Factors Influencing Full Immunization Coverage among Children Aged 12-23 months in Chadereka Rural Community, Zimbabwe

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Abstract

Full Immunization (a child having received BCG, 3 doses of oral polio, three doses of pneumococcal conjugate, three doses of pentavalent and measles vaccine) against vaccine preventable diseases reduces deaths of under-fives in developing countries. Zimbabwe records show low full immunization coverage of 69.2% in 2015 and the causalities are poorly understood. We examine factors undermining full immunization coverage among children aged 12-23 months in Chadereka community, Centenary district. We adopted a cross sectional study design using modified cluster sampling method to select study participants. Fifteen systematically selected clusters of 8 children were utilized to determine full immunization coverage. Data collection was done using a pretested structured questionnaire and analysed using excel software. Mothers (n=120) with children (aged 12-23 months) were sampled and history of immunization was extracted from child's baby card plus mother's history. We found that 64.2% (95% CI: 53.9-74.5) of study participant had achieved full immunization. Specific vaccine coverage for BCG, three doses of polio, three doses of pneumococcal conjugate, three doses of pentavalent, and measles vaccine were 90.8%, 89.4%, 86.1%, 82.4% and 70% respectively. Source for immunization were health centre (53.5%), outreach services (37%) and hospital (9.5%). Mother's awareness (p-value 0.0317) and wealth status (p value 0.01592) were the major predictors of full immunization coverage. Reasons given for failure to fully immunize children were obstacles (74.4%), lack of motivation (11.6 %), lack of information (9.3%) and community factors (4.7%). We conclude that improved awareness to mothers and empowering women potentially increase the national full immunization coverage.

Keywords: Full immunization, factors, coverage, vaccine preventable diseases.

Introduction

Immunizing children reduces deaths of under-fives in developing countries[30]. It is estimated that every year 27 million children worldwide do not receive vaccination[31]. In addition, 2 million children are estimated to die of vaccine preventable diseases globally[31]. In 2013, 145,700 of the child deaths were due to measles[34]. In low and middle income countries, immunization is effective in protecting children against vaccine preventable diseases[19]. Vaccination to children prevent 2. 5 million deaths per year[30].

The World Health Organization (WHO) introduced the Expanded Programme on Immunization (EPI) to control vaccine preventable diseases among children in 1974[17]. Zimbabwe launched Expanded Program on Immunization in 1982 to reduce child morbidity and mortality from six vaccine preventable diseases. Child vaccination services are offered at most health facilities in Zimbabwe by qualified health personnel. However, full vaccination coverage remains low compared to the required World Health Organization target of 90 % at national level. The national level full immunization coverage is 69 %[24]. Mashonaland Central Province has a full immunization coverage of 67 %[37]. This is despite that routine immunization is offered at most health facilities in the province.

Several studies show that full immunization coverage is hampered by long distance of travel to health facility[6], missed opportunity[1], poor socioeconomic status[18], high birth order[25] and low educational status of mother[14.] Studies done in Zimbabwe show the effect of poor logistical arrangements and health systems on

vaccination of children[3, 23]. The Ministry of Health and Child Care view that high attrition of experienced and skilled personnel resulted in low immunization at health facilities as there was lack of staff offering vaccination services[21].

At Chadereka health facility, the dropout rate for measles vaccine compared to pentavalent one ranges from 14% to 52% for the period January-August 2015[12]. This is despite that vaccination services are routine. In addition, outreach services are offered at four villages in the catchment area of the health facility monthly. Furthermore, the health facility utilizes the supermarket approach to offer vaccination services to clients in their catchment area[21]. Monthly, the district Community Nursing Department offers supportive supervision to health facility staff and mentors them on vaccination.

The study will determine full immunization coverage for Chadereka health facility and elicit the reasons for immunization failure to inform program authorities. Identifying factors influencing full immunization coverage will assist in determining the most critical factors that affect full immunization status in Chadereka Community. There is little information about factors affecting full vaccine uptake at Chadereka health facility although vaccination coverage for specific antigens are available in the district. Results from the study will contribute towards establishing the full immunization coverage and will be used by National, Provincial and EPI focal persons to improve full vaccination uptake within districts.

Methods

Description of study site

The study was conducted in Centenary District of Mashonaland Central Province in Zimbabwe. The district was reported to have low childhood immunization status in the province (District Health Information Report, 2015). Chadereka health facility is a council owned health facility with a catchment population of 23,054. The under-one population which was expected to be vaccinated in 2013 and 2014 was 816 and 830 respectively.

Study population

The study population comprised of 120 children aged 12-23 months of age. Modified cluster sampling method was applied to select eligible children and give information on immunization coverage[8]. Fifteen clusters and eight children from each cluster were chosen because the sample size gives an accuracy of 10 % and 95 % Confidence interval[1]. Level of accuracy is based on the assumption of high level of difference in coverage between clusters[1].

Study duration

The study was conducted from September 2015 to December 2015. Pilot study was conducted in another district for validation of data collection tools in November 2015. Questions were adjusted accordingly after the pretesting of the questionnaire.

Sampling method

Chadereka health facility has 43 villages. Modified cluster sampling technique was used to select respondents. Fifteen systematically selected clusters of 8 children was utilized to determine full immunization coverage at Chadereka health facility. Each of the 15 clusters comprised of 8 children in the 12-23 months age group. Selection of the clusters was done by listing down all the villages in Chadereka catchment area with corresponding population. Cumulative population was done per village by adding the previous total population to the population for the next village. Sampling interval was calculated and a random number was selected using a currency note. The random number had the same number of digits as the number of digits on sampling interval. The random number identified was less than the sampling interval. First cluster was identified by locating the first community listed which had the cumulative population equals or exceeding the random number. To identify the next village, the random number was added to the sampling interval. Again the cumulative population for cluster 2 was greater than or equal to

the total of random number and sampling interval. See attached Annex a on cluster identification in this study. The next cluster was identified through adding the sampling interval to the current cumulative population of the next village.

Selection of households in identified clusters was done randomly. A list of households in identified clusters of Chadereka community was obtained from the health facility Environmental and Health Department. Households were numbered from 1 to the highest number. A random number was selected using a currency note from one to the highest number on the household list (inclusively). The household (HH) whose number corresponded to the random number selected was the first HH visited. The nearest subsequent household whose front door was next to the first was selected as the second household until eight children were selected. If there was more than one child in the same family eligible for study, the youngest child was chosen.

Inclusion and exclusion criteria for study population

Study population included children born exactly 12 months from the date the interviews were conducted and any age before 24 months. If there are two young children from the same family eligible for the study, the youngest child was selected to participate in the study. Children who were visitors were excluded in the study. In addition, children whose parents refused to participate in the study were excluded as well as those with parents who had communication challenges. The child's care giver was defined as any mother, father or anybody attending to the needs of the child.

Sample size

Sample size was calculated using the World Health Organization (WHO) modified cluster sampling method[8]. The expected full immunization coverage for the district is 85%, precision of =+/-10% (*d=10*), design effect of 2 (DE=2), 95% confidence interval[1]

$n_{min}=$ DE x $\dfrac{Z^2_{(1-\alpha)} \, x \, p \, x \, (1-p)}{d^2}$

Therefore sample size equals:

$n=2$ x $\dfrac{1.96^2 \, x \, 0.85 \, x \, (1-0.85)}{10^2} = 97.96$

n= 98

- Being a district with poor road network, we expected a non-response rate of 20%, taking the non-response rate thus by dividing by 0.8 sample size of 123 was obtained.
- A sample with 15 clusters was chosen in this study. Therefore per cluster: 123/15=8.2 children per cluster, rounded off to 8 children per cluster.
- The total sample size was 15 clusters multiplied by 8 children per cluster to give 120 children

Study tools

Structured questionnaires were used to collect data on factors influencing full immunization coverage among children aged 12-23 months. Pretesting was done in another district in Mashonaland Central Province. Ambiguous questions were rephrased following pretesting.

Collection of data

Data collection was done using a structured questionnaire to identify factors associated with full immunization coverage and determine the full immunization coverage at Chadereka health facility. The structured questionnaire was administered by the researcher and five nurses trained by the researcher. The study interviewed the child's mother, and for those who were not raised by their mother, the person taking care of the child was interviewed. Questionnaires covered information on physical access, health worker knowledge, attitudes and practices, missed opportunity, caregiver factors, community and societal factors and vaccine availability and child vaccination status.

Full immunization status was determined by asking the caregiver to produce a vaccination card for the

child and also to give history of vaccination of their child in cases where the card had been lost. WHO manual on EPI coverage describes two alternatives for estimating uptake of vaccines, one is by 'card only'[40]. Vaccinations have to be documented on the card, with the date of vaccination on the numerator and batch number on the denominator. The second one is by 'card plus history', which included in numerator all reported vaccination including those not documented other than the mother's report.

Questionnaire on reason for failure to immunize was administered to caregivers whose children were partially or not immunized. Respondents were asked to state the single most important reason why the child was not fully immunized. In cases where the response by the caregiver is not among options given in the questionnaire, interviewers would capture verbatim responses for analysis later with other team members.

Data analysis

Collected data was entered, coded and analysed using Excel software. The frequency of continuous and categorical variables, means and standard deviation of age were calculated. Chi-square test was used to test statistical associations and p-value at 5% significance level.

Ethical consideration

Permission to conduct the study was granted by the District Health Executive together with Catholic Organization for Relief and Development Aid Country Office. This was a district generated request in making effort to understand immunization coverage at the health facility. Caregivers were given informed consent and signed to agree participation in this study.

Results

This chapter presents findings of the study under selected characteristics of mother and child in relation to full immunization at Chadereka health facility. In addition, reasons for failure to immunize children are also presented in this chapter.

Sociodemographic characteristics of study population

A total of 120 mothers of children aged 12-23 months were selected for interviews and the response rate was 100%. Majority of the children were females (53.3%). A total of 78 (65%) children were aged between 14 and 20 months and the mean age was 17.8 months (SD 3.4). All respondents were mothers of the children targeted in the study. The mean age of the mothers was 27.5 (SD= 7) years, which ranged from 15 to 56 years. Table 4.1 below presents the socio-demographic characteristics of mothers and children.

Only 45% of the mothers had secondary education compared to 55% who had primary education. Majority of them (64.2%) were not aware of the immunization services offered at their health facility. Minority (32.5%) of the mothers were of medium wealth status whereas the majority were poor (67.5%). Majority (94.2%) were married at the time of the study and few (5.8%) were divorced. Mothers were mainly of the apostolic sect (79.2%) whilst 8.3% did not report any religion. 9.2% mothers had a birth order of 6 children or more. Majority of the mothers (47.5%) had a birth order of 2 to 3.

Table 4.1. Sociodemographic characteristics of mothers and child at chadereka health facility

Characteristic	Frequency	Percent
Sex of the child		
Male	56	46.7
Female	64	53.3
Age group in months		
12 to 13	13	10.8
14-23	107	89.2
Mothers		
15-24	44	36.7
25-34	54	45.0
35+	22	18.3
Educational Status		
Primary	66	55.0
Secondary	54	45.0
University	0	0.0
Mother's Awareness		
Not Aware	77	64.2
Aware	43	35.8
Wealth Status		
Poor	81	67.5
Medium	39	32.5
Rich	0	0.0
Marital Status		
Never Married	0	0.0
Currently Married	111	92.5
Divorced	9	7.5
Widowed	0	0.0
Religion		
Christian	15	12.5
Apostolic	95	79.2
Jewish	0	0.0
Other	10	8.3
Birth Order		
1	23	19.2
2 to 3	57	47.5
4 to 5	29	24.2
6+	11	9.2
Total	120	100

Immunization coverage by card plus history

Based on the vaccination card plus history, 64.2% (95% CI: 53.9-74.5) were fully immunized, 10 (8.3%, 95% CI: 4.3-12.3) of the children were not immunized and 27.5% (95% CI: 17.1-37.9) were partially immunized (Table 5). The most frequently received vaccine was OPV. Particularly for OPV1, 93.3% of the children were vaccinated. This was followed by BCG with 90.8% and Pentavalent 1 (90.8%). OPV2 was taken by 90% of the children and Pentavalent 2 was taken by 85.8% of the children. The least taken vaccines were Pentavalent 3 with 82.5% and measles with 70%. Results from the study show a decrement from first dose vaccine to the last dose (Table 4.2)

Table 4.2. Immunization coverage by card and card plus mother's history, Chadereka health facility

Vaccine	Card plus history		Card only	
	Frequency	Percent	Frequency	Percent
BCG	109	90.8	95	79.2
OPV1	112	93.3	95	79.2
OPV2	108	90.0	89	74.2
OPV3	102	85.0	90	75.0
Pentavalent 1	109	90.8	90	75.0
Pentavalent 2	103	85.8	91	75.8
Pentavalent 3	99	82.5	87	72.5
Measles	84	70.0	74	61.7
Not immunized	10	8.3	10	8.3
Partially immunized	33	27.5	20	16.7
Fully immunized 12-23 months	77	64.2	65	54.2
*Percentages cannot be added to hundred.				

Immunization coverage by card only

Of the total surveyed children aged 12-23 months, vaccination card was seen and confirmed for 95 (79.2%) children. 79.2% took BCG and OPV1 vaccines. This was followed by Pentavalent 3 (75.8%) and Pentavalent 1 and 2 (75%). Measles vaccine was administered to 61.7% children. Of the 54.2% that were fully immunized by card only, only 38.3% were fully immunized below 1 year of age by card only. The coverage for individual vaccines by card were lower than the coverage's for card and history (Table 4.2).
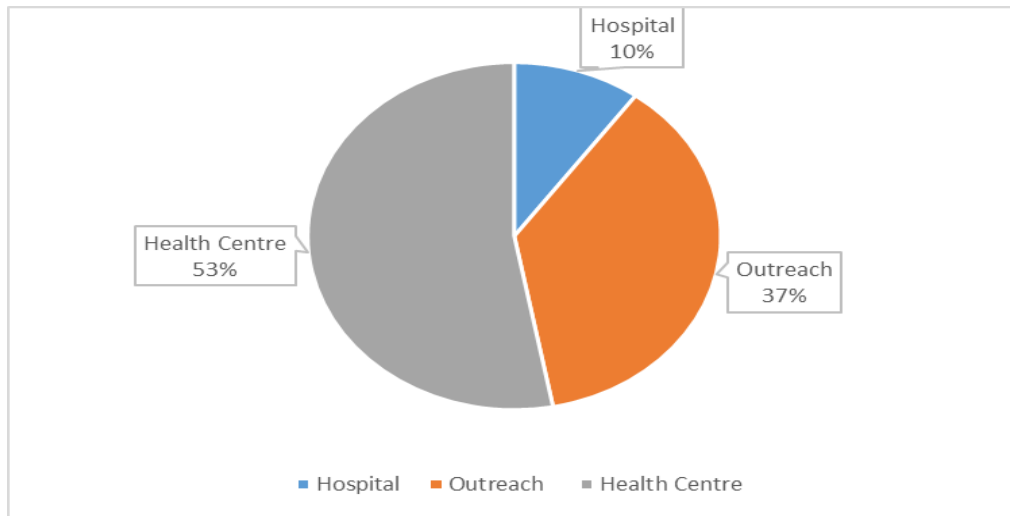
Immunization by source

Figure 4.1. Immunization of surveyed children by source

The most frequently used source for immunization was the health center with 53.5% vaccine doses being administered there (Figure 4.1). This was followed by outreach services which contributed 37% of the vaccination doses administered to children. The least used source for vaccination was the hospital (9.6%).

Reasons for immunization failure

In total, failure to immunize were mainly a result of obstacles (74%) followed by lack of motivation (12%). Lack of information contributed to failure to immunize by (9%).Community factors (5%) were the least cited as reason for immunization failure (Figure 4.2).
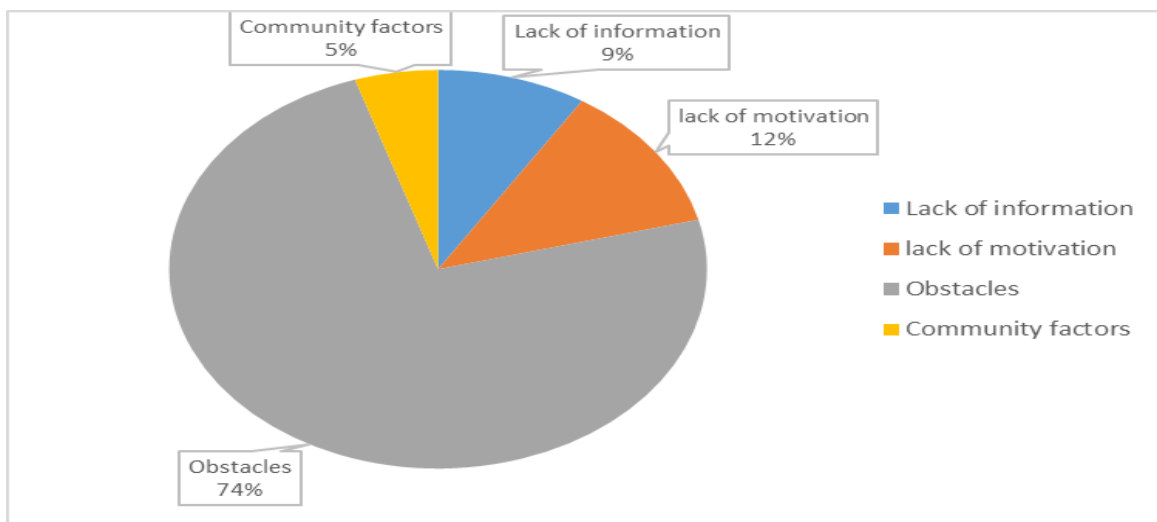

Figure 4.3. Major reasons for immunization failure

Table 4.3 below shows reasons for immunization failure reported by forty three participants from the study. Participants mentioned that lack of information on the place of time for immunization (6.98%) and that they were unaware of need for immunization (2.3%) as reasons for failure to immunize. Some participants cited lack of motivation to immunize children and postponed until another time (6.98%). Sixteen percent reported that the place of immunization was too far and also 16.3% reported that the child was ill and not brought for immunization. Whilst 13.95% reported that the mother was too busy to take the

child for immunization. Religious reasons were mentioned by 4.7% as reason for failure to immunize children.

Table 4.3. Reasons for immunization failure

Reason for failure to immunize (Partially and not immunized: N=43)		Total, n (%)
Lack of information	Unaware of need for immunization	1 (2.3%)
	Unaware of need to return for 2nd and 3rd dose	-
	Place of time of immunization unknown	3 (6.98%)
	Fear of side reactions	-
	Wrong ideas about contraindications	-
Lack of motivation	Postponed until other time	3 (6.98%)
	No faith in immunization	2 (4.7%)
	Rumors	-
Obstacles	Place of immunization too far	7 (16.3%)
	Time of immunization inconvenient	1 (2.3%)
	Vaccinator absent	2 (4.7%)
	Vaccine not available	3 (6.98%)
	Mother too busy	6 (13.95%)
	Family problem	4 (9.3%)
	Child ill not brought	7 (16.3%)
	Child ill brought but not immunized	-
	Long waiting time	-
	Geographic barrier mobility	2 (4.7%)
	Seasonal barrier to mobility	-
Community factors	Religious reasons	2 (4.7%)
	Scientific reasons	-
	Cultural reasons	-
	Total	-

Factors influencing full immunization coverage

Table 4.4 shows bivariate analysis of sociodemographic characteristics of mothers influencing full immunization coverage among 12-23 months children of age at Chadereka health facility. Chi-square test was done for each variable to determine the effect of independent variables on the outcome variable. Bivariate analysis showed that two factors (Mothers awareness: p-value 0.0317, X^2 Test=4.6105, Wealth status: p value 0.01592, X^2 Test= 5.8981) statistically significant with p values less than 0.05.

Table 4.4. Bivariate analysis of factors influencing full immunization at Chadereka health facility, November 2015

Factors	Partially and unimmunized (n, %)	Fully immunized (n, %)	Chi-square X2	P value
Mothers age				
15-24	14 (11.7)	30 (25)	2.0827	0.3529
24-34	23 (19.2)	31 (25.8)		
35+	6 (5)	16 (13.3)		
Education level				
Primary	23 (19.2)	43 (35.8)	0.061869	0.8496
Secondary	20 (16.7)	34 (28.3)		
Mothers awareness				
Not aware	10 (8.3)	33 (27.5)	4.6105	0.031776
Aware	33 (27.5)	44 (36.7)		**OR=2.5**
Wealth status				
Poor	35 (29.2)	46 (38.3)	5.8981	0.015157
Medium	8 (6.7)	31 (25.8)		**OR=0.3**
Marital status				
Currently married	40 (33.3)	71 (59.2)	1.3533	0.2929
Divorced	5 (4.2)	4 (3.3)		
Religion				
None	5 (4.2)	5 (4.2)	2.5504	0.2794
Apostolic	35 (29.2)	60 (50)		
Christian	3 (2.5)	12 (10)		
Birth order				
1	7 (5.8)	16 (13.3)	2.1771	0.5365
2 to 3	19 (15.8)	38 (31.7)		
4 to 5	11 (9.2)	18 (15)		
6+	6 (5)	5 (4.2)		

Limitations of study

The study was done in Chadereka health facility catchment population. Generalization of findings to other health facility catchment population might not be possible since characteristics of caregivers may not be the same. However, the sample size was calculated by proven scientific methods and hence results could be utilized for planning purposes at the health facility.

Discussion

Coverage for full immunization by card plus history in this study (64.2%) was lower than the national full immunization coverage (69%) [13] and provincial coverage (67%) [33]. The low coverage's elicited in this study show that the health facility immunization coverage is performing lower than both the national and provincial rates. Hence the need for strengthening vaccination services at both health center and outreach services.

Mother's awareness was significantly associated with full immunization coverage among children in the study [13, 4, 36]. Mothers who were aware of immunization services offered at health facility were more likely to fully immunize their children (36.7%) compared to their counterparts 27.5% who were not aware. In this

study, majority of the respondents (64.2%) were not aware of immunization service offered at the health facility. Awareness of the mother on vaccination services encourages the mother to seek for the health service[13]. Hence awareness plays a key role in improving vaccination coverage's.

The study found out that wealth status was also significantly associated with full immunization coverage[18, 15]. Mothers who were of medium wealth status were most likely to immunize their children compared to mothers who had a poor wealth status[15]. Less than 10% of the children from families with medium wealth status were partially immunized compared to 29.2% from poor families. The majority of mothers in the study were poor (67.5%) and hence their children less likely to be fully immunized. Wealth status and mothers awareness were the independent determinants of full immunization in Chadereka community.

Findings from the study indicate that there are high coverage's for vaccines at birth compared to other vaccines over time (BCG coverage 90.8% compared to measles which is 70%) [26]. High coverage for BCG indicates that the community is accessing the health facility for vaccination services at the initial stages when the child is born. However, the decrement in relative vaccines indicates that there is poor continuity of vaccination to children[30]. This is also evidenced by the coverage for measles (70%).

There were higher coverage's for immunization by card plus history compared to card only. Recall biases by mothers of vaccination done may result in overestimation of the coverage rates. However, the study also determined full immunization coverage by card only. Children who were partially immunized by card plus recall were 27.5% compared to those by card only (20%). It is crucial for children to be fully immunized because incomplete vaccinations result in high infant mortality rates and also in the occurrence of childhood vaccine preventable diseases.

The study found out that the most common used source for immunizing children was the health center (53%) followed by outreach services (37%). Findings from the study confirm that outreach services are crucial in complementing vaccination services offered at the health center and in the community. Furthermore, majority (16.3%) of the respondents who reported that obstacles were a major reason for failure to immunize mentioned the place of immunization being too far[7, 6]. Hence the need to strengthen outreach service provision for immunizations. Respondents cited various obstacles as reasons for immunization failure. Respondents pointed out that mothers are too busy to take the children for immunization[28]. This concurs with findings from other studies[20, 6].

The place of time for immunization was unknown by respondents and in some cases the vaccine and vaccinator were absent. Findings from the study were confirmed by other studies[33, 23] Child illness contributed to failure for immunization since caregivers did not bring child for immunization. This agrees with findings from other studies[3, 23].

Conclusion

In conclusion, maternal awareness of vaccination services offered at health facility and maternal wealth status significantly influence full immunization among children aged 12-23 months in Chadereka community. Majority of the mothers were not aware of the immunization services offered at their health facility. This might affect seeking of immunization services by the community.

Findings from the study indicate high coverage's for vaccines at birth followed by low coverage's for vaccines administered later. This decrement of vaccine coverage is worrisome since it indicates poor utilization of vaccination services.

There is low full immunization coverage for children under one year of age. Hence timely vaccinations are still a challenge in this community. Also, there is high dropout rate for measles relative to vaccines administered at birth. This indicates poor continuity of vaccination services at the health facility.

Reasons for failure to immunize were mainly due to obstacles encountered by mothers such as health facility being too far to walk and that mothers were too busy to go health facility for vaccination of their children. Child's illness was also cited as reason for immunization failure.

Outreach services were utilized by the community to access vaccination services. Findings confirm the notion that outreach services indeed compliments health facility activities in improving vaccination coverage's. This is crucial in reaching clients that are hard to reach in the community.

Findings from this study are crucial in designing strategic solutions towards the achievement of the district full immunization target of 85%. Hence, target achievement ensures achievement of the Millennium Development Goal 4.

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