far, 9.2% (6.6% to 12.4%).time of vaccination is to be inconvenient, 1.5% people experienced absence of vaccinator, 26.3% of people told that despite maternal illness they getting children's vaccinated, 26% (95% ci 21.6% to 30.8%) child receiving vaccines despite maternal illness, 52% (95% ci 46.3% to 56.6%) are having some domestic problems which make it difficult to get vaccination according IAP schedule, 2.4% child having some illness during vaccination, 1.8% health worker refuse vaccine some time due to some reason, 5% felt that the waiting time is unduly long during vaccination, 98% families financially cannot afford vaccine suggested

IAP (Table 4).

The median age of full vaccinated children is 17 months. In comparison to partially vaccinated children median age of 10 months. This indicates delayed pattern of complete vaccination. Higher level of father's education is

significantly associated with partial vaccination status of child. Mother education status, Total family income of family, monthly income of family is not associated with vaccination status (Table 5, Graph 11 and 12)

**Table 1:** Information about the family background of the region surveyed 0 - 24 months

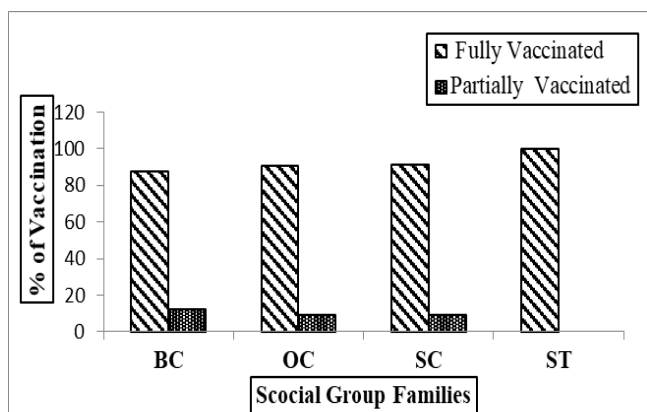
| Variable                     | Category            | Frequency | %         | 95% Confidence Interval |
|------------------------------|---------------------|-----------|-----------|-------------------------|
| Informant                    | Father              | 8         | 2.1       | 0.8-3.7                 |
|                              | Mother              | 332       | 87.4      | 84.2-90.5               |
|                              | Others              | 40        | 10.5      | 7.4-13.4                |
| Social Group                 | BC                  | 217       | 57.1      | 51.8-62.1               |
|                              | OC                  | 53        | 13.9      | 10.5-17.6               |
|                              | SC                  | 100       | 26.3      | 21.8-31.0               |
|                              | ST                  | 10        | 2.6       | 1.1-4.5                 |
| Number of Children in family | 1                   | 229       | 60.3      | 55.3-65.0               |
|                              | 2                   | 134       | 35.3      | 30.8-40.0               |
|                              | 3                   | 14        | 3.7       | 1.8-5.8                 |
|                              | 4                   | 3         | 0.8       | 0.0-1.8                 |
| Family Members Total         | 2                   | 1         | 0.3       | 0.0-0.8                 |
|                              | 3                   | 157       | 41.3      | 36.3-46.0               |
|                              | 4                   | 126       | 33.2      | 28.7-37.6               |
|                              | 5                   | 64        | 16.8      | 12.9-20.5               |
|                              | 6                   | 30        | 7.9       | 5.3-10.8                |
| Family Type                  | 7                   | 2         | 0.5       | 0.0-1.3                 |
|                              | Joint               | 98        | 25.8      | 21.3-30.5               |
| Father's Occupation          | Nuclear             | 282       | 74.2      | 69.5-78.7               |
|                              | Business            | 52        | 13.7      | 10.5-17.4               |
|                              | Employee            | 104       | 27.4      | 22.9-31.6               |
|                              | Farmer              | 11        | 2.9       | 1.3-4.7                 |
|                              | Professional I      | 2         | 0.5       | 0.0-1.3                 |
|                              | Semi-skilled worker | 37        | 9.7       | 6.8-12.6                |
|                              | Skilled worker      | 30        | 7.9       | 5.5-10.5                |
| Unskilled worker             | 144                 | 37.9      | 32.9-42.9 |                         |

**Table 2:** Mother's occupation, Delivery place and Source of vaccination details

| Variable                | Category         | Frequency | %     | 95% Confidence Interval |
|-------------------------|------------------|-----------|-------|-------------------------|
| Mother's Occupation     | Cooly            | 127       | 33.4  | 28.7-38.2               |
|                         | Housewife        | 252       | 66.3  | 61.6-71.1               |
|                         | Tailor           | 1         | 0.3   | 0.0- 8                  |
| Birth order of Child    | 1                | 246       | 64.7  | 60.0-69.5               |
|                         | 2                | 116       | 30.5  | 26.3-35.0               |
|                         | 3                | 14        | 3.7   | 1.8-5.8                 |
|                         | 4                | 4         | 1.1   | 0.3-2.1                 |
| Delivery Place          | Hospital         | 380       | 100.0 | 100.0                   |
| Vaccination Place       | CHC              | 106       | 27.89 | 23.62-32.61             |
|                         | PHC              | 98        | 25.79 | 21.65-30.42             |
|                         | SUBCENTER        | 176       | 46.32 | 41.36-51.34             |
| Vaccination Card        | Yes              | 380       | 100.0 | 100.0                   |
| Source vaccination Card | ANM              | 176       | 46.3  | 41.1-51.6               |
|                         | CHC              | 107       | 28.2  | 23.7-32.6               |
| BCG given where         | ANM              | 38        | 10.0  | 7.37-13.43              |
|                         | CHC              | 154       | 40.53 | 35.7-145.53             |
|                         | PHC              | 3         | 0.79  | 0.27-2.30               |
|                         | Private Hospital | 185       | 48.68 | 43.70-53.70             |
| OPVzero given where     | ANM              | 38        | 10.0  | 7.37-13.43              |
|                         | CHC              | 154       | 40.53 | 35.7-145.53             |
|                         | PHC              | 3         | 0.79  | 0.27-2.30               |
|                         | Private Hospital | 185       | 48.68 | 43.70-53.70             |

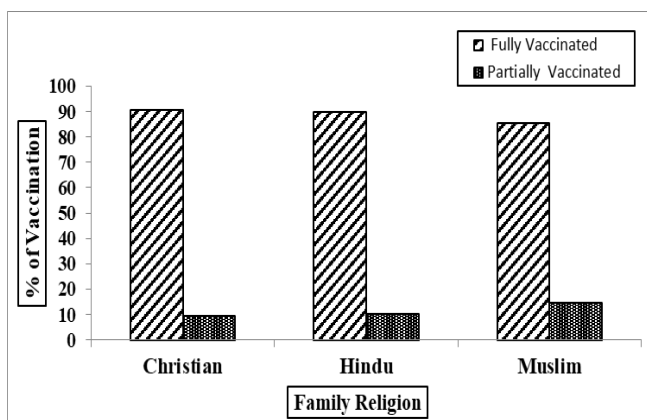
**Table 3:** % of vaccination rate

| Vaccine   | %     | 95% CI      |
|---|-------|-------------|
| BCG, OPV zero, OPV1, OPV2<br>OPV3, Hepatitis B1, B2, B3, 1B, DPT 1, 2, 3, Hib 1, 2, 3 | 100.0 | 100.0       |
| DPT3  | 99.74 | 98.52-99.95 |
| JE (Japanese Encephalitis)  | 92.1  | 88.8-94.5   |
| DPTB  | 87.37 | 83.65-90.34 |
| Measles   | 89.2  | 85.6-92.1   |
| MMR (Measles, Mumps, and Rubella)   | 85.8  | 81.9-89.1   |
| Rotavac1  | 47.11 | 42.14-52.13 |
| Rotavac2  | 46.1  | 41.0-51.2   |
| Rotavac3  | 46.1  | 41.0-51.2   |
| IPV1  | 21.05 | 17.25-25.43 |
| IPV2  | 20.26 | 16.53-24.59 |
| IPV3  | 0.53  | 0.14-1.93   |
| IPV1B   | 0.53  | 0.14-1.90   |
| Hib1B (Haemophilus Influenzae type B)   | 2.11  | 1.07-4.10   |
| Pneumococcal 1  | 0.5   | 0.1-2.1     |
| Typhoid   | 1.1   | 0.3-2.9     |
| HepatitisA1   | 1.1   | 0.3-2.9     |

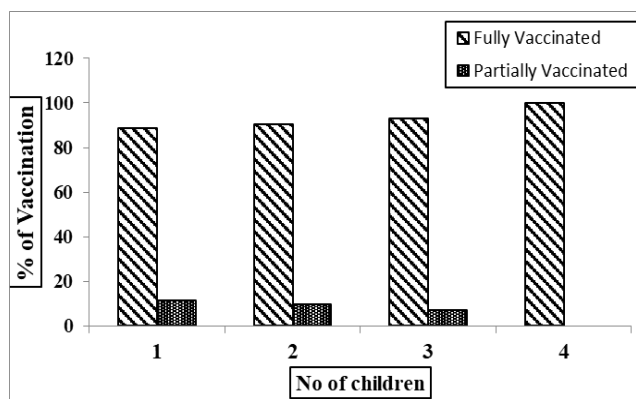


BC = Back ward Classes. OC = Open community Castes. SC = Scheduled Castes, ST =Scheduled Tribes

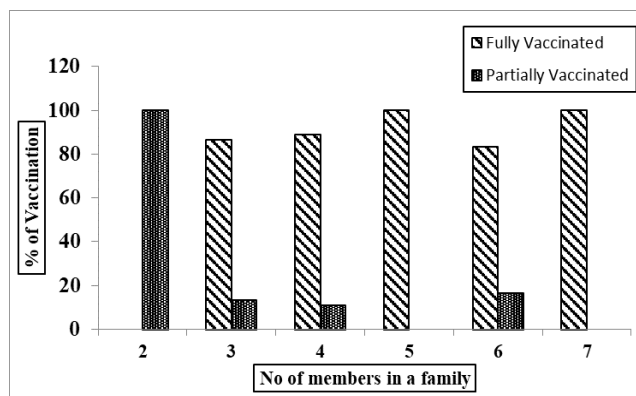
**Graph 1:** % of vaccination in various social group families



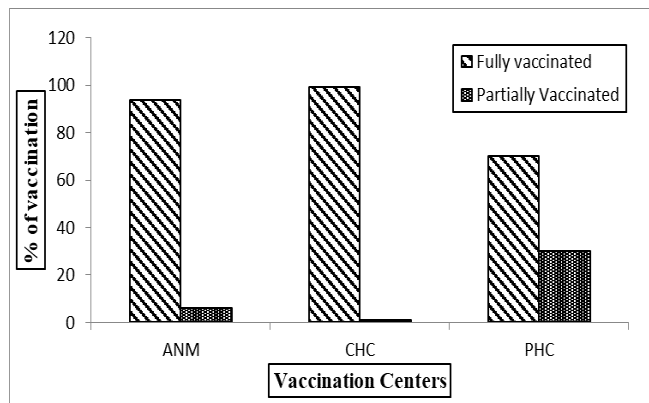
**Graph 2:** % of vaccination in various families belonging to different religions.



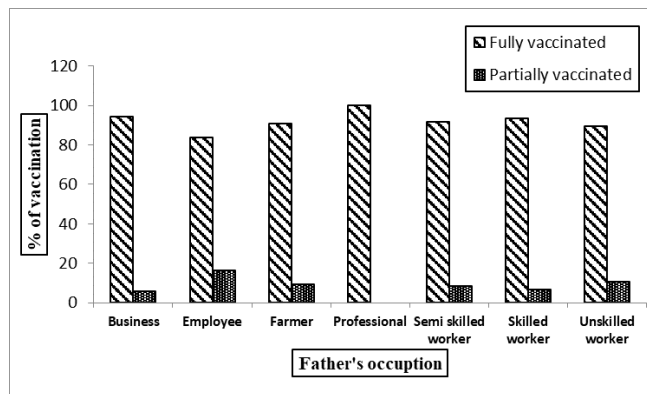
**Graph 3:** % of vaccination in relation with number of Children



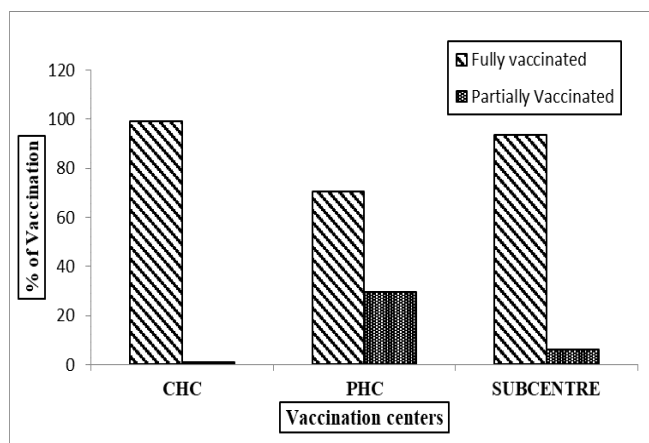
**Graph 4:** % of vaccination depending upon the number of family members



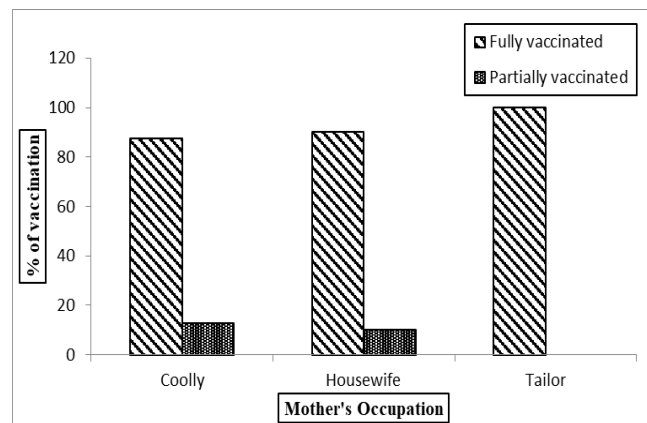
Graph 5: % of vaccination done in various Health centers



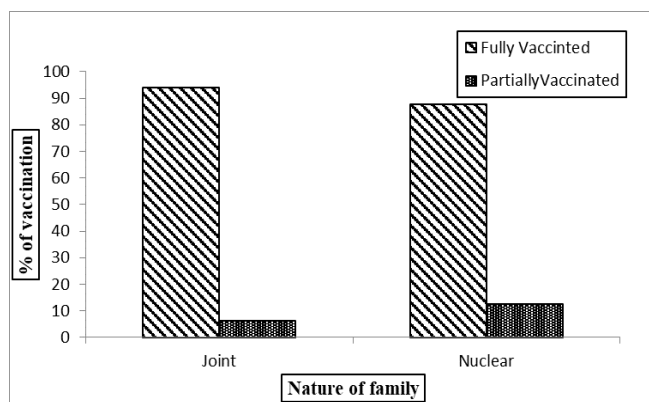
Graph 8: % of vaccination depending on the occupation of father



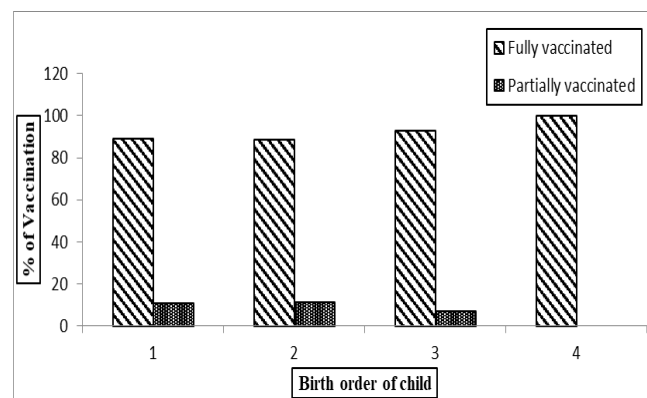
Graph 6: % of vaccination depending on Place of vaccination



Graph 9: % of vaccination in relation with mother's occupation



Graph 7: % of vaccination depending on nature of family



Graph 10: % of vaccination in relation with Birth order of child

Table 4: A Factors Influencing Vaccination Status of Children

| Factors influencing Vaccination       | Information | % of Vaccination     |                  | 95% Confidence Interval |
|---------------------------------------|-------------|----------------------|------------------|-------------------------|
|                                       |             | Partially Vaccinated | Fully Vaccinated |                         |
| Lack of Information about Vaccination | No          | 0                    | 0.9              | 0.0-1.8                 |
|                                       | Yes         | 100                  | 99.1             | 98.2-100.0              |
| Unaware of Need for vaccination       | No          | 12.5                 | 87.5             | 0.8-3.7                 |
|                                       | Yes         | 10.8                 | 89.2             | 96.3-99.2               |
| Fear of Side effects of vaccine       | No          | 13.33                | 86.69            | 100                     |
|                                       | Yes         | 7.65                 | 92.35            | 0                       |
| Misconceptions about Vaccine          | No          | 12.01                | 87.99            | 50.3-60.5               |
|                                       | Yes         | 2.13                 | 97.81            | 39.5-49.7               |
| Place of Vaccination is - Too Far     | No          | 10.85                | 89.15            | 84.0-91.1               |
|                                       | Yes         | 0                    | 100              | 8.9-16.0                |
| Place of Vaccination is - Too Far     | No          | 10.64                | 89.36            | 98.7-100.0              |
|                                       | Yes         | 8.75                 | 91.25            | 0.0-1.3                 |
| Time of Vaccination Inconvenient      | No          | 9.28                 | 90.72            | 77.6-85.5               |
|                                       | Yes         | 25.71                | 74.29            | 14.5-22.4               |

|  |     |       |       |           |
|--|-----|-------|-------|-----------|
| <b>Vaccinator Is Absent</b>              | No  | 10.72 | 89.28 | 87.6-93.4 |
|  | Yes | 14.29 | 85.71 | 6.6-12.4  |
| <b>*Mother- Busy</b>                     | No  | 10.9  | 89.1  | 96.6-99.5 |
|  | Yes | 0     | 100   | 0.5-3.4   |
| <b>@Mother</b>                           | No  | 12.14 | 87.86 | 97.9-99.7 |
|  | Yes | 7     | 93    | 0.3-2.1   |
| <b>**Family Problem</b>                  | No  | 8.7   | 91.02 | 69.2-78.4 |
|  | Yes | 12.76 | 87.24 | 21.6-30.8 |
| <b>#Child – Ill</b>                      | No  | 10.78 | 89.22 | 95.8-98.9 |
|  | Yes | 11.11 | 88.89 | 1.1-4.2   |
| <b>Health Worker refused Vaccination</b> | No  | 10.99 | 89.01 | 96.6-99.5 |
|  | Yes | 0     | 100   | 0.5-3.4   |
| <b>Long Waiting Time for Vaccination</b> | No  | 9.39  | 90.61 | 92.9-97.4 |
|  | Yes | 38.89 | 61.11 | 2.6-7.1   |
| <b>*Financial problem (IAP)</b>          | No  | 0     | 100   | 1.1-3.9   |
|  | Yes | 11.05 | 88.95 | 96.1-98.9 |

#### 4. Discussion

Current research has been designed according to the GOI schedule and factors associated with partial vaccination status to evaluate the % of vaccination of children residing in rural area and fall into age category of 0-24 months. Based on the information collected from 87.4% mothers, rate of vaccination is reported more in children belonging to Hindu community followed by Christians, Muslims communities, whereas considering social groups % of vaccination was reported less in OC and ST in comparison with BC. On the bases of family environment Children coming from nuclear families constitutes are more vaccinated (74.2%) followed by single child families (60.3%), families with 3 total members, 2 children (35.3%), or 4 total members (33.21%). All the children are vaccinated in ANM sub center (46.3%), CHC (28.2%) or PHC (25.5%) and possess vaccination card or record as a proof of vaccination. Looking into the BCG vaccination status 48.7% received from private hospitals and 40.5% from CHC wherever delivery has been done indicating nearly 89% of children are getting vaccinated BCG vaccines around time of delivery and 11% records are showing missing of the dose received during time of Birth. Based on the survey, 100% of OPV 1B, HEP1B, DPT 2RD DOSE by 24 months coverage is observed followed by DPT (99.74%), MMR (92%), JE vaccine (89%), DPT (87.4%) indicate the very good coverage. On the other hand, the scenario is quite opposite in case of few vaccinations such as the IPV dosage, HIB 1B, 1A, Rotavirus vaccine because the rate of vaccination is less than 50%. For example, Rotavac 1 (47.1%, Rotavac 2 and Rotavac 3 (46%), IPV (21%), IPV (20%) IPV 3 (0.53%), IPV booster (53%), HIB 1B (2.11%), Hepatitis 1A (1.1%), typhoid vaccine (0.1%) has been reported indicating poor coverage and less knowledge of vaccine dose importance. According to GOI vaccination schedule child receives 1 BCG, OPV 4 doses, 3 doses of DPT doses and one dose of Measles. The data of the present study the proportion of children is fully vaccinated 89.2% CI (85.69) about 11% of children are partially vaccinated CI (8.05 to 14.31 %) but the points to be kept in mind such as what age the complete vaccination has occur because complete vaccination before 9 months age will serve the purpose of vaccination and if the schedule of vaccination is not followed as per the prescribed timing there might be chances of getting vaccine preventable disease and in this study out of 19 children below 10 months of age Only 1 child receive measles vaccine by 10 months which states that the rate of fully vaccination is 5.26%, 95% CI (0.13%

TO 26.03%). Based on the official reports GOI target is much far from the reality, as it stated that at least 90 % people should be fully vaccinated. But the reality is much far in comparison with the paper work and planning done. According to the person to person interview made with families few factors which are influencing complete vaccination have been noted, such as incomplete information about complete and in time vaccination (99.21%); un aware of need for vaccination (97.9%); fear of side effects of vaccination (44.7%), some misconceptions about vaccine (12.4%), place of vaccination too far in (18.4%), time of vaccination is inconvenient only for (9.2%), Mothers is ill in (26.3%) and financial problems in (97.6%) etc. Out of these factors associated with partial vaccination status of child on Bavarian analysis are Family members total, Misconception, Time of vaccination in convenient, Long Waiting time, Source of vaccination card, Vaccination place, Age in months of child, Fathers education etc. When compared to similar studies this study has identified risk factors with better statically analysis (multivariate logistic regression) other studies have identical risk factors basing on bivariate analysis alone with, still risk of partial vaccination not identified confounders. According to our data it has been noted that children belonging to joint families have been vaccinated in comparison with others. Common factors that were observed associated with partial vaccination in this study was time of vaccination in convenient and long waiting time for vaccination, same factors were highlighted in the previous studies done by Anil B Kurane *et al.*, 2018, Neha B *et al.*, 2017, Angadi MM *et al.*, 2013, Yadavj *et al.*, 2008. Yemesrach *et al.*, 2018<sup>[15, 16, 17, 18, 19]</sup>. Keeping in view about the low % of full vaccinated children of age below 24 months, it is the need of the hour to strengthen vaccination coverage by taking few measure like making people understand the importance of vaccination and also the drawbacks if the vaccine is not taken on and before the deadline, increase the health education, get in contact with the families of children's who are not coming to vaccination place at appropriate age, keep a track record of the status of vaccination based on area wise etc.

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