Factors Affecting Fully Immunization Status of Children Aged 12-23 Months in Hosanna Town, South Ethiopia

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Abstract

**Background:** Assessment of Immunization status and associated factors is rare in some regions of Ethiopia.

**Objective:** To Measure fully immunization status and associated factors among children aged 12-23 months old in Hosanna Town, South Ethiopia was done.

**Methods:** A cross-sectional community based study was conducted from January 26 to February 21, 2014 in Hosanna town. First using multi-stage sampling then by simple random sampling methods a total of 508 children of aged between 12-23 months from 508 households was selected.

**Results:** From total children surveyed only 155 (30.51%) were fully vaccinated by card plus history. study showed that children are more likely to be fully vaccinated if mothers/care takers attended ≥3ANC follow up AOR = 1.62 (AOR 95% CI: 1.34, 1.965), vaccinated Tetanus toxoid AOR = 1.271 (AOR 95 % CI: 1.062, 1.522). Children are less likely to be fully vaccinated if Mothers’ have poor knowledge of EPI AOR = 0.594 (AOR 95 % CI 0.394, 0.894), mothers knew two or less vaccine preventable diseases AOR = 0.421 (AOR 95 % CI: 0.243, 0.727), knew only three or four vaccine preventable diseases AOR = 0.539 (AOR 95% CI: 0.318, 0.914).

**Conclusion:** This study revealed that from total survey only155 (30.51%) was fully vaccinated by card plus history. Antenatal follow up, Tetanus toxoid (TT) vaccination status, mothers’ knowledge of EPI, age to begin, finishes and session needed for immunization were significant predictors associated with fully immunization of children. The Town Health Office should work to raise awareness of the community on immunization, antenatal care and Tetanus Toxoid Immunization utilizations which in turns increase the immunization coverage among children.

**Keywords:** Immunization; South Ethiopia; Vaccine; Children

Introduction

The death of children is common in developing world. Especially Children living below Sub-Saharan African die every year due to communicable diseases that can be prevented by immunization.

Thus World Health Organization (WHO) launched the Expanded Programme on Immunization (EPI) in 1974, and many developing countries adopted it. Despite this effort, over 24,000 children die of vaccine-preventable diseases every day around the world [1]. This is equivalent to 1 child dying every 3.6 seconds, 16-17 children dying every minute, and just about 9 million children dying every year. Of these deaths in 2008, a bigger proportion occurred in sub-Saharan Africa (4.4 million) and South Asia (2.8 million) compared to Latin America, the Caribbean (0.2 million), and industrialized countries (0.1 million) [1,2].

Even though Immunization coverage is increasing globally, many children around the world especially in developing countries still left without Fully Immunization or unvaccinated. In 2008, approximately 27 million infants worldwide were unvaccinated against common childhood diseases and 2-3 million children die of vaccine preventable diseases. In Ethiopia around 1 million children were unvaccinated in 2007 and only 20% of the countries children are fully vaccinated in the year 2005 [1,2].

According to the 2006 national Expanded Programme of Immunization (EPI) survey in Ethiopia, only 50% of the children were fully immunized, with wider variations from one region to another. These shows, half of the children were not fully protected [3]. Despite various initiatives and campaigns over the years, immunization coverage Diphtheria- Pertussis Tetanus (DPT3) in most parts of Ethiopia remains low (41.91%), and this contributes to high morbidity and mortality among children [4,5].

Knowledge of mothers or immediate caretakers about schedule of vaccines had significant association with completion of immunization [6]. Knowledge of the mothers about child immunization, postponing child immunization and perceived health institution support were the best predictors of defaulting from completion of child immunization. Mothers should be educated about the benefits of vaccination and the timely administration of vaccines [6]. It was expected that antenatal care visits would have a positive impact on immunization coverage of children [7]. Antenatal follow up, institutional delivery and knowledge of mothers about the age at which child begins and finishes the vaccination are significant predictor of child immunization status [8,9]. The study revealed that children are more likely to be vaccinated if the child is health institution born and mothers followed Antenatal care (ANC) [8]. Children of mothers who received sufficient antenatal care (at least five or more antenatal care visits) were significantly more likely to be fully immunized than children of those mothers who received insufficient antenatal care and those who had received no antenatal

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care [9]. It was also observed that mothers who had received two or more doses of tetanus toxoid (TT) injections were more likely to fully immunize their children [10].

The main objective of this study is to measure fully immunization status and associated factors among children aged 12-23 months old in Hosanna Town, South Ethiopia. The specific objectives are: to determine the magnitude of fully immunization coverage among children aged 12-23 months. And to identify factors affecting fully immunization status among children aged 12-23 months. If Magnitude of fully immunization is identified and low, it helps identifying Reason for un-vaccination. All in all Findings are very helpful for reduction of child mortality. Because infant mortality is the highest and bulkiest part of under 5 mortality.

Materials and Methods

The cross-sectional community-based study design was conducted from selected children’s mother or caretakers from January 26 to February 21, 2014 in 8 kebeles of Hosanna Town. Hosanna is Capital city of Hadya zone in South Nation, Nationality, and People’s Region (SNNPR). The town is 320 km to the South of Addis Ababa, the capital of Ethiopia with an area of 140 km² and a total population of 97,185.

Source population was all children in households having children12-24months living or residing in Hosanna Town. Study population/subjects were all children in households having aged 12-23 months living or residing in Hosanna Town. Sample population Number of Children in Households selected from all households that have children aged 12-23months living or residing in Hosanna Town during study period.

Sample size determination

Sample size was calculated based on the proportion of fully immunized children aged 12-23 months which is 27.7% with 95% confidence level and precision of 5% [8]. The sample size was taken after multiplying by design effect (DE) which is 1.5 [8]. Design effect is Necessary because I used different sampling methods.

\[
n_s = \frac{(z_{1-\alpha/2})^2 \cdot p \cdot (1-p) \cdot DE}{d^2}
\]

\[
Z_{1-\alpha/2} = 1.96, d = 5\% = 0.05 \quad (13)
\]

\[
p = 27.7\% = 0.277 \quad (13), \ DE = 1.5
\]

After addition of 10% non-response rate to the calculated sample size, the total number of 508 children aged between 12-23 months were targeted and implemented for the study. First multi-stage sampling then simple Random sampling methods; a total of 508 children of aged between 12-23 months from 8 kebeles households were selected from 8 Kebel’s.

Sampling methods

The main objectives of this study are useful to know magnitude of fully immunization in the town. If magnitude of fully immunization is identified and low, it helps identifying Reason for un-vaccination. Therefore, the other aim of this study was to identify factors affecting fully immunization status among children 12-23 months of age. Hosanna town has 8 kebeles. From this 8 one kebele is rural and 7 kebeles are urban.

First multi-stage sampling method was used by forming clusters into urban and rural. Cluster sampling divides the population into groups or clusters. Second all, kebeles with in selected clusters were included in the sample. Finally simple random sampling method is used in each kebele using lottery method. The total sample size was divided by the size of all households that have child of age 12-23 proportionally in each kebeles including rural. Then all households that have child of age 12-23 were registered in each kebeles with their village they are living. Since the sample size is 508, so that it is necessary to collect data of 508 children aged b/n 12 to 23 months from the town. Then we distributed these total children proportionally to these all kebeles according to number of children they have. Since there is sampling frame, list of children in each kebeles. Finally Simple random sampling methods were employed using Lottery method in each kebele. Below-K_1 = kebele1, K_2 = kebele2...

And numbers are sample sizes distributed to all kebeles proportionally. The town has total of 5006 children age 12-23 months.

Study instrument used

During study period Questionnaires, computer, C.D. for storing paragraphs, Camera, pencil, and eraser were used additionally. All of Data collectors were above grade 10 in educational status. Training was given for 3 days before data collection. When the interviewer collected data they were asked the respondents in local language which is Amharic.

After data collection completed, template is prepare by EPINFO version 6, then data entry was carefully done each questions one by one until complete of 508 questions. After that exported to Statistical Package for Social Science (SPSS) version16. Odds ratio was employed for both bivariate analyses Crude Odds Ratio (COR) and multivariate Adjusted Odds Ratio (AOR) analysis. Odds Ratio was used, at 95% Confidence Interval (CI) and p-value < 0.05. Bivariate analysis was used for assessing the association between independent and dependent variables. Then all variables that showed significant in the bivariate analysis were included in multivariate analysis.

Results

Socio demographic characteristics of the study population

Socio demographic of this study total of 508 mothers of children aged between 12-23 months old were interviewed from 8 kebeles, with the response rate of 100%. Most of the respondents 448 (88.2%) were from urban areas and 60 (11.8%) from rural areas. All respondents were mother of the children aged 12-23 months. The age of the mother participated in this study was ranged from 18 to 50 with mean and median of 30.22 and 28, respectively.

Majority of the households, 260 (51.2%) had the average monthly income of greater than 1001 followed by those who have Income less than 500 E.Birr139 (27.4%) the rest 109 (21.5%) income of 501-1000E. birr (Table 1).

Family size, child ever born and experience of child death by the mothers

The average family size of the study population was 4.8 ranging from 1 to 12. Most families had 5 or more members 260 (51.2%), the rest 248 (48.8%) have 4 or less than 4members (Table 2).
Table 1: Socio-demographic characteristics of children surveyed for magnitude of fully immunization coverage Hossana Town, South Ethiopia 2014 (n = 508).

| Variables                          | Frequency | Percent |
|------------------------------------|-----------|---------|
| Educational status                 |           |         |
| Not able to read/write/literate    | 57        | 11.20   |
| Read and write                     | 83        | 16.30   |
| Primary schooling (1-8)            | 154       | 30.30   |
| Grade (9-12) and above             | 214       | 42.2    |
| Marital status                     |           |         |
| Single                             | 22        | 4.33    |
| Married                            | 398       | 78.50   |
| Divorced                           | 46        | 9.10    |
| Widowed                            | 41        | 8.10    |
| Occupation                         |           |         |
| Housewife                          | 230       | 45.30   |
| Daily laborer                      | 65        | 12.80   |
| Government employee                | 99        | 19.50   |
| Merchant                           | 46        | 9.10    |
| Private/Self-employed              | 68        | 13.40   |
| Family income                      |           |         |
| < 500                              | 139       | 27.40   |
| 501-1000                           | 109       | 21.50   |
| > 1000                             | 260       | 51.20   |
| Family size                        |           |         |
| ≤ 4                                | 248       | 48.80   |
| ≥ 5                                | 260       | 51.20   |
| Child ever born                    |           |         |
| 1 child                            | 161       | 31.7    |
| 2-4 children                       | 267       | 52.6    |
| ≥ 5 child                          | 80        | 15.7    |
| Age of mothers                     |           |         |
| ≤ 20 years                         | 47        | 9.30    |
| 21-30 years                        | 287       | 56.50   |
| 31-40 years                        | 119       | 23.40   |
| 41-50 years                        | 55        | 10.80   |
| Ethnicity of mothers               |           |         |
| Haduya                             | 279       | 54.9    |
| Kembata                            | 82        | 16.10   |
| Amhara                             | 56        | 11.0    |
| Garage                             | 49        | 9.60    |
| Oromo                              | 24        | 4.70    |
| Others (silli)                     | 18        | 3.50    |
| Sex of child                       |           |         |
| Male                               | 254       | 50      |
| Female                             | 254       | 50      |
| Religion                           |           |         |
| Orthodox                           | 125       | 24.60   |
| Protestant                         | 279       | 54.90   |
| catholic                           | 56        | 11.00   |
| Muslim                             | 48        | 9.50    |
| Experience of child Death          |           |         |
| Yes                                | 135       | 26.57   |
| No                                 | 373       | 73.43   |

Table 2: Sample size distribution in the town.

| Kebele/village | Number of children age 12-23 months | Sample size | Place of residence |
|----------------|-------------------------------------|-------------|--------------------|
| K1             | 749                                 | 76          | Urban              |
| K2             | 867                                 | 88          |                    |
| K3             | 503                                 | 51          |                    |
| K4             | 552                                 | 56          |                    |
| K5             | 591                                 | 60          |                    |
| K6             | 473                                 | 48          |                    |
| K7             | 493                                 | 50          |                    |
| K8             | 778                                 | 79          | Rural              |
| Total          | 5006                                | 508         |                    |

Table 3: Health service utilization characteristics of children’s mothers /care givers / surveyed for magnitude of fully immunization coverage Hossana Town, South Ethiopia 2014.

| Variables                          | Frequency | Percent |
|------------------------------------|-----------|---------|
| Place of delivery                  |           |         |
| Home                               | 110       | 21.70   |
| Health facility                    | 387       | 76.20   |
| Other/On travel                    | 11        | 2.20    |
| ANC follow up                      |           |         |
| Yes                                | 427       | 84.10   |
| No                                 | 81        | 15.90   |
| Number of ANC follow up            |           |         |
| < 2                                | 190       | 37.4    |
| ≥ 3                                | 318       | 62.6    |
| Mothers’ TT vaccination status     |           |         |
| Yes                                | 365       | 71.90   |
| No                                 | 143       | 28.10   |
| Number of TT vaccinated            |           |         |
| None                               | 143       | 28.10   |
| 1-2                                | 251       | 49.40   |
| ≥ 3                                | 114       | 22.40   |
| Nearby health Facility             |           |         |
| Yes                                | 481       | 94.70   |
| No                                 | 27        | 5.30    |
| Place of Resident                  |           |         |
| Rural                              | 60        | 11.8    |
| Urban                              | 488       | 88.2    |
| Time takes to reach Health Facility|           |         |
| <15 minute                         | 158       | 31.10   |
| 15-30 minute                       | 176       | 34.60   |
| 31-60 minute                       | 91        | 17.90   |
| >60minute                          | 83        | 16.30   |
| Presence of vaccine service        |           |         |
| Yes                                | 481       | 94.70   |
| No                                 | 27        | 5.30    |
| Mothers involved in Kebele EPI plan and review| | |
| Yes                                | 214       | 42.10   |
| No                                 | 294       | 57.90   |
| Nearby health Facility             |           |         |
| Yes                                | 481       | 94.70   |
| No                                 | 27        | 5.30    |

Availability and accessibility of vaccination service

About 481 (94.7%) of the respondents were reported that they had access to the health facility that provides immunization services and 158 (31.1%) of them reported that the average walking time to the nearest health facilities was less than 15 minutes (Table 1).

Knowledge on vaccination and vaccine preventable diseases

From the total respondents about 480 (94.5%) of them heard about vaccination and vaccine preventable disease, most of them 350 (68.9%) heard from health professionals.

Majority of the respondent 360 (70.9%) mentioned the objective immunization is to prevent disease, 104 (20.5%) responded it is for healthy child, 30 (5.9%) said they do not know and 14 (2.8%) mentioned it is for other reason like for prevention of malaria disease. Concerning knowledge on immunization those who have response of average sum of response for questions like Know age to start, complete immunization, session needed for fully vaccination, know objective of vaccination, heard about vaccination and number of diseases immunization prevents considered as good (> 3/6 response)otherwise poor. Those which have good knowledge were only 161 (31.7%) most of them 347 (68.3%) had poor knowledge (Table 3).
Immunization coverage among children aged between 12-23 months

From total of 508 children aged 12-23 months selected and included in this study, 480 (94.49%) of them were ever took one or more of the eight recommended vaccine and 28 (5.51%) are unvaccinated (Table 4).

Immunization coverage by card and recall

Immunization coverage surveyed both by vaccination card and history as follows. High Pentavalent1 to Measles dropout rate 33.8% was observed followed by BCG to Measles dropout rate which was 33.3% and Penta1 to Penta3 Dropout rate of 29.2% (Table 5,6).

| Vaccinated by card only | Frequency | Percent |
|-------------------------|-----------|---------|
| Yes                     | 395       | 77.80   |
| No                      | 113       | 22.20   |

| Vaccinated by card plus recall | Frequency | Percent |
|-------------------------------|-----------|---------|
| Yes                           | 480       | 94.49   |
| No                            | 28        | 5.51    |

| Fully Immunization status by card plus recall. | Frequency | Percent |
|-----------------------------------------------|-----------|---------|
| Fully immunized                              | 155       | 30.51   |
| Partially Immunized                          | 325       | 63.98   |
| Un Immunated                                 | 28        | 5.51    |

| Had Vaccination card | Frequency | Percent |
|----------------------|-----------|---------|
| Yes                  | 395       | 77.80   |
| No                   | 113       | 22.20   |

| Fully immunized by card only | Frequency | Percent |
|------------------------------|-----------|---------|
| Yes                          | 144       | 28.35   |
| No                           | 364       | 71.65   |

| Fully immunized by card plus recall. | Frequency | Percent |
|-------------------------------------|-----------|---------|
| No                                  | 155       | 30.51   |
| Yes                                 | 353       | 69.49   |

| Variables                        | Frequency | Percent |
|----------------------------------|-----------|---------|
| Exposure to media about source of information on EPI |          |         |
| Radio                            | 51        | 10      |
| TV                               | 57        | 11.20   |
| Friends/peers                    | 31        | 6.10    |
| School                           | 19        | 3.70    |
| Health professional              | 350       | 68.90   |

| Disease that can vaccination prevents | Frequency | Percent |
|--------------------------------------|-----------|---------|
| ≤ 2                                  | 210       | 41.30   |
| > 5                                  | 160       | 31.50   |

| Know Vaccination session needed for child to be fully vaccinated. | Frequency | Percent |
|-----------------------------------------------------------------|-----------|---------|
| Yes                                                             | 90        | 17.70   |
| No                                                              | 418       | 82.30   |

| Vaccination session needed for child to be fully vaccinated. | Frequency | Percent |
|-------------------------------------------------------------|-----------|---------|
| 2 times                                                     | 22        | 4.3     |
| Repeatedly                                                  | 46        | 9.1     |
| 5 times                                                     | 90        | 17.7    |
| 4times                                                      | 283       | 56.7    |
| I don’t know                                                | 35        | 6.9     |
| Others (once)                                               | 32        | 6.3     |

| Know Correct age of begin immunization | Frequency | Percent |
|----------------------------------------|-----------|---------|
| Yes                                    | 208       | 40.90   |
| No                                     | 300       | 59.10   |

| Know the correct age of complete immunization | Frequency | Percent |
|------------------------------------------------|-----------|---------|
| Yes                                           | 197       | 38.80   |
| No                                            | 311       | 61.20   |

Table 4: Magnitude of fully immunization among children aged 12-23 months by immunization history and vaccination card, Hossana Town, South Ethiopia 2014.

Table 5: Knowledge on immunization characteristics of children's mothers (care givers surveyed for magnitude of child immunization coverage Hossana Town, South Ethiopia 2014.

Table 6: Magnitude of Immunization for children surveyed. Vaccination card versus Card and Recall.

| Antigen Immunized | Vaccinated by card history | Vaccinated by card only |
|-------------------|---------------------------|-------------------------|
|                   | Frequency | Percent | Frequency | Percent |
| BCG               | 451       | 88.8     | 374       | 73.6     |
| OPV0              | 310       | 61       | 273       | 53.7     |
| Penta1            | 455       | 89.6     | 383       | 75.4     |
| Penta2            | 417       | 82.1     | 352       | 69.3     |
| Penta3            | 322       | 63.4     | 286       | 56.3     |
| OPV1              | 473       | 93.1     | 387       | 76.2     |
| OPV2              | 442       | 87       | 365       | 71.9     |
| OPV3              | 303       | 59.6     | 258       | 50.8     |
| PCV1              | 436       | 85.8     | 365       | 71.9     |
| PCV2              | 389       | 76.6     | 327       | 64.4     |
| PCV3              | 270       | 53.1     | 239       | 47       |
| Measles           | 301       | 59.3     | 261       | 51.4     |
| Fully Immunized   | 155       | 30.51    | 144       | 28.35    |

Table 7: Magnitude of Immunization for children surveyed. Vaccination card versus Card and Recall.

Immunization coverage by card only

Magnitude of Immunization Coverage by card only was observed from the total survey by card and history. Measles vaccine was taken by 261 (51.4%) of children and 144 (28.35%) were fully vaccinated by card only. Pentavalent1 to Measles dropout rate was 31.9% followed by BCG to Measles dropout rate of 30.2% and Pentavalent1 to Pentavalent3 dropout rate was also 25.3% during the study period (Table 7).

Factors Affecting Fully Immunization Status of Children

Factors associated with child completion of immunization were seen using logistic regression. Those variables suggested to be associated to fully immunization status of the children were included in the study. This study used fully Immunization status by card and history for using bivariate and multivariate analyses.
Socio-Demographic Characteristics of Children's Mothers

The association of mothers’ socio demographic characteristics with fully immunization status of the children was assessed using bivariate and multivariate analyses by logistic regression analysis. This study used fully Immunization status and card history.

Knowledge of Age Begins, Finishes and Session Needed for Immunization

Mothers’ that have poor knowledge were AOR = 0.594 (AOR 95% CI: 0.394, 0.894) times less likely to fully vaccinate child than mothers that have good knowledge. Additionally mothers knew two or less vaccine preventable diseases were AOR = 0.421 (AOR 95% CI: 0.243, 0.727) times less likely fully vaccinate child than mothers answered 5 or more diseases. Knowledge of mothers that have good knowledge. Additionally mothers knew two or less vaccine preventable diseases were AOR = 0.421 (AOR 95% CI: 0.243, 0.727) times less likely fully vaccinate child than mothers answered 5 or more diseases. And mothers knew three or four vaccine preventable diseases were AOR = 0.539 (AOR 95% CI: 0.318, 0.914) times less likely fully vaccinate child than mothers answered 5 or more diseases. Knowledge of mothers on immunization and Number of vaccine preventable disease known by the respondents were associated with fully immunization of children. Mothers’ that have poor knowledge were AOR = 0.594 (AOR 95% CI: 0.394, 0.894) times less likely to fully vaccinate child than mothers that have good knowledge.

Discussion

During the study Immunization coverage was assessed using the availability of vaccination card and maternal recall. From total children surveyed by card plus history; we can see that very low coverage of fully immunization observed. We can observe fully immunization status by card only and card plus history above Table 5. There is difference between the two responses. Discrepancy was anticipated here. Reason may be due to mothers’ were not remembering whether their child took all doses of vaccine. They also don’t consider the importance of vaccination by adjusted odds ratio of 1.621 (AOR 95% CI: 1.23, 1.933) also Tetanus toxoid (TT) vaccination status is significantly associated with the fully completion of vaccination by adjusted odds ratio of 1.271 (AOR 95 % CI: 1.083, 1.565). Additionally mothers knew two or less vaccine preventable diseases were AOR = 0.421 (AOR 95% CI: 0.243, 0.727) times less likely fully vaccinate child than mothers answered 5 or more diseases. And mothers knew three or four vaccine preventable diseases were AOR = 0.539 (AOR 95% CI: 0.318, 0.914) times less likely fully vaccinate child than mothers answered 5 or more diseases.

Summary of bivariate (COR) and multivariate (AOR) analysis

All in all summary of all variables that show association in Bivariate (COR) and significantly associated with fully immunization. It showed that ANC follow up have significantly associated with the completion of vaccination by adjusted odds ratio of 1.621 (AOR 95% CI: 1.23, 1.933) also Tetanus toxoid (TT) vaccination status is significantly associated with the fully completion of vaccination by adjusted odds ratio of 1.271 (AOR 95 % CI: 1.083, 1.565). Additionally mothers knew two or less vaccine preventable diseases were AOR = 0.421 (AOR 95% CI: 0.243, 0.727) times less likely fully vaccinate child than mothers answered 5 or more diseases. And mothers knew three or four vaccine preventable diseases were AOR = 0.539 (AOR 95% CI: 0.318, 0.914) times less likely fully vaccinate child than mothers answered 5 or more diseases.

Table 8: Socio-demographic, Health service utilization, Accessibility of Health service and Knowledge on Immunization factors associated with characteristics of children’s mothers /care givers surveyed for child Fully Immunization coverage Hosanna Town, South Ethiopia 2014.continued from above.
| Place of delivery               | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|--------------------------------|-----|----|------------------|---------------------|
| Home                           | 13  | 142| 4.751 (2.577, 7.518) | NSI                 |
| Health facility                | 107 | 246|                  |                     |

| ANC follow up               | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|------------------------------|-----|----|------------------|---------------------|
| Yes                          | 149 | 6  | 6.7 (2.849, 15.754) | NSI                 |
| No                           | 287 | 75 |                  |                     |

| Number of ANC follow up | ≤ 2 | 2  |                      | ≥ 3 | 3  |                      |
|------------------------|-----|----|----------------------|-----|----|----------------------|
| Yes                    | 26  | 129|                      | 139 | 18 |                      |
| No                     | 164 | 189|                      | 225 | 128|                      |

| Mothers' TT vaccination status | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-------------------------------|-----|----|------------------|---------------------|
| Yes                           | 139 | 16 | 4.942 (2.82, 6.662) | 1.271 (1.062, 1.522) |
| No                            | 16  | 225|                  |                     |

| Nearby health Facility | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-----------------------|-----|----|------------------|---------------------|
| Yes                   | 147 | 8  | 0.957 (0.410, 2.235) | NSI                 |
| No                    | 334 | 19 |                  |                     |

| Time takes to reach Health Facility | < 15 minute | 15-30 minute | 31-60 minute | > 60 minute | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-----------------------------------|-------------|--------------|--------------|-------------|------------------|---------------------|
| Yes                               | 49          | 66           | 23           | 17          | 1.335 (0.847, 2.103) | 0.573 (0.305, 1.077) |
| No                                | 109         | 110          | 68           | 66          |                  |                     |

| Presence of vaccine service      | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|----------------------------------|-----|----|------------------|---------------------|
| Yes                              | 147 | 8  | 0.957 (0.410, 2.235) | NSI                 |
| No                               | 334 | 19 |                  |                     |

| Mothers involved in Kebele EPI plan and review | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-------------------------------------------------|-----|----|------------------|---------------------|
| Yes                                             | 79  | 76 | 1.679 (1.147, 2.457) | NSI                 |
| No                                              | 135 | 218|                  |                     |

Note: NSI = Not significantly associated because p>0.05

**Table 9: Vaccinate child and mothers.**

| Variables                                      | Fully Immunized | Odds Ratio (95% C.I.) |
|------------------------------------------------|-----------------|-----------------------|
| Exposure to media as source of EPI information |                 |                       |
| Radio                                          | 12              | 0.663 (0.334, 1.314)  |
| TV                                             | 15              | 0.769 (0.409, 1.445)  |
| Friends/peers                                  | 11              | 1.184 (0.549, 2.556)  |
| School                                         | 6               | 0.994 (0.368, 2.683)  |
| Health professional                            | 111             | 1                     |

| Know Number of vaccine preventable Diseases | ≤ 2 | 3-4 | ≥ 5 | Crude OR (95% CI) | Adjusted OR (95% CI) |
|--------------------------------------------|-----|----|-----|------------------|---------------------|
| Yes                                        | 41  | 49 | 65  | 0.269 (0.167, 0.434) | 0.421 (0.243, 0.727) |
| No                                         | 39  | 112| 72  |                  | 0.539 (0.318, 0.914) |

| Know Correct age of begin immunization      | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|---------------------------------------------|-----|----|------------------|---------------------|
| Yes                                         | 80  | 75 | 1.875 (1.279, 2.749) | NSI                 |
| No                                          | 128 | 225|                  |                     |

| Know the correct age of complete immunization | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-----------------------------------------------|-----|----|------------------|---------------------|
| Yes                                           | 72  | 83 | 1.582 (1.078, 2.322) | NSI                 |
| No                                            | 125 | 228|                  |                     |

| Age to begin immunization                     | After birth | 1month after birth | 1year | Other/At 45days | Crude OR (95% CI) | Adjusted OR (95% CI) |
|-----------------------------------------------|-------------|--------------------|-------|----------------|------------------|---------------------|
| Yes                                           | 80          | 24                 | 6     | 45             | 1                | NSI                 |
| No                                            | 128         | 81                 | 51    | 93             |                  |                     |

| Know Objective of Vaccination                 | Yes | No | Crude OR (95% CI) | Adjusted OR (95% CI) |
|----------------------------------------------|-----|----|------------------|---------------------|
| Yes                                          | 123 | 31 | 1.881 (1.202, 2.944) | NSI                 |
| No                                           | 237 | 116|                  |                     |

| Knowledge on immunization                    | Poor | Good | Crude OR (95% CI) | Adjusted OR (95% CI) |
|----------------------------------------------|------|------|------------------|---------------------|
| Yes                                          | 86   | 69   | 0.439 (0.296, 0.654) | 0.594 (0.394, 0.894) |
| No                                           | 261  | 92   |                  |                     |

Note: NSI = Not significantly associated because p>0.05

**Table 10: Finishes and session needed for immunization.**
to second dose of vaccine Opv2, Penta2 and Pcv2 vaccination status is decreasing and decreasing. Again as going down again from second dose of vaccine Opv2, Penta2, Pcv2 to third dose of vaccine Opv3, Penta3, Pcv3; similarly vaccination status becomes decrease and decrease until reached Measles vaccination. This finally end up with very low fully immunization. Here the reason may be due to long appointment for the second and third doses of vaccine. Mothers may forget vaccinating their children through time gap. Based on immunization card and recall, High dropout rate was observed. Comparing immunization coverage of Hossana town with Ethiopian Demographic and Health Survey (EDHS 2011) [11], only a difference of five percent. It is possible to say nearly the same result. Relative to a study done in Ambo Woreda of West Shewa Zone [4], the same result shown. Only a difference of five percent fully immunization status of children observed. So that Possible to say nearly similar result of study. Comparing fully immunization status with a study done in Wenago Woreda of South Region there is a difference of eleven percent [12] and another study done in Uganda [13] showed us there is big difference between this study which is wide gap. This finding again is consistence with the study done in Nigeria in which, more than half of mothers knew the objective and the schedule of immunization [14]. There is difference b/n this result and previous reports. In most parts of Ethiopia Immunization remains low (41.91%), and this contributes to high morbidity and mortality among children [4,5]. According to the 2006 national EPI survey in Ethiopia, only 50% of the children were fully vaccinated [3]. But this study in Hosana town showed lower than other region of Ethiopia. Because of religious factors, ethnicity difference and political issue. Additionally over reporting is one of discrepancy observed in regions of Ethiopia. When we compare fully immunization status with that of developed world very low coverage in showed in this study. In developed world more than 75% of children were fully vaccinated. In United States (USA) Vaccination coverage levels at 3 months of age varied across sites: 82.4% in northern Manhattan, 70.5% in Detroit, 82.3% in San Diego, and 75.8% in rural Colorado [15]. Big difference between developed world and this study may be due to knowledge, socioeconomic, political, geographical and infrastructure difference.

Bivariate and multivariate analysis was also used for identifying factors associated with fully immunization status of children. For bivariate analysis (COR) Educational status, occupation, age of mothers, religion, and family income of the mother and experience of child death showed significant association with the immunization status of the children. Mothers/care-takers learned primary schools were more likely to fully immunize children than illiterate.

Governmental employees were also more likely to fully vaccinate their children than house wife. But daily laborers were less likely to fully immunize their children than house wife. Here we can easily see knowledge difference between Governmental employees and the two. Daily laborers and house wife were far from source of knowledge than that of government employees. When we see other studies it is necessary to see degree of precision and confidence interval in order to compare and contrast with this study. So that study done in Ambo Woreda of West Shewa Zone 2011, study done in Wenago Woreda, another study done in Uganda, study in Nigeria, and the study done in Burkina Faso [4,5,12,14,16] were done with degree of precision (P-value<0.05) and confidence interval of (95% CI). Now it is possible to compare with these studies. Educational status, occupation, age of mothers, religion, and family income of the mother and experience of child death showed significant association with the immunization status of the children. These variables were similarly associated with studies done in different places. For instance as a study done in Ambo Woreda [4] is consistence with the study done in Burkina Faso [16] additionally this study is similar to study done in Uganda [5].

In this study mothers those have income level of 500 or less E.BIRR and mothers those have income level of 501-1000 were less likely to fully immunize their children than mothers with income of 1001 or more. Experience of child death was another associated factor according to this study. Mothers Experienced child deaths were more likely to fully immunize children than no case of child death. Here fear of child death can make mothers to vaccinate their children. They may not have enough understanding about use of vaccination. Study done by EDHS 2011, study in Wenago Woreda of southern Ethiopia, study done in Uganda and study done in Bangladesh were resulted Similar outcome with this study [5,6,11,12].

In bivariate (COR) analysis Health Service utilization like ANC follow up and tetanus toxoid vaccination status of mother and place of delivery are the second factors assessed for their association with completion of child immunization in this study. In bivariate analysis ANC follow up and mothers TT vaccination status including place of delivery showed a significant association with completion of vaccination among children aged between 12-23 months. Mothers Attending Antenatal Care were more likely to fully immunize children than mothers not attending ANC at health facility. Mothers/care-takers gave birth to child at health institution were more likely to fully vaccinate their child than mothers delivered at home. Mothers/care-takers vaccinated TT were more likely to fully vaccinate their child than mother's not vaccinated Tetanus Toxoid vaccination. Again Mothers/care-takers vaccinated TT three or more were more likely to fully vaccinate their child than mother's not vaccinated Tetanus Toxoid vaccination. Most of mothers’ complain about Vaccination time is inconvenient, Unaware of need to return for second and third doses, don't know time and place of vaccination, Absence of vaccinators, Vaccination card lost and Vaccination site is far away. But health service utilization can improve mothers’ health status. At the same time they start thinking about child health and develop new idea for immunization. Different studies done in Ambo Town of Oromia state [5], other study in Uganda [5] and study done in Bangladesh [7] were similar studies associated with these variables.

The associations of health care availability and accessibility with the completion of vaccination, and Exposure to media as source of EPI information were also seen by using bivariate analysis. But no association observed between them. There is a difference concerning exposure to media with a study done by EDHS 2011[11], study done in Uganda [5] and study done in Bangladesh [7]. The main reason for this big difference is due to increasing number of health institution in the town. And due to most mothers may not have exposure to media in Hosana town. Also when we compare those with no health facility provides vaccination service and with those different walking time to reach the health facility, the likely hood of the children to be fully vaccinated becomes decrease as the walking time to reach health facility increase. But no significant difference between those takes more than one hour and no vaccination service near to their locality. Study done in ambo town [4] had a similar out come with this study. But study done in Bangladesh had a different outcome with this study [7].

Children of mothers who knew correctly age at the child should begin and finishes immunization were more likely to be fully vaccinated than mothers/caretakers didn't know correct age begin and finishes immunization respectively. Mothers’ responded age to start Immunization is one month after birth and one year after birth.
were less likely to fully immunize than mothers answered just at birth. Similar studies were done in two different Places of Ethiopia, Wenago and Ambo Town [4,12]. Regards to session needed for immunization, bivariate analysis shows that mother know correct sessions needed for the immunization has no significant association with completion of vaccination which is opposite of study done in Wenago Woreda [12]. Mothers’ that have poor knowledge were less likely to fully vaccinate their child than mothers that have good knowledge.

Factors were also assessed by using logistic regression multivariate analysis (AOR). It showed that ANC follow up have significantly associated with the completion of vaccination by adjusted odds ratio of 1.621. Also Tetanus toxoid (TT) vaccination status is significantly associated with the full completion of vaccination by adjusted odds ratio of 1.271. The reason probably might be due to awareness on immunization from health professional and decreasing perception of vaccination hearts children. Misunderstanding about immunization decreases as they utilize health services. Because majority of them reason out as religious and culture refuse vaccination followed by vaccine has no benefit, Vaccination hearts children, Fear of side effect. Similar to study done in Ambo town which showed ANC follow up and TT vaccination were significantly associated with fully immunization of children [8]. The same study was done in Bangladesh [12] where TT vaccination status and ANC follow up significantly associated with Fully Immunization status of children.

Despite the results of bivariate, Logistic regression multivariate analysis (AOR) shows additionally for these two factors. Knowledge of mothers on immunization and Number of vaccine preventable disease known by the respondents were associated with fully immunization of children. Mothers’ that have poor knowledge were 0.594 times less likely to fully vaccinate child than mothers that have good knowledge. Additionally mothers knew two or less vaccine preventable diseases were 0.421 times less likely fully vaccinate child than mothers answered five or more diseases. And mothers knew three or four vaccine preventable diseases were 0.539 times less likely to fully vaccinate child than mothers answered five or more diseases. Here we can see that knowledge can change mothers’ healthy behavior.so awareness creation for mothers about use of vaccination is mandatory. Study that supports this outcome was done in Wenago Woreda and Ambo town of west Shewa zone [4,12]. Another study which is done in Britain Faso supports this association [16]. But for other variables there was no significant association with completion of vaccination. This is consistence with study done in Bangladesh [6].

Concerning Limitations of this study, Immunization coverage might have reported by mother may under/over of immunization coverage. Because mothers may not remember doses that child took due to recall bias. Recoding bias may decrease quality of data and Qualitative study was not done.

In Conclusion, very low fully immunization coverage was observed. Antenatal follow up, Tetanus toxoid (TT) vaccination status, knew three or four vaccine preventable diseases and Mothers’ that have knowledge of age to begin, finishes and session needed for immunization were Significant predictors associated with fully immunization of children. The town health office should work to raise awareness of the community on immunization; Tetanus Toxoid Immunization utilizations and increasing ANC follow up. Additionally health office is expected to change mother’s knowledge on age at the child should start complete and session need for fully immunization of children which in turns increase the immunization coverage among children.

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