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Understanding the factors associated with utilization of institutional delivery service in Ethiopia: A study based on the 2011 EDHS data.

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Abstract: Background: High maternal mortality is a continued challenge for the achievement of the fifth millennium development goal in Sub-Saharan African countries including Ethiopia. Reducing maternal morbidity and mortality is a global priority which is particularly relevant to developing countries like Ethiopia. One of the key strategies for reducing maternal morbidity and mortality is increasing institutional delivery service utilization of mothers under the care of skilled birth attendants. The aim of this study was to determine the level of institutional delivery service utilization and associated factors.

Objectives: To determine the magnitude and associated factors related to utilization of institutional delivery in Ethiopia.

Methods: A community based cross sectional secondary data analysis were conducted by taking all eligible mothers who gave at least one birth in the study period were selected from all clusters of Ethiopian Demographic survey of 2011. Variables were selected, transformed and fitted to bivariate and multivariate Logistic regression model to assess factors associated with institutional delivery using SPSS version 16. P-values ≤ 0.05 were considered as statically significant.

Result: A total of 7758 mothers who gave last birth, only 16% of them were delivered in the health institution; out of 12% were urban and 4% were residing in rural areas. Being rural resident, lower education, long distance to health institutions, male headed household, poor access to media, lower antenatal care follow-up, poor perinatal seeking and family planning knowledge were found to be major factors for less utilization of institutional delivery

Conclusion and recommendation: In this study, institutional delivery was quit lower. Hence, stakeholders need to strive on; information, education communication; universal accessibility of health facilities and improving maternal health care services.

Key Words: Ethiopia, IEC, Institutional Delivery, Obstetric characteristics, Spatial Distance

INTRODUCTION:

Background:

Maternal mortality remains a major challenge to health systems worldwide. According to assessment of trends in maternal mortality for 181 countries from 1980–2008, it was estimated to be 342,900 maternal deaths worldwide in 2008 decreasing from 526,300 in 1980. More than 50% of all maternal deaths were only from six countries in 2008 (India, Nigeria, Pakistan, Afghanistan, Ethiopia, and the Democratic Republic of Congo) Worldwide, the major causes of maternal mortality are haemorrhage (24%), infection (15%), unsafe abortion (13%), prolonged labour (12%) and eclampsia (12%) whereas primary causes of maternal mortality in Africa are haemorrhage (34%), other direct causes (17%), infection (10%), hypertensive disorders (9%) and obstructed labour (4%), abortion (4%) and anaemia (4%)(1).

Maternal deaths have both direct and indirect causes. About 80% of maternal deaths are due to causes directly related to pregnancy and childbirth(2).One of the objectives of the United Nations Millennium Development Goals (MDGs) was to reduce MMR by an average of 5.5% every year over the period 1990–2015(3). Recent estimates suggest that the average annual rate of reduction in MMR in SSA countries is less than 1%(4).

As Ethiopian EDHS 2011 has shown, the MMR was 676 per 100,000 live births for the seven year period preceding the survey which is not significantly different from EDHS 2005 report (673 per 100,000 live births). The maternal mortality ratio of Ethiopia was 676 deaths per 100,000 live births by 2011 compared to 673 deaths per 100,000 live births by 2005. Skilled birth attendance is correlated with lower MMR. At least 15% of all births in the population should take place in basic or comprehensive emergency obstetrics facilities. However, the proportion of births with a skilled attendant is 10% in Ethiopia. In Ethiopia, Maternal deaths account for 30 percent of all deaths to women age 15 - 49 and maternal mortality ratio was estimated to 676 maternal deaths per 100,000 live births(5).

Skilled attendance during labor, delivery and early post-partum period could reduce deaths due to obstructed labor, hemorrhage, sepsis and eclampsia (6). Most of the maternal deaths will be avoidable if women have access to vital health care before, during, and after childbirth. A skilled birth attendant at delivery is critical to reducing maternal deaths. In 2006, nearly 61% of the births in the developing world were assisted by skilled birth attendants. However, coverage remains low in Southern Asia (40%) and SSA (47%)–the two regions with the greatest number of maternal deaths(3).

Rationale of the study:

Maternal mortality remains a major challenge to health systems worldwide. Maternal mortality was in one or other way is associated with delivery and pregnancy. The major causes of maternal mortality are haemorrhage (24%), infection (15%), unsafe abortion (13%), prolonged labour (12%) and eclampsia (12%) whereas primary causes of maternal mortality in Africa are haemorrhage (34%), other direct causes (17%), infection (10%), hypertensive disorders (9%) and obstructed labour (4%), abortion (4%) and anemia (4%) (1). To benefit from available care and treatment options, pregnant mothers should obtain the ANC and delivery services within the health institutions. This is critically important for assessing the magnitude of institutional delivery and factors associated with it.

High maternal mortality is a continued challenge for the achievement of the fifth millennium development goal in Sub-Saharan African countries including Ethiopia. Although different strategies were designed to decrease the maternal mortalities in Ethiopia still it is a major challenge to reach the millennium development goal. Therefore this study is critically important for assessing the magnitude of institutional delivery and factors associated with it. After determining the magnitude institutional delivery and factors associated with it, the study would be used for future scale up of the strategy to solve the factors at all levels (1).

LITERATURE REVIEW:

Utilization of Institutional Delivery:

Appropriate delivery care is crucial for both maternal and perinatal health and increasing skilled attendance at birth is a central goal of the safe motherhood and child survival movements. Skilled attendance at delivery is an important indicator in monitoring progress towards Millennium Development Goal 5 to reduce the maternal mortality ratio by three quarters between 1990 and 2015 (7). A community based studies shown that 40% in Guangxi region, China; 34% in rural Rajasthan, India, 69% in India, 20% in Pakistan, 20% in Bangladesh, 67% in Senegal, 23% in Kenya, of them delivered at the health-care facilities(8-14).

Factors associated with institutional delivery service utilization:

Socio-demographic factors:

According to several studies socio demographic characteristics were found to be determinants of choice of place of delivery. A study in Guangxi region, China, in Pakistan, in Senegal, in Kenya, in rural Tanzania and in rural Zambia revealed that those with the education of high school were higher likely to deliver in health institution (8, 11, 13-14, 17-18). In Pakistan and in rural Tanzania, younger mothers were also more likely to deliver in a health facility (11, 17). A study done in Pakistan, in rural India, in Indonesia, in rural Tanzania and in rural Zambia shown that household poverty was directly related with poor utilization of institutional delivery (11, 15-18).

Regarding lack of female autonomy in Pakistan, in rural Tanzania and in rural Zambia, Women who lived in male-headed households were less likely to deliver in a health facility than women in female-headed households (11, 17-18).

IEC and Physical accessibility factors:

A study in Guangxi region (China), in Pakistan, in Senegal, in Kenya, in Indonesia and in rural Zambia revealed that Physical distance was a major constraint that prevented community members from accessing institutional delivery (8, 11, 13-14, 16, 18). A study done in Pakistan indicated that exposure to mass media was also important drivers of institutional delivery (11).

Obstetric factors:

A study in Guangxi region (China), revealed that multipara mothers, were higher likely to deliver in health institution (8). Those with over 5 times in terms of frequency of prenatal checkup were higher likely to deliver in health institution (18). In Pakistan, mothers who had at least three ANC visits, use of family planning within a year of delivery have higher likely to deliver in a health facility (11).

According to a study in Senegal, lack prenatal examination and low service quality were directly related to poor utilization of institutional delivery. In the same study, factors such as; number of prenatal care >3, early prenatal care were positively associated with childbirth at Health institutions (13).
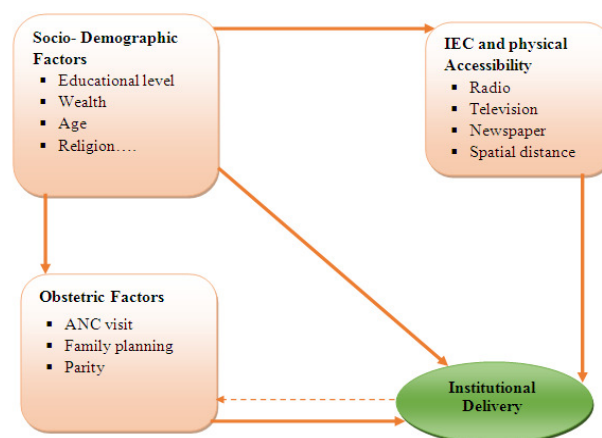
Conceptual framework:

Figure 1: Conceptual frame-work of factors associated with utilization of Institutional Delivery.

The different literatures showed that Socio-demographic Factors (Educational level, Wealth, age), Obstetric Factors (ANC visit, family planning, parity) and IEC and physical Accessibility were the factors associated with utilization of Institutional Delivery.

Based on this, the study used the aforementioned three variables as a predictor for places of their delivery (institutional and Home).

OBJECTIVES

General objectives:

a. To determine the magnitude and associated factors related to utilization of institutional delivery in Ethiopia.

Specific Objectives:

a. To determine the magnitude of institutional delivery

b. To identify factors associated with institutional delivery

METHODOLOGY:

Study area:

Ethiopia is found in the Horn of Africa with a total surface area of about 1.1 million km^2. The capital city, Addis Ababa has been serving as a seat for the African Union. The country is administratively structured into nine regional states; Tigray, Affar, Amhara, Oromiya, Somali, Benishangul-Gumuz, SNNP, Gambela, and Harari; including Addis Ababa and Dire Dawa city Administration Councils. It is one of the least urbanized countries in the world; only 16 percent of the population lives in urban areas. The majority of the population lives in the highland areas. The main occupation of the settled rural population is farming, while the lowland areas are mostly depend mainly on livestock production. The country is home to more than 80 ethnic groups. More than 80 percent of the country's total population lives in the regional states of Amhara, Oromiya, and SNNP. Christianity and Islam are the main religions; about half of the population are Orthodox Christians, one-third are Muslims, about 18% are Protestants and 3% are followers of traditional religion (19).
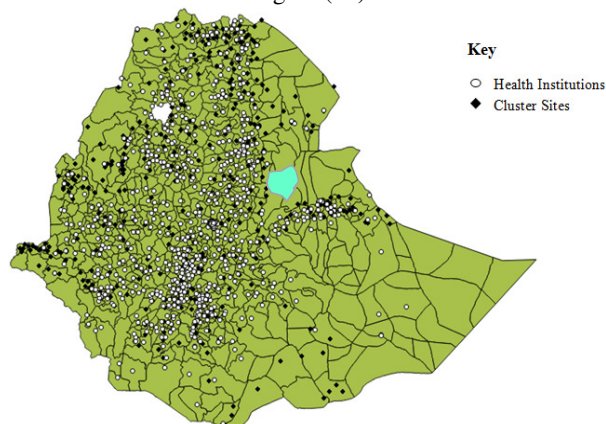

Key
○ Health Institutions
◆ Cluster Sites

Figure 2: Distribution of Health Institutions (Health Centers and Hospitals) and Demographic and Health Survey Cluster sites of 2011 in Ethiopia

Study Design:

A cross sectional quantitative secondary data analysis was conducted among mothers who gave at least one birth from 2006 to 2010 using Ethiopian Demographic and Health Survey data set, 2011. The last birth was an event taken for analysis to determine factors affecting utilization of institutional delivery in the country.

Source population:

The source populations of the study were all mothers who do have at least one birth within 2006 to 2010 in Ethiopia.

Study population:

The study populations were all mothers in the selected cluster sites who do have at least one birth during the study period from 2006 to 2010.

Inclusion criteria:

All mothers gave birth during the study period

Exclusion criteria:

Those mothers who have incomplete records

Sample size and Sampling technique:

The Ethiopian Demographic health 2011 survey took a nationally representative population. In this study all mothers (7758) from all cluster samples who gave at least one birth during the study period from the EDHS 2011 were taken as study participants. All mothers who fulfilled the inclusion criteria were included in the study.

Data collection procedures:

Ethiopian DHS records and GIS shape file of 2011 data set were obtained from measure DHS (www.measuredhs.com). Data was first collected using standardized questionnaires through interview by DHS team during the period and GPS were used in tracing spatial data. For this study, all possible target variables of the eligible mothers were selected using SPSS operating tools.

Data quality Assurance:

To assure the quality of the data, the exported data was reviewed and checked for completeness and relevance of the variables by the principal investigators.

Data Analysis:

The data obtained from the EDHS were transformed and coded using SPSS version 16. GIS data obtained from EDHS were also analyzed using Q-GIS (Quantum GIS) software were used for competing spatial distance from the cluster of study participants to the nearest Health Center/Hospital. Eventually the spatial distance was merged with the main data set as predictor variable.

Statistical analysis was carried out to assess the associations between independent variables and dependent variables two strategies were used and those included:-

a. Independent variables were fit in to a separate binary logistic regression model

b. All variables which were analyzed using bivariate logistic regression were fitted in to a multi-variate logistic regression model to control the effect of confounders and to come up with independent predictors of institutional delivery utilization.

Odds ratio was used to examine group differences and to ascertain the influence of residence, age, sex, education, employment status, religion, marital status, and ethnic group. CI was used to see the strength of association. P-values of less than 0.05 and a confidence level of 95% by a two-sided test were considered to indicate statistical significance. To describe the characteristics of the study population, means, SD, medians, and proportion were calculated.

Study variables:

Dependent variables: -

a. Institutional delivery (Yes/No)

Independent Variables included: -

a. **Socio demographic variables: -** Age, residence, region, sex of household head, education, religion, educational level.

b. **Physical accessibility of service and IEC related variables: -** Distance to the Health Center/Hospital, availability of Radio, Television, telephone in the

household, frequency of reading newspaper or magazine, frequency of listening to radio, frequency of watching television

c. **Obstetric related factors: -** Number ANC visit, perinatal care of mothers during the last pregnancy, number of children ever born, knowledge on family planning services and pattern of use; wanted last child, etc.

Measurement (operational definition) of variables:

a. **Institutional delivery: -** Those who delivered in a public or private health facility.
b. **Knowledge on contraception: -** Respondents who considered as Knowledgeable were those who mention at least one method of contraception.
c. **Spatial distance: -** The space from the center of the each DHS clusters to their nearest Health Center/Hospital which was measured by GPS during the survey.

RESULTS:

Socio demographic characteristics of the respondents:

Out of a total number of 7758 mothers who gave their last birth; 6247 (80.5%) of them were from rural areas of the country. The mean age of respondents were 29.08 ± SD

6.902 years; the majority 2290 (29.5%) were within the age range of 25-29, followed by 1596 (20.6%) between 20-24 age range. Largest portion 1100 (14.2%) of study subjects were from Oromiya followed by SNNPR 1052(13.6%) and Amhara 965(12.4%) regional state and the smallest 346(4.5%) of them were from Addis Ababa city administration. (Table1).

Regarding religion; most of the respondents 3358(43.3%) were Muslim followed by Orthodox Christians 2692(34.7%). About 6197(79.9%) of study subjects were living in paternal headed household. Concerning educational status, most of the participants 2094(27.0%) had primary whereas, 311(4.0%) and 173(2.2%) of them were secondary and higher level of education respectively. The wealth index shows that 2277(29.4%) were poorest and 1659(21.4%) were richest. (Table 1).

Concerning physical accessibility (Spatial distance from the center of the cluster site to the nearby heath center/Hospital), about half 4111(53%) of the respondents were living within 10kms radius of physical access to the nearest heath center/Hospital (Table 1). The average (median) spatial distance from mothers' residence to the nearest health institution was 9.3km (with IQR of 13kms.)

Table 1: Socio demographic characteristics of institutional delivery of mothers gave last birth, EDHS record 2011 (n=7758)

Socio-demographic Characteristics		number	Percent
Age group	15-19	416	5.4
	20-24	1596	20.6
	25-29	2290	29.5
	30-34	1506	19.4
	35-39	1203	15.5
	40-44	547	7.1
	45-49	200	2.6
Region	Tigray	847	10.9
	Affar	713	9.2
	Amhara	965	12.4
	Oromiya	1100	14.2
	Somali	559	7.2
	Benishangul-Gumuz	673	8.7
	SNNP	1052	13.6
	Gambela	607	7.8
	Harari	440	5.7
	Addis Ababa	346	4.5
	Dire Dawa	456	5.9
Place of residence	Urban	1511	19.5
	Rural	6247	80.5
Sex of household head	Male	6197	79.9
	Female	1561	20.1
Educational Level	Primary	2094	27.0
	Secondary	311	4.0
	Higher	173	2.2
Religion	Orthodox	2692	34.7
	Catholic	77	1.0
	Protestant	1478	19.1
	Muslim	3358	43.3
	Traditional	60	.8
	Other	89	1.1
Wealth index	Poorest	2277	29.4
	Poorer	1354	17.5
	Middle	1239	16.0
	Richer	1229	15.8
	Richest	1659	21.4
Spatial distance	Within 10km radius	4111	53.0
	Beyond 10km radius	3647	47.0
	Total	7758	100.0

RESEARCH PAPER

Obstetric characteristics of the respondents:

From a total of 7758 respondents, about half 3865 (49.8%) of them had ever born four and more children. The average (mean) number of children ever born by the study subjects were 4 with SD of ±2.624. About 4477(57.7%) of them gave only one birth while the rest had two and more in the last five years. (Table 2)

Regarding family planning, majority 7306(94.2%) of respondents had knowledge about modern family planning methods. However, 4625(59.6%) of them had never used any of family planning methods. While only 725(9.3%) were using family planning methods before last birth. Larger portion of mothers participated in the study had given birth in the moment they wanted. Around half of study subjects had not been given TT vaccination at all before last birth. (Table 2)

Twenty two percent of the study subjects had four and more ANC visit before last birth. But 4288(55.3%) of them had not ANC visit at all. The average (mean) round of ANC visit of the respondents were 1.5 with SD ± 2.174. Out of the total study participants, 2212(28.5%) of them had been provided perinatal care by either Nurses or Midwife before last birth. However 4290(55.3%) of them were not provided with it at all. (Table 2)

Table 2: Obstetric characteristics of mothers gave last birth, EDHS record 2011 (n=7758)

Obstetric characteristics		n	Percent
Number of Children Ever born	One	1476	19.0
	Two	1335	17.2
	Three	1082	13.9
	Above Three	3865	49.8
Number of Birth in 5 Years	One	4477	57.7
	Two	2721	35.1
	Three	513	6.6
	Four and more	47	.6
Knowledge of Family planning methods	Knows no method	420	5.4
	Only traditional method	32	.4
	Knows modern method	7306	94.2
Pattern of Family planning use	Currently using	1891	24.4
	Used since last birth	517	6.7
	Used before last birth	725	9.3
	Never used	4625	59.6
Wanted last child	Wanted then	5759	74.2
	Wanted later	1334	17.2
	Wanted no more	664	8.6
TT Vaccination before birth	Not at all	4077	52.6
	Once	875	11.3
	Twice	1402	18.1
	three times	1082	13.9
	Four and more	322	4.2
Number of ANC visit	Not at all	4288	55.3
	Only once	338	4.4
	Twice	527	6.8
	Three times	901	11.6
	Four and more	1704	22.0
Perinatal care	By MD	702	9.0
	By Nurses/midwife	2212	28.5
	By HEWs	554	7.1
	No prenatal care	4290	55.3
	Total	7758	100

Utilization of Institutional Delivery:

In this study utilization of institutional delivery was 16%; which implies that 6492(83.7%) mothers who gave last birth of them gave birth at home, while only 1266(16.3%) of them utilize health institutions. (Figure 3)
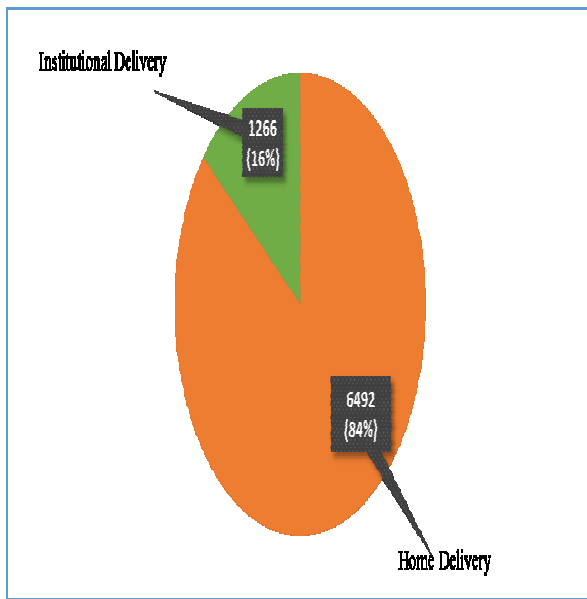
Figure 3: Utilization of institutional delivery of mothers gave last birth, EDHS record 2011. (n=7758)

Based on region, utilization of institutional delivery was higher (83%) in Addis Ababa city administrative followed by Dre Dawa city administrative (43%) and Hareri region (38%). The lowest utilization was seen in Afar (6%), SNNPR (7%), Benshangul-Gumuz (8%) regional states of the country. (Figure 4)
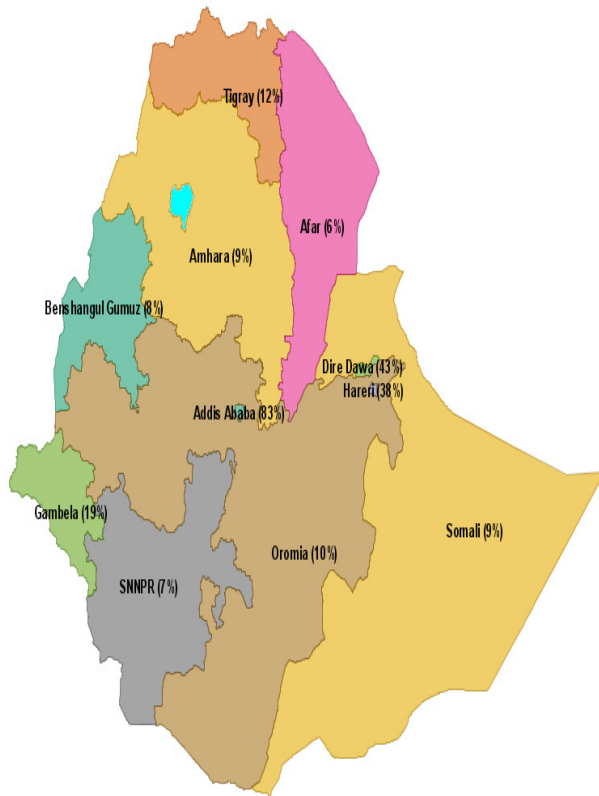

Figure 4: Utilization of institutional delivery of mothers gave last birth, EDHS record 2011. (n=7758)

According to place of residence, utilization of institutional delivery was 12% in urban but only 4% in rural part of the country, as shown on the Figure 5.
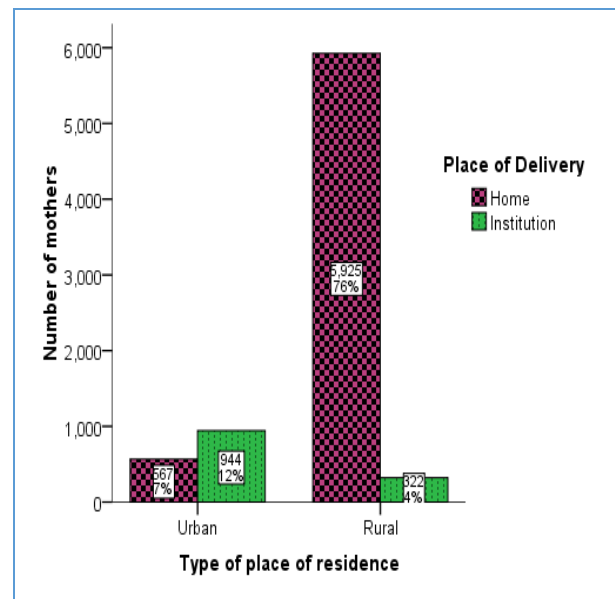

Figure 5: Utilization of institutional delivery by place of residence of mothers gave last birth, EDHS record 2011. (n=7758)

Based on physical accessibility of Health Centers/Hospitals, major portion 1087(14%) of institutional deliveris were utilized by mothers living within 10km radius from the nearest Health Center/Hospital. (Figure 6)

Figure 6: Utilization of institutional delivery by spatial distance from the center of the cluster site to the nearest Health center/Hospital of mothers gave last birth, EDHS record 2011. (n=7758)

Reason of mothers for refusing institutional delivery:

Mother who gave last birth at home (6492) had been inquired for their reason of refusing utilization of health institutions. Based on the finding, they replied that it was due to the fact that majority 3499(54%) believe it was not necessary; 1959(30%) respond that it was not customary; 1257(19%) of them responded that institutions were too far/unavailability of transportation facility and other reason as displayed in the Figure 7.
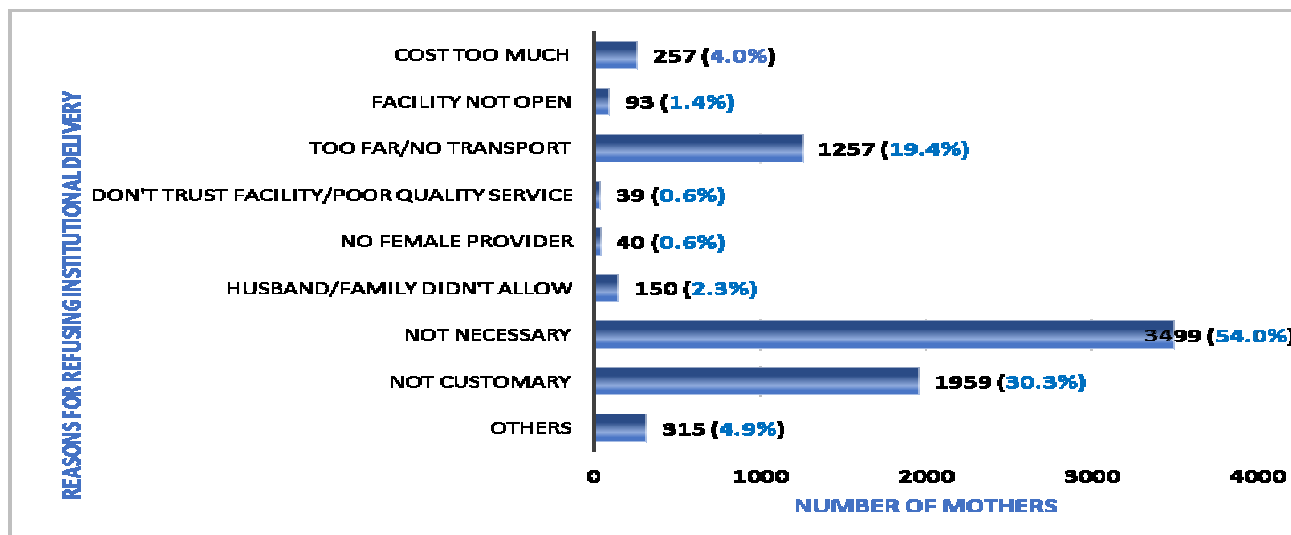
Figure 7: Reasons of mothers refusing institutional delivery of mothers gave last birth, EDHS record 2011(n=6492).

Factors associated with institutional delivery:

Sociodemographic factors:

Bivariate analysis was carried out to examine factors associated with institutional delivery service. The socio demographic characteristics like; age of the mother, place of residence, sex of household head, educational level of the mother, wealth index showed statistically significant association (p-value ≤ 0.05). (Table 3)

In the multivariable logistic regression analysis only, place of residence, sex of household head, educational level, and wealth index of socio demographic factors were found to be significantly associated with the institutional delivery service utilization. Mothers who were urban residents were about 4 times (AOR = 3.6, 95% CI = [2.77 - 4.82]) more

likely to give birth in health facilities than rural mothers. Mothers in female headed household were found to be 1.5 times more likely to deliver in health institutions than mothers in male headed household (AOR = 1.5, 95% CI = [1.17 - 1.81]). Mothers with educational level of higher were about 4 times (AOR = 4.29, 95% CI = [2.39 - 7.72]); secondary level were about 2 times (AOR = 2.92, 95% CI = [1.93 - 4.41]); and primary level of education were about 1.5 times (AOR = 1.51, 95% CI = [1.22 - 1.88]) more likely to give birth in health facilities than those with no education at all. Those mothers with richest wealth index category were about 2 times more likely to give birth in health facilities than those who had poorest wealth index (AOR = 1.64, 95% CI = [1.11 - 2.43]). (Table 3)

Table 3: Socio demographic factors associated with institutional delivery of mothers gave last birth, EDHS record 2011. (n=7758)

Variables		Institutional Delivery		COR(95% CI)	AOR(95% CI)
		No	Yes		
Age	15-19	359(86.3%)	57(13.7%)	2.28(1.22-4.28)*	.99(.46 - 2.17)
	20-24	1257(78.8)	339(21.2%)	3.88(2.18-36.89)*	1.08(.53 - 2.18)
	25-29	1845(80.6)	445(19.4%)	3.47(1.95-96.145)*	.88(.44 - 1.78)
	30-34	1275(84.7)	231(15.3%)	2.61(1.46-4.65)*	.71(.34 - 1.44)
	35-39	1060(88.1)	143(11.9%)	1.94(1.08- 3.49)*	.61(.29 - 1.27)
	40-44	509(93.1%)	38(6.9%)	1.07 (.56- 2.06)	.59(.27 - 1.31)
	45-49	187(93.5%)	13(6.5%)	1	1
Place of residence					
	Urban	567(37.5%)	944(62.5%)	30.64(26.29- 35.70)*	3.65(2.77 - 4.82)*
	Rural	5925(94.8)	322(5.2%)	1	1
Sex of household head					
	Male	5297(85.5)	900(14.5%)	1	1
	Female	1195(76.6)	366(23.4%)	1.80(1.57 - 2.07)*	1.46(1.17 - 1.81)*
Educational level					
	No education	4820(93.1)	360(6.9%)	1	1
	Primary	1571(75.0)	523(25.0%)	4.5(3.85 - 5.16)*	1.51(1.22 - 1.88)*
	Secondary	76(24.4%)	235(75.6%)	41.4(31.29 - 54.77)*	2.92(1.93 - 4.41)*
	Higher	25(14.5%)	148(85.5%)	79.26(51.19-122.71)*	4.29(2.39 - 7.72)*
Wealth index					
	Poorest	2192(96.3)	85(3.7%)	1	1
	Poorer	1299(95.9)	55(4.1%)	1.09(.77 - 1.54)	1.03(.71 - 1.51)
	Middle	1190(96.0)	49(4.0%)	1.06(.74 - 1.52)	.77(.52 - 1.14)
	Richer	1118(91.0)	111(9.0%)	2.56(1.91 - 3.43)*	1.21(.86 - 1.71)
	Richest	693(41.8%)	966(58.2%)	35.94(28.34 - 45.59)*	1.64(1.11 - 2.43)*

Remark: * (P-value less than 0.05)

IEC and physical accessibility factors:

Similarly factors regarding IEC and physical accessibility of services like; availability of Radio, television, telephone in the household; frequency of reading newspaper or magazine, listening to radio, watching television, spatial distance from the nearby health center/hospital showed statistically significant association (p-value $\leq$ 0.05) in bivariate analysis. (Table 4)

In the multivariable logistic regression analysis IEC and physical accessibility related services like, availability of television in the household, frequency of watching television and distance to the nearby Health Center/Hospital were found to be significantly associated with the institutional delivery service utilization. Respondents who do have television in their household were 1.5 time more likely to give birth in health facilities than those mothers who were not available. (AOR = 1.55, 95% CI = [1.13 - 2.13]). Mothers who watch television at least once a week were 1.5 times more likely to give birth in health facilities than those mothers who did not watch television at all (AOR = 1.58, 95% CI = [1.14 - 2.19]). Those mothers who reside within 10km radius from the nearest Health center/Hospital were 1.5 times more likely to give birth in health facilities than those mothers beyond 10 Km (AOR = 1.49, 95% CI = [1.18 - 1.89]). (Table 4)

Table 4: IEC and Accessibility factors associated with institutional delivery of mothers gave last birth, EDHS record 2011. (n=7758)

Variables		Institutional Delivery		COR(95%CI)	AOR(95%CI)
		No	Yes		
Household has radio					
	No	4167(90.3)	450(9.7%)	1	1
	Yes	2166(73.4)	784(26.6%)	3.35(2.95 - 3.81)*	.99(.79 - 1.24)
	Not a dejure resident	159(83.2%)	32(16.8%)	1.86(1.26 - 2.76)*	.95(.55 - 1.65)
Household has television					
	No	6092(91.5)	569(8.5%)	1	1
	Yes	239(26.4%)	665(73.6%)	29.79(25.11 -35.35)*	1.55(1.13 - 2.13)*
Household has: telephone					
	No	6276(86.2)	1001(13.8%)	1	1
	Yes	56(19.4%)	232(80.6%)	25.98(19.26-35.04)*	1.39(.93 - 2.07)
Frequency of reading newspaper or magazine					
	Not at all	6192(88.1)	835(11.9%)	1	1
	< Once a week	262(45.5%)	314(54.5%)	8.89(7.43 - 10.63)*	1.21(.89 - 1.64)
	≥ Once a week	35(23.3%)	115(76.7%)	24.36(16.57 - 35.81)*	1.65(.95 - 2.88)
Frequency of listening to radio					
	Not at all	3853(90.1)	423(9.9%)	1	1
	< Once a week	1776(81.2)	411(18.8%)	2.11(1.82 - 2.44)*	1.12(.889 - 1.41)
	At least once a week	858(66.5%)	432(33.5%)	4.59(3.94 - 5.35)*	1.06(.80 - 1.41)
Frequency of watching television					
	Not at all	4913(94.0%)	315(6.0%)	1	1
	< Once a week	1219(79.4%)	317(20.6%)	4.06(3.43 - 4.79)*	1.25(.98 - 1.59)
	≥ Once a week	354(35.9%)	633(64.1%)	27.88(23.46 - 33.15)*	1.58(1.14 - 2.19)*
Spatial distance categorical					
	Within 10km radius	3024(73.6%)	1087(26.4%)	6.96(5.90 - 8.22)*	1.49(1.18 - 1.89)*
	Beyond 10km	3468(95.1%)	179(4.9%)	1	1

Remark: * (P-value less than 0.05)

Obstetric factors:

According to bivariate analysis, the obstetric variables that showed statistically significant association (p-value ≤ 0.05) were knowledge of mothers on family planning methods, pattern of family planning use, wanted last child, Parity, number of ANC visit at last pregnancy and perinatal care. (Table 5)

Regarding obstetric characteristics of mothers, the multivariable logistic regression analysis shows that pattern of family planning use, parity, number of ANC visit and perinatal care in last pregnancy were found to be significantly associated with the institutional delivery service utilization. Mothers who were using family planning methods at the moment were about 2 times (AOR = 1.66, 95% CI = [1.31 - 2.09]); and those who were using since last birth were 1.5 times (AOR = 1.48, 95% CI = [1.06 - 2.07]) more likely to give birth in health facilities than those mothers who never used any the methods. Mothers who had ever born only one child were about 3 times (AOR = 3.47, 95% CI = [2.39 - 5.04]); those who ever had two children were about 2 times (AOR = 1.69, 95% CI = [1.23 - 2.35]); more likely to give birth in health facilities than those mothers who ever had four and more children. Mothers who had ANC visit of four or more in the last pregnancy were about 3 times more likely to give birth in health facilities than those mothers who had not ANC visit in the last pregnancy (AOR =2.56, 95% CI = [1.06 - 6.15]). Mothers who provided with prenatal care by medical Doctors were 5 times (AOR =5.48, 95% CI = [4.04 - 7.43]); by Nurses/midwifes were 3 times; (AOR =3.07, 95% CI = [2.45 - 3.84]) by Health Extension Workers were 1.5 times more likely to give birth in health facilities than those mothers who did not provided with perinatal care in the last pregnancy. (Table 5)

Table 5: Obstetric factors associated with institutional delivery of mothers gave last birth, EDHS record 2011. (n=7758)

Variables	Institutional Delivery		COR(95%CI)	AOR(95%CI)
	No	Yes		
Knowledge of any Family planning method				
Knows no method	414(98.6%)	6(1.4%)	1	1
Know traditional method	31(96.9%)	1(3.1%)	2.23(.26 - 19.07)	1.57(.17 - 14.16)
Knows modern method	6047(82.8%)	1259(17.2%)	14.36(6.40 - 32.23)*	1.93(.82 - 4.51)
Pattern of Family planning use				
Currently using	1226(64.8%)	665(35.2%)	7.37(6.36- 8.55)*	1.66(1.31 - 2.09)*
Used since last birth	372(72.0%)	145(28.0%)	5.29(4.24 - 6.62)*	1.477(1.06 - 2.07)*
Used before last birth	586(80.8%)	139(19.2%)	3.22(2.59 - 4.01)*	1.29(.95 - 1.79)
Never used	4308(93.1%)	317(6.9%)	1	1
Wanted last child				
Wanted then	4838(84.0%)	921(16.0%)	1	1
Wanted later	1097(82.2%)	237(17.8%)	1.14(.97 - 1.33)*	1.12 (.81 - 1.54)
Wanted no more	556(83.7%)	108(16.3%)	1.02(.82 - 1.27)*	.84(.59 - 1.22)
Number of Ever born children				
One	956(64.8%)	520(35.2%)	7.24(6.15 - 8.53)*	3.47(2.39 - 5.04)*
Two	1013(75.9%)	322(24.1%)	4.23(3.55 - 5.05)*	1.69(1.23 - 2.35)*
Three	928(85.8%)	154(14.2%)	2.21(1.79 - 2.73)*	1.19(.87 - 1.65)
Four and more	3595(93.0%)	270(7.0%)	1	1
Number of ANC visit				
Not at all	4110(95.8%)	178(4.2%)	1	1
Once	307(90.8%)	31(9.2%)	2.33(1.57 - 3.47)*	1.24(.47 - 3.28)
Twice	471(89.4%)	56(10.6%)	2.75(2.00 - 3.76)*	1.32(.52 - 3.35)
Three times	699(77.6%)	202(22.4%)	6.67(5.37 - 8.29)*	1.83(.75 - 4.49)
Four and more	905(53.1%)	799(46.9%)	20.39(17.07 - 24.35)*	2.56(1.06 - 6.15)*
Perinatal care				
By MD	237(33.8%)	465(66.2%)	47.84(38.42 - 59.58)	5.48(4.04 - 7.43)*
By Nurses/Midwifes	1607(72.6%)	605(27.4%)	9.18(7.668 - 10.991)	3.07(2.45 - 3.84)*
By HEWs	527(95.1%)	27(4.9%)	1.25(.82 - 1.89)	1.56(.98 - 2.48)
No prenatal care	4121(96.1%)	169(3.9%)	1	1

Remark: * (P-value less than 0.05)

DISCUSSION:

One of the objectives of the United Nations Millennium Development Goals (MDGs) was to reduce MMR by an average of 5.5% every year over the period 1990–2015(3). Recent estimates suggested that the average annual rate of reduction in MMR in SSA countries is less than 1%(4). Ethiopia is one of the countries with a higher maternal mortality. Skilled attendance during labor, delivery and early post-partum period could reduce deaths due to obstructed labor, hemorrhage, sepsis and eclampsia (6).

In this study out of a total number of 7758 mothers who gave their last birth; 80.5% of them were from rural areas of the country. Concerning physical accessibility (Spatial distance from the center of the cluster site to the nearby Heath Center/Hospital), about 53% of the respondents were living within 10kms radius (median spatial distance of 9.3km with IQR of 13kms) to the nearest Heath Center/Hospital (Table 1). This study shown that only 16% of mothers who gave their last birth were utilized health institutions during delivery. Hence, the rate of institutional delivery utilization was lower as compared with similar studies done; 40% in Guangxi region (China), 34% in rural Rajasthan (India), 20% in Pakistan, 20% in Bangladesh, 67% in Senegal and 23% in Kenya delivered at the health-care facilities (8-14).

Regarding factors affecting utilization of institutional delivery, socio-demographic characteristics like; Mothers who reside in urban were about 4 times (AOR = 3.6, 95% CI = [2.77 - 4.82]) more likely to give birth in health facilities than rural mothers. This could be due to the fact that accessibility of health institutions and generally better welfare of mothers in urban than rural may lead better utilization of the service. Mothers in female headed household were found to be 1.5 times more likely to deliver in health institutions than mothers in male headed household (AOR = 1.5, 95% CI = [1.17 - 1.81]). This finding is consistent with studies in Pakistan, in rural Tanzania, in rural Zambia, women who lived in male-headed households were less likely to deliver in a health facility than women in female-headed households (11, 17-18). The reason for poor utilization in male headed household can be due to lack of female autonomy. Mothers with educational level of higher were about 4 times (AOR = 4.29, 95% CI = [2.39 - 7.72]); secondary level were about 2 times (AOR = 2.92, 95% CI = [1.93 - 4.41]); and primary level of education were about 1.5 times (AOR = 1.51, 95% CI = [1.22 - 1.88]) more likely to give birth in health facilities than those with no education at all. Similarly; several studies in Guangxi region (China), in Pakistan, in Senegal, in Kenya, in rural Tanzania, in rural Zambia, revealed that those with the education of high school were higher likely to deliver in health institution (8, 11, 13, 14, 17, 18). Those mothers with richest wealth index category were about 2 times more likely to give birth in health facilities than those who had poorest wealth index (AOR = 1.64, 95% CI = [1.11 - 2.43]). Likewise, a study done in Pakistan, in rural India, in Indonesia, in rural Tanzania, in rural Zambia, household poverty was directly related with poor utilization of institutional delivery (11, 15-18).

Concerning IEC and physical accessibility of services like, availability of television in the household, frequency of watching television and distance to the nearby Health

Center/Hospital were found to be significantly associated with the institutional delivery service utilization. Respondents who do have television in their household were 1.5 time more likely to give birth in health facilities than those mothers who were not available. (AOR = 1.55, 95% CI = [1.13 - 2.13]). Mothers who watch television at least once a week were 1.5 times more likely to give birth in health facilities than those mothers who did not watch television at all (AOR = 1.58, 95% CI = [1.14 - 2.19]). It is also in line with the study done in Pakistan; exposure to mass media was also important drivers of institutional delivery (11).Those mothers who reside within 10km radius from the nearest Health center/Hospital were 1.5 times more likely to give birth in health facilities than those mothers beyond 10 Km (AOR = 1.49, 95% CI = [1.18 - 1.89]). Similar studies, in Guangxi region (China), in Pakistan, in Senegal, in Kenya, in Indonesia, and in rural Zambia, also revealed that inaccessible physical distance was a major constraint that prevented community members from accessing institutional delivery (8, 11, 13-14, 16, 18).

Regarding Obstetric factors like; Mothers who were using family planning methods at the moment were about 2 times (AOR = 1.66, 95% CI = [1.31 - 2.09]); and those who were using since last birth were 1.5 times (AOR = 1.48, 95% CI = [1.06 - 2.07]) more likely to give birth in health facilities than those mothers who never used any the methods. A study in Pakistan, mothers who use family planning within a year of delivery have higher likely to deliver in a health facility (11). Mothers who had ever born only one child were about 3 times (AOR = 3.47, 95% CI = [2.39 - 5.04]); those who ever had two children were about 2 times (AOR = 1.69, 95% CI = [1.23 - 2.35]); more likely to give birth in health facilities than those mothers who ever had four and more children. A study in Guangxi region (China); also shown that multipara mothers, were higher likely to deliver in health institution (8). Mothers who had ANC visit of four or more in the last pregnancy were about 3 times more likely to give birth in health facilities than those mothers who had not ANC visit in the last pregnancy (AOR =2.56, 95% CI = [1.06 - 6.15]). Likewise, a study in rural Zambia shown that those with over 5 times in terms of frequency of prenatal checkup were higher likely to deliver in health institution (18). According to a study in Senegal, lack prenatal examination and low service quality were directly related to poor utilization of institutional delivery. In the same study, factors such as; number of prenatal care >3, early prenatal care were positively associated with childbirth at Health institutions (13). Mothers who provided with prenatal care by medical Doctors were 5 times (AOR =5.48, 95% CI = [4.04 - 7.43]); by Nurses/midwifes were 3 times; (AOR =3.07, 95% CI = [2.45 - 3.84]) by Health Extension Workers were 1.5 times more likely to give birth in health facilities than those mothers who did not provided with perinatal care in the last pregnancy. In general the findings indicate that abundant obstetric health care delivery services have direct and indirect influence on better utilization of institutional delivery.

STRENGTHS AND LIMITATIONS OF THE STUDY:

Strengths:
a. Geographic Information system (GIS) data was used in spatial distance analysis.
b. All regional states of the country were represented in the study

Limitations:
a. The data set did not include all possible predictor variables exhaustively.
b. The research was not supported by qualitative data.
c. Spatial distance could not be the exact estimate of the actual distance.

CONCLUSIONS:

a. In general, the findings of this study shown that utilization of institutional delivery among mothers who gave their last birth was quite lower.
b. The main factors associated with utilization of institutional delivery indicates that:
c. Rural residence, male headed household, lower educational level, and poor wealth index were found to be socio demographic factors for poor institutional delivery service utilization.
d. Unavailability and poor utilization of mass media; longer distance (physical inaccessibility) to the nearby Health Center/Hospital were also found to be predictors of lower institutional delivery service utilization.
e. Regarding Obstetric factors like; poor family planning use, low parity, infrequent ANC visit and perinatal care in last pregnancy were found to be directly associated with poor utilization of institutional delivery service.

RECOMMENDATIONS:

Policy makers need to:
a. Improve participation of women in universal education.
b. Empower the stake of decision making of women in reproductive health issues.
c. Expand the accessibility of physical health service delivery in rural areas where majority of citizens live in.
d. Maximize accessibility and utilization of mass media to the public.

Health Care Service Providers need to:
a. Enhance accessibility and quality of obstetric health service delivery to women in all possible health institutions.
b. Encourage mothers who had less experience of institutional delivery with special attention.

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