Original article

# Factors influencing child immunization coverage in a rural District of Ethiopia, 2000

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**Abstract**

**Background**: Immunization coverage in many parts of Ethiopia is less than desired to prevent the spread of target diseases.

**Objective**: To identify factors influencing urban and rural immunization coverage.

**Methods**: A community-based cross-sectional survey was conducted in 220 households with children 12-13 months of age in 7 villages and 4 urban centres selected by stratified multistage cluster sampling. Trained nurses were used to collect relevant information for the study.

**Result**: Fifty-one percent were validly fully immunized for age. Immunization coverage as assessed by card plus history was BCG 99.1%, $DPT_1/OPV_1$ 97.3%, $DPT_3/OPV_3$ 92.7%, measles 75.5%, and BCG to measles defaulter 23.9%. The mean Mother Immunization Awareness Score (MIAS) was higher for mothers of children fully immunized for age ($6.2\pm1.6$ vs $5.5\pm2.2$, $p=0.01$), and was significantly correlated with child age at $DPT_3$ ($r=-0.337$, $p=0.001$) and measles dose ($r=-0.266$, $p=0.014$). Multiple logistic regression analysis indicated that residence and mother's education were significant predictors of immunization status of children, children from rural areas and whose mothers were literate had higher immunization coverage.

**Conclusion**: Community mobilization and efforts to raise the awareness of mothers are important strategies to increase immunization coverage in urban as well as rural areas. [*Ethiop.J.Health Dev.* 2003;17(2):105-110]

## Introduction

In 1980 the Expanded Program on Immunization (EPI) was initiated by the Ministry of Health, with the objective of reaching 90% coverage among children under one year of age by the year 1990 (1). The vaccination schedule since then has been in accordance with that recommended by WHO for developing countries (2). Many studies in other countries have shown that maternal education is decisive to immunisation status of the child (3-6). In most studies immunization coverage in urban areas is higher than in rural areas (4, 6-8).

The people in Tigray region are well organized (9) at the grass roots level. Community mobilization to solve public problems has been a long tradition in the rural areas (10), and community based organisations function well and are strong pillars for community based health promotion activities (11). Representatives from social organizations (women association, youth associations and farmers association) are involved in EPI advocacy and community mobilization. Community health workers (CHWs) are also involved in community mobilization and defaulter tracing. Both the social organizations and CHWs are involved in monitoring the immunisation program through regular assessment sessions.

The EPI service in the study area was started in 1992. The immunization coverage from routine reports was higher in the rural than in the urban areas. The immunization report for Tselemti district in 2000 revealed more children were

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vaccinated for measles than BCG (12). A survey conducted in Tselemti in 2001 revealed contradictory results (13). The conflicting reports from different sources motivated us to conduct an EPI coverage survey.

The general objective of the study was to determine immunization coverage, describe the urban and rural immunization coverage differences, and identify factors associated with not immunising children in Tselemti district. The specific objectives were to determine the coverage for the six EPI vaccines among 12-23 month old children, assess factors associated with immunization status of 12-23 month old children, and verify the reported immunization coverage for the study area in 2000. The study is important to determine strategies to improve immunisation in the lower coverage areas.

**Methods**

The study area has a population of 67,964. In 2000, the immunization coverage for the study area as compiled from monthly immunization reports were 96.6%, 97.9% and 93.6% for BCG, $DPT_3$ and measles respectively**.**

The study was a descriptive community based cross-sectional survey. The WHO multi-stage cluster sampling method with stratification was used (14). The study area was first stratified into urban (> 2,000 population) and rural areas; 4 urban and 7 rural villages were then randomly selected; the "spin the pen" method was then used to select ten households with children 0-11 months age and ten households with children 12-23 month age in each cluster. All eligible children in the randomly selected households were surveyed using a revised WHO EPI cluster survey questionnaire.

A medical doctor supervised the field activities. The actual data collection was done by eight nurses who received a two day training including field exercise.

Data were entered and analyzed in SPSS Version 9.0 statistical program. Immunization differences were reported as statistically significant when Pearson chi square p-value is less than 0.05. Independent T-test for two samples was used to compare two means. Pearson correlation was used to test the association between MIAS and the age of vaccination. Stepwise multiple logistic regression with backward elimination was performed to analyse which factors predicted mothers compliance with childhood immunisation. The significance level was p=0.25 for including independent variables in the model, and p=0.4 for dropping variables from the model.

**The following operational definitions were used.**

**Documented dose**: Dose of a vaccine child received recorded on immunization card.
**Dose by history**: Dose of a vaccine child received as reported by mother.
**Invalid dose**: Dose of a vaccine received at a time interval shorter than or at younger age than recommended by WHO.
**Valid dose**: Dose of a vaccine received at a right interval and age as recommended by WHO; in case of BCG, card or history plus scar.
**Fully vaccinated**: A child 12-23 months old who received one dose of BCG, one dose of measles, and three doses of DPT/OPV before her/his 1st birthday.
**Validly fully vaccinated**: A child 12-23 months old who received valid doses of the stated vaccines before her/his 1st birthday.
**Fully Vaccinated For Age (FVFA)**: A child 0-11 months old who had received at the survey time all vaccines for age within one month of becoming age–eligible.
**Coverage by card only**: Coverage calculated with numerator based only on documented dose, excluding from the numerator those vaccinated by history.
**Coverage by card plus history**: Coverage calculated with numerator based on card and mother's report.
**Coverage by documented dose**: Coverage calculated based on documented dose and

excluding those vaccinated by history both from the numerator and denominator.

**Maternal immunisation awareness score (MIAS)**: Sum of correct answers of mother to the questions on EPI vaccines.

**Literate**: mother with formal education or able to read and write.

**BCG to Measles defaulter rate**: the percent of children vaccinated for BCG who defaulted for measles.

## Results

The proportion of married women was 88.6%; 78.8% for urban and 94.3% for rural areas (p<0.001). Eighty-five percent of the mothers were illiterate: only 27.5% of urban mothers were literate, and only 8.6% of rural mothers (p<0.001). Literate mothers had higher mean MIAS than illiterate mothers (7.4 ±1.1 vs 6.0 ± 1.8, p<0.001). Mothers of children fully vaccinated for age had higher mean MIAS than mothers of children not fully vaccinated for age (6.2±1.6 vs 5.5 ± 2.2, p=0.001).

Based on card plus history, BCG, $DPT_1/OPV_1$, $DPT_3/OPV_3$ and Measles coverage for 12-23 months old children was 99.1%, 97.3%, 92.7% and 75.5% respectively (Table 1). BCG scar among those vaccinated by card was 89%(81/91) and 76.5% (13/17) among those vaccinated by history.

Table 1: **Vaccination coverage of 12-23 months children by card, card plus history and based on documented dose for the EPI vaccines, 2000**

| Vaccines | Card only validly vaccinated before age one year n=110 | Card only vaccinated* before age one year n=110 | Based on card and validly vaccinated before age one year n*= | Based on card vaccinated* before age year. n* = | Card plus history vaccinated* before age one year n=110 |
|---|---|---|---|---|---|
| BCG | 105(95.5)[a] | 105(95.5) | 105(99.0) | 105(99.0) | 109(99.1) |
| $OPV_1$ | 91(82.7) | 91(82.7) | 91(96.8) | 91(96.7) | 107(97.3) |
| $DPT_1$ | 91(82.7) | 91(82.7) | 91(96.8) | 91(96.7) | 107(97.3) |
| $OPV_3$ | 88(80) | 90(81.8) | 88(89.9) | 90(91.9) | 102(92.7) |
| $DPT_3$ | 88(80) | 90(81.8) | 88(89.9) | 90(91.9) | 102(92.7) |
| Measles | 46(41.8) | 74(67.3) | 46(45.5) | 74(73.2) | 83(75.5) |
| Fully vaccinated | 46(41.8) | 73(66.3) | 46(46.0) | 73(73.0) | 83(75.5) |

n* = number of children with documented dose for each vaccine(106 for BCG, 94 for $DPT_1$, 98 for $DPT_3$ and 101 for measles).
vaccinated* both valid and invalid dose.
[a] figures in parentheses are percentages.

The MIAS for mothers with children 12-23 months was significantly correlated with child age at $DPT_3$ dose (r=-0.337, p=0.001) and measles dose (r=-0.266, p=0.014). $DPT_3$ coverage (card plus history) among 4-23 months old children was 79%: 71.4% for urban and 83.6% for rural areas (p=0.048). The mean MIAS for illiterate mothers from rural areas with children vaccinated for $DPT_3$ was significantly higher than for illiterate mothers from urban areas with children not vaccinated for $DPT_3$ (6.3 ± 1.7 vs 5.1 ±2.2, p=0.018).

Of 110 children 12-23 months old, 16 (15.5%) were not vaccinated for measles, 9 (8.2%) were vaccinated by history, 11 (10.0%) were vaccinated after the age of one year, 28 (25.4%) were vaccinated before 9 months' of age, and only 46 (41.8%) were vaccinated with valid dose of measles before their 1st birthday. The measles coverage (card plus history) was 57.1% for children with urban illiterate mothers, 78.1% for those with rural illiterate mothers, 91.7% for those with urban literate mothers, and 100% for those with rural literate mothers (p=0.03) (Figure 1).

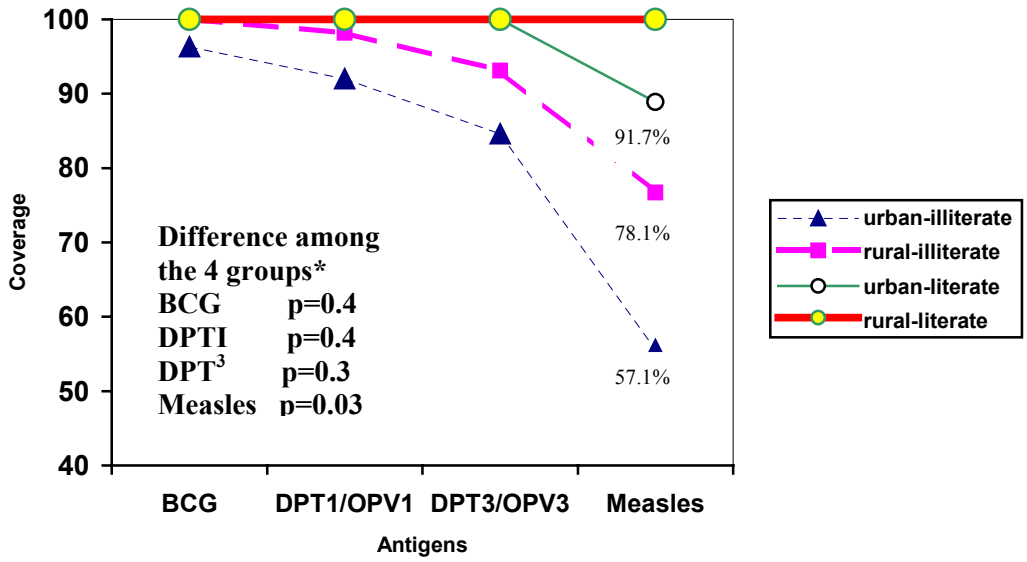


Figure 1: **Immunisation coverage (%) of 12-23 months old children by residence and maternal education, 2000**

The percent of 12-23 months old children who were fully vaccinated (card plus history) was 75.5% (83/110), while only 41.8% (46/110) were validly fully vaccinated. The percent of all age groups (0-23 months) validly vaccinated for age was 50.9% by card, and 72.7% by card plus history.

The fully vaccinated coverage among children 12-23 months was higher for literate compared to illiterate mothers (card plus history), 17 (94.4%) vs 66 (71.7%), p=0.041. Fully vaccinated coverage was higher in rural than in urban areas, 56 (80%) vs 27 (67.5%), p=0.143. The difference in the coverage of the various EPI vaccines among the four groups of mothers of 12-23 months old children increased with time (Figure 1). Unlike univariate analysis, which showed only maternal education to be independently associated with coverage, multiple logistic regression analysis indicated that area of residence and maternal education significantly predicted vaccination compliance among 12-23 months old children (Table 2).

Measles defaulter rate among 12-23 months old children was 23.9%. The main reasons given by mothers for defaulting included lack of awareness on vaccination or need for subsequent dose (41.5%), lack of motivation

Table 2: **Factors predicting fully vaccinated status of 12-23 months old children.**

| Risk factor | Not fully Vaccinated/ Total | Univariate OR | Multivariate OR | 95% CI | p-value |
|---|---|---|---|---|---|
| Husband literacy | | | | | |
| Illiterate | 16/54 | 1 | | | |
| Literate | 11/45 | 1.7224 | 1.2655 | (0.4999,3.2035) | 0.6192 |
| Mother literacy | | | | | |
| Illiterate | 26/92 | 1 | | | |
| Literate | 1/18 | 6.6913 | 9.2992 | (1.0845,79.7391) | 0.0420 |
| Residence | | | | | |
| Urban | 13/40 | 1 | | | |
| Rural | 14/70 | 1.9259 | 2.7362 | (1.0644,7.0342) | 0.0367 |

(17.6%), family problems (11.8%), unavailability of vaccination service or inconvenient time of vaccination (11.8%), mother too busy (5.9%), fear of side effects (5.9%) and place of immunisation too far (5.9%)

**Discussion**

Despite good access to immunization service, as evidenced by the 97.3% coverage of $DPT_1/OPV_1$, the validly fully vaccinated coverage was very low in the study area. One of the reasons for low validly fully vaccinated coverage identified in our survey is early vaccination of children when they were not yet eligible for measles. This implies proper screening is not done by the health personnel. Another reason for low coverage was defaulting for measles. The most common reason given by mothers for defaulting was unawareness of need for subsequent dose.

In most studies immunization coverage in urban areas is higher than in rural areas (4,6-8). In contrast, in our study the results are the opposite. The most likely reason is better community mobilisation in the rural areas[10]. For this reason, though defaulting was high among illiterate mothers in general, illiterate rural mothers had lower defaulter rates. An earlier immunization coverage survey in 12-23 months old children in Mekelle, Tigray's capital town, showed high coverage among children from literate mothers and among children from mothers who were currently married (15). In our study a high proportion of urban illiterate mothers were not currently married, implying that they could be socially unstable and might have poor social support, which could explain for the low coverage for that group.

As many studies have shown and as our study confirms, maternal education is decisive to immunization status of the child. As not knowing subsequent dose was the most common reason given for defaulting and since the immunization knowledge was related to education of the mother, coverage was low among illiterate mothers. Residence was not, however, independently significantly associated with fully vaccinated coverage on univariate analysis. The reason was that the high proportion of literate mothers in the urban area confounded the association between areas of residence and immunization status.

From the BCG scar rate difference in 12-23 months old children vaccinated by card and by history, the accuracy of mother's recall on BCG vaccination was 86%. This was consistent with results from rural Egypt where the accuracy of mother's recall for the same age group ranged from 83% to 93% (16).

The 75.5% coverage for measles was quite low compared to the 93.6% reported administrative coverage for the study area. The reasons for the discrepancy were most probably over reporting, in that children vaccinated for measles after the age of one year and children vaccinated before the age of 9 months were included in the routine EPI reports.

This study has demonstrated that where there are strongly functioning social organizations for mobilizing the community, high immunization coverage can be achieved irrespective of the educational status of the community. These findings can be generalized to most areas of Tigray, more so to the rural areas, which have well functioning social organizations and a long tradition of community mobilization. They can also be generalised to other parts of Ethiopia since all regions have such social organisations.

In conclusion, area of residence and level of mother education were found to be important factors for a mother's knowledge on EPI vaccines and compliance with immunization schedules. Thus giving health education, timely mobilisation, identifying mothers not complying with immunization, and educating at individual level are important strategies to raise the awareness of mothers on immunization and decrease the defaulting among illiterate mothers

in urban and rural areas. Proper screening and revaccination at 9 months of age for those vaccinated with invalid measles dose would also increase the validly fully vaccinated coverage.

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