



Statistical Analysis of Determinants of Institutional Delivery Service among Reproductive Age Women in Ethiopia

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Health care services during pregnancy and during delivery are important for the survival and wellbeing of both the mother and the infant so that increasing institutional deliveries is a basic concern for reducing maternal and neonatal mortality. This article was focused on assessing the trend of institutional delivery service and identifying associated factors using basic statistical tools. The analysis was based on the hypothetical data of 5753 women in reproductive age carefully managed from Ethiopian Mini Demographic and Health Survey (EMDHS) 2019. The trend of institutional delivery revealed a sharp increase from 26% in 2016 to 49.92% in 2019 based on DHS data of the respective years. The study identified variables such as region, place of residence, education level, sex of household head, wealth index, number of living children and antenatal care as highly significant determinants of institutional delivery service in Ethiopia. Institutional delivery service increases with better access to education, living in urban, being in better off wealth category, and following antenatal care visit. The study recommended that there should be well equipped health facilities for pregnant women at each stage.

Keywords: *Institutional delivery; logistic regression; women; determinants; Ethiopia.*

1. INTRODUCTION

Maternal mortality and morbidity is a global public health concern. It has been reported that the rates of deliveries attended by skilled health workers are low in developing countries and this problem is preventable if a skilled attendant is present during childbirth. Globally, due to pregnancy related causes, an estimated 303,000 maternal deaths occurred every year. From the total deaths, 99% were from developing countries and 66% in sub-Saharan Africa alone [1]. According to the Ethiopian Demographic and Health Survey (EDHS) 2016 report, the maternal mortality ratio in Ethiopia was 412/100,000 live births [2]. It has become increasingly clear that maternal mortality in sub-Saharan Africa is highly attributed to home delivery, and most births take place at home. Sub-Saharan Africa and South Asia together contribute over 85% of maternal deaths, and of which only half of deliveries are institutional [3]. Different reasons account for the high maternal mortality ratio in sub-Saharan African countries, including Ethiopia. A lack of decision-making power among women within the family remains a challenge in many countries. Low levels of female education and little availability of medical services during pregnancy prevent women receiving care and accessing the best choices for themselves and their children's health, resulting in critical delays in receiving care and unnecessary maternal complications and deaths [4].

The World Health Organization has reported that the proportion of deliveries attended by skilled health providers rose from 58% in 1990 to 68% in 2008 worldwide while remained 50% in Africa [5]. In this regard, every woman has a human right to the best possible care during pregnancy, delivery and postpartum periods to ensure her survival and that her newborn without the distinction of race, religion and political beliefs, economic and social condition. Despite this fact, approximately eight million women suffer from pregnancy-related and delivery-related complications. Although these deaths can be prevented, over half a million die every year [5]. This variation impacts on the levels and quality of delivery outcomes. Each death or long-term complication represents an individual tragedy for the woman, her parents, her children and society at large.

While there is physical access to institutional delivery services, many women are failing to use them because of demographic and

socioeconomic factors at individual, household, and community levels that shape an individual's ability to seek health care. However, few attempts have been made to show how these factors affect institutional delivery in Ethiopia. This study, therefore, has attempted to fill the gaps in understanding the status of women using healthcare services for delivery by identifying determinants of institutional delivery in Ethiopia and their change over time. By doing so, the findings could inform interventions aimed at improving institutional delivery service utilization in the country.

2. METHODS

2.1 Source of the Data

The data was obtained from Ethiopian Mini Demographic and Health Survey 2019, which was retrieved from the Website of DHS. The EDHS collects information about social, behavioral, and demographic indicators including health status and reproductive health issues from reproductive age women (15-49 years). The data was carefully managed for 5753 women in reproductive age. The logistic regression analysis and other descriptive results for the hypothetical data were carried out by SPSS (version 20).

2.2 Data Analysis

Logistic regression which is a very common statistical tool often used in analyzing health related data is used to find out potential variables influencing institutional delivery among reproductive age women. It was developed in late 1960s and early 1970s and became popular among researches in various fields particularly, among health researches [6]. The mathematical concept of logistic regression is to express the relationship between outcome variable and predictor variables in terms of odds ratio. The relationship does not follow a linear trend and hence not possible to describe through a linear regression. Logistic regression facilitates this situation by logit transformation on the outcome variable Y . The simplest form of logistic regression model can be written as:

$$\text{Logit}(Y) = \ln \frac{\pi}{1-\pi} = \beta_0 + \beta_1 X \quad (1)$$

Here π is the probability of occurring the outcome Y and $\frac{\pi}{1-\pi}$ is the odd of success; the ratio of the probability of occurring the outcome Y and the

probability of not occurring the outcome Y . β_0 and β_1 are called intercept and slope (regression coefficient), respectively. By taking antilog on both sides of equation (1), we can estimate the probability of the occurrence of outcome Y for a given value of predictor X :

$$\pi = P(Y \setminus X = x) = \frac{e^{\beta_0 + \beta_1 x}}{1 + e^{\beta_0 + \beta_1 x}} \quad (2)$$

The predictor variable X can be either continuous or categorical. We can extend the logistic model for more than one predictor as well.

$$\text{Logit}(Y) = \ln \frac{\pi}{1-\pi} = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_p \quad (3)$$

Equation (3) is the general form of logistic regression model for p number of predictors. Regression parameters β s can be estimated by either maximum likelihood method or weighted least square method. The value of regression coefficients $\beta_0, \beta_1, \dots, \beta_p$ indicate the relationship between X 's and logit of Y . For the ease of interpretation, we usually report the odds ratio along with regression coefficient. Odds ratio can be calculated by the following formula:

$$OR = e^\beta \quad (4)$$

Statistical significance of the regression coefficient can generally be tested using Wald's test and overall model significance can be tested by likelihood ratio test or pseudo R^2 test.

2.3 Variables of the Study

2.3.1 Institutional delivery

A dichotomous dependent variable coded as 0 for the woman who gives birth at home and 1 for the woman who gives birth at health institution.

2.3.2 Explanatory variables

Explanatory variables which are assumed to influence institutional delivery among women of reproductive age were selected based on the literature review and theoretical aspects. These variables are age in 5-year group (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49), Region (Tigray, Afar, Amhara, Oromia, Somali, Benishangul Gumuz, SNNPR, Gambela, Harari, Addis Ababa, Dire Dawa), Education status of mother (No education, Primary, Secondary, Higher), Sex of household head (Female, Male),

Age of household head, Wealth index (Poorest, Poorer, Middle, Rich, Richest), Number of living children, Current marital status (Single, Married, Widowed, Divorced) and Attend antenatal care (No, Yes).

3. RESULTS AND DISCUSSION

3.1 Descriptive Results

3.1.1 Delivery care status

The improvement of delivery care has indispensable benefit for both maternal and child health as it decreased mortality and morbidity rates. Accesses such as proper medical attention and hygienic situation during delivery can minimize the risk of complications and infections that may lead to death or serious illness for the mother, baby or both [5]. Based on the country representative data, Ethiopian Mini Demographic and Health Survey 2019 data, this study found that the percentage of institutional delivery progressively increased from 26% in 2016 to 49.92% in 2019. On the other hand, the percentage of home delivery sharply decreased from 73% in 2016 to 50.08% in 2019 (Figure 1). In Ethiopia the trend of delivery service revealed that institutional deliveries have increased from 5% in 2000, 10% in 2011, and 26% in 2016. During the same period, a sharp decline was observed in home deliveries from 95% in 2000 to 73% in 2016 [2].

3.1.2 Percentage of institutional delivery by region

The study attempted to present the institutional delivery status of women by regional differentiation and found that the percentage of institutional deliveries are the lowest in Somali region (18.8%) followed by Afar (23.3%), Oromia (41.4%) and SNNPR (45.2%) while the highest percentage of the institutional deliveries are in Addis Ababa (95.3%). Home delivery was the highest in Afar region (15%) in 2016 EDHS [2]. In 2019 EMDHS, Somali region became region with the highest percentage of home delivery. From the result, it can be observed that all regions show a sharp decline in home deliveries. Home deliveries are believed to have survival risk for both mother and child while institutional deliveries are highly recommended to reduce the risk. Access to quality health facilities and qualified health professionals is a major tool of reducing maternal deaths during pregnancy and

delivery. Home deliveries are still taking place in all regions and this may be due to poor infrastructure such as road, electricity and poor health facilities such as health education

coverage, family planning and maternal health programs particularly in rural and hard-to-reach.

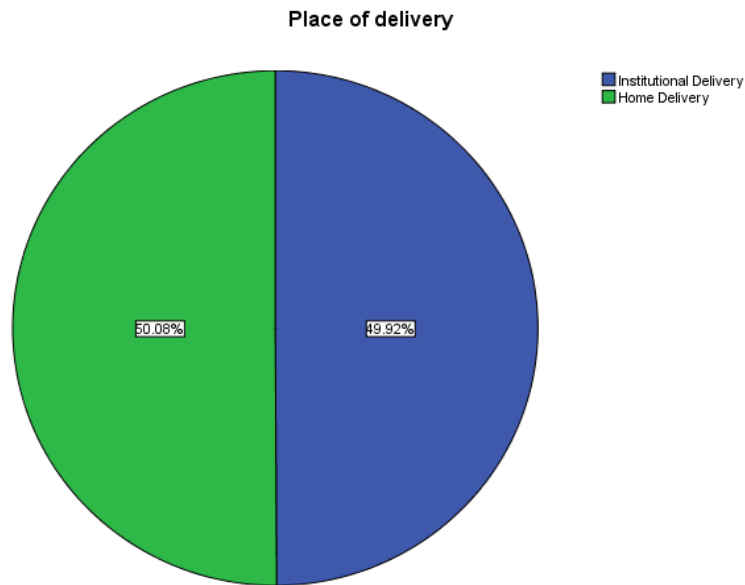


Fig. 1. Percentage of home delivery

Source: Author's computation

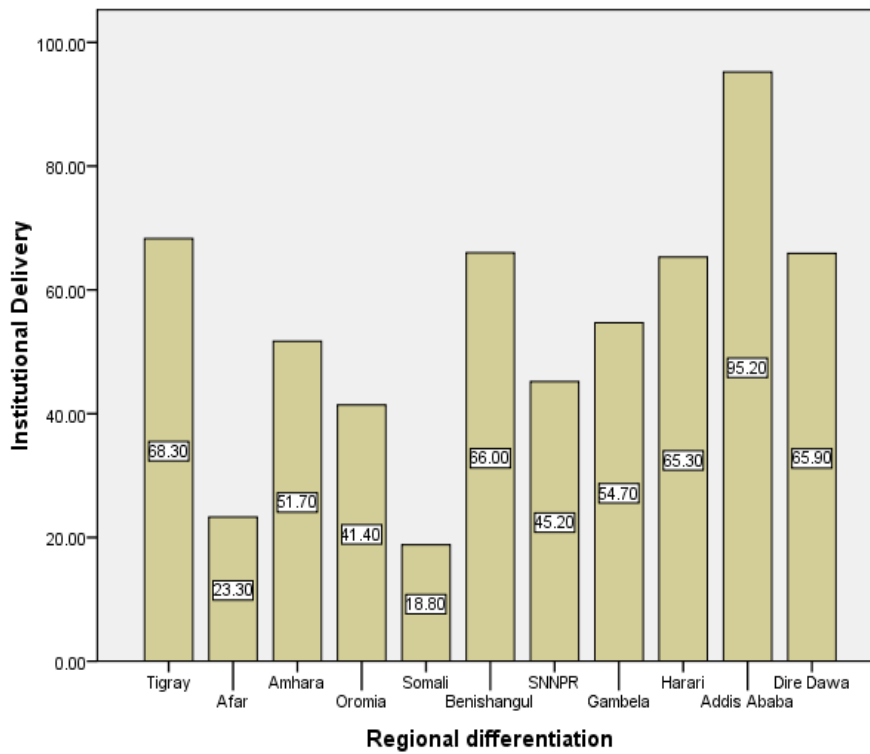


Fig. 2. Percentage of institutional delivery by region

Source: Author's computation

Table 1. Characteristics of women across education, marital status and place of residence

Variables	Category	Institutional Delivery	Home Delivery
Highest Education Level	No education	33.9	66.1
	Primary	61.2	38.8
	Secondary	83.5	16.5
	Higher	96.0	4.0
Age in 5-year group	19-19	49.7	50.3
	20-24	55.3	44.7
	25-29	50.9	49.1
	30-34	48.5	51.5
	35-39	46.7	53.3
	40-44	42.8	57.2
	45-49	38.9	61.1
Place of residence	Urban	83.1	16.9
	Rural	40.0	60.0

Source: Author's computation

3.1.3 Education status

Education background of the surveyed women depicted that 61.2%, 83.5% and 96.0% of the women with primary, secondary and higher education, respectively, gave birth at health institution while only 33.9% of those with no education utilize institutional delivery. This shows that the institutional delivery utilization increases with the level of education. Education remains highly important for the women to improve institutional delivery service which saves the life of both mother and baby. Majority of the women (50.9%) who gave birth at health institution were between 25-29 years old. Urban women were more likely to give birth at health institution (Table 1). This may be due to the reason that health infrastructure is well expanded in urban than rural areas.

3.2 Inferential Results

As clearly indicated in methodology part, a binary logit model is applied to assess potential factors influencing institutional delivery service among reproductive age women in Ethiopia. Before using the model for prediction, goodness-of-fit of the model is tested by Hosmer and Lemeshow test and this handles numerical problems in logistic model. This test shows insignificance ($p = 0.104$) and concludes that the model prediction does not significantly differ from the observed. Also Omnibus test was used to evaluate if the data are well fitted to the model. The finding of the significance of the omnibus test ($P = 0.000$) shows that at least one of the predictors is significantly related to the response variable. Ten variables were entered in logistic model as predictors and seven of them were

found to be significantly related to institutional delivery. These variables were region, place of residence, education status, sex of household head, wealth index, number of living children and attend antenatal care. Odds ratio and coefficients of logistic regression (Table 2) were used to interpret and give possible discussion of the significant variables.

Accordingly, region is an important significant variable influencing institutional delivery by women in reproductive age. The result of odd ratio indicated that, controlling the effect of other variables, women living in Afar, Amhara, Oromia, Somali, SNNPR, Gambela and Harari regions were 0.364, 0.852, 0.611, 0.418, 0.690, 0.676 and 0.652, respectively, times less likely to give birth at health institution than women living in Dire Dawa region. On the other hand, women living in Tigray, Benishangul Gumuz and Addis Ababa regions were 1.517, 2.243 and 1.188, respectively, times more likely to give birth at health institutions than women living in Dire Dawa region.

Place of residence is also a significant variable influencing institutional delivery and the result confirmed that urban women were 2.227 times more likely to give birth at health institutions than their rural counter parts keeping the effect of other variables constant. A contributing factor to this result may come from the fact that urban women have better maternal health and family planning programs than rural women. Similar finding was documented in [7] who argued that urban women have better experience of institutional delivery than rural women.

Education status of the respondents revealed that women with primary, secondary and higher

education were 0.125, 0.231 and 0.414, respectively, times more likely to give birth at health institutions than women with no education keeping the effect of other variables constant. This result is related to increased access to getting the right information by educated women concerning maternal health and increased free access of using health facilities for pregnant mother in many regions of the country. This result is consistent with a study conducted in Tanzania by [8] who concluded that the likelihood of delivering at health facility increases with an increase in education level of women.

Similar result was found in [9] who argued that mothers with secondary and higher education were three times more likely than women with no education to utilize delivery care services.

Another significant variable influencing institutional delivery is sex of household head and the odd ratio of this variable depicted that women with male headed households were 0.672 times more likely to give birth at health institution than women with female headed households while the effect other of variables

Table 2. Coefficients and Odds ratio of Logistic Regression

Variables	Item	β	SE(β)	P	Exp(β)
Age in 5-year groups	Ref. (45-49)			0.106	
	15-19	-0.358	0.302	0.236	0.699
	20-24	-0.189	0.271	0.485	0.828
	25-29	-0.119	0.254	0.640	0.888
	30-34	0.087	0.247	0.726	1.091
	35-39	0.156	0.248	0.529	1.169
	40-44	0.185	0.265	0.485	1.204
Region	Ref. (Dire Dawa)			0.000	
	Tigray	0.417	0.184	0.023	1.517
	Afar	-1.012	0.182	0.000	0.364
	Amhara	-0.161	0.177	0.366	0.852
	Oromia	-0.492	0.168	0.003	0.611
	Somali	-0.872	0.188	0.000	0.418
	Benishangul	0.808	0.176	0.000	2.243
	SNNPR	-0.371	0.170	0.029	0.690
	Gambela	-0.391	0.185	0.034	0.676
	Harari	-0.428	0.188	0.023	0.652
Addis Ababa	0.172	0.328	0.600	1.188	
Place of residence	Ref. (Rural)			0.000	
	Urban	0.801	0.122	0.000	2.227
Education status	Ref. (No education)			0.000	
	Primary	2.082	0.322	0.000	0.125
	Secondary	1.466	0.320	0.000	0.231
	Higher	0.881	0.341	0.010	0.414
Sex of household head	Ref (Female)			0.000	
	Male	0.398	0.102	0.000	0.672
Age of household head	Year	-0.001	0.003	0.600	0.999
Wealth index	Ref. (Richest)			0.000	
	Poorest	-1.810	0.150	0.000	0.164
	Poorer	-1.294	0.153	0.000	0.274
	Middle	-1.241	0.155	0.000	0.289
	Rich	-0.599	0.152	0.000	0.549
Number of living children	Number	-0.084	0.022	0.000	0.919
	Current marital status			0.128	
	Married	-0.051	0.480	0.916	0.950
	Widowed	0.364	0.172	0.135	1.440
	Divorced	0.056	0.349	0.872	1.058
	Attend antenatal care	Yes	1.128	0.069	0.000
Constant		3.922	0.495	0.000	50.491

Source: Author's computation

remain constant. Wealth index highly influenced the institutional delivery and the result of the odd ratio showed that women with poorest, poorer, middle and rich wealth category were 0.164, 0.274, 0.289 and 0.549, respectively, times less likely to give birth at health institutions than richest women keeping the effect of other variables constant.

Number of living children is also another significant variable and the result of odds ratio confirmed that every unit increase in the number of living children is associated with 8.10% decrease in the odd of giving birth at health institutions keeping the effect of other variables constant. The implication of this result can be explained in terms of income share by household members. If this is a claim, women with more number of living children can be limited by income constraint to get better access to health facility than those with less number of living children.

Similarly, women who attend antenatal care were 0.324 times more likely to give birth at health institutions than those women who do not attend antenatal care keeping the effect of other variables constant. Although antenatal care is so important for reducing the risk of death for both mother and child, its practice still needs improvement in Ethiopia. The result obtained is in line with the result by [10] who discussed that women who had antenatal visits were about two times more likely to use institutional delivery than the subjects who did not have antenatal care visits at all in Ethiopia.

4. CONCLUSION AND POLICY IMPLICATION

Institutional delivery service among reproductive age women showed sharp increase from 26 percent in 2016 and 49.92 percent in 2019. The inferential result revealed women living in Tigray, Benishangul Gunuz and Addis Ababa regions were more likely to use institutional delivery service than those women living in Dire Dawa region. Urban women were more likely to give birth at health institution than their rural counterpart. This may be due to the reason that there is better maternal and family planning programs in urban. The likelihood of delivering at health institution increases with the increase in education level. That is, women with primary, secondary and higher education were more likely to give birth at health institution than women with no education at all. Women headed by male

household were more likely to give birth at health institution than women headed by female household. Richest women were more likely to give birth at health institution while having more number of living children decreases the likelihood of using institutional delivery service. Women attending antenatal care were more likely to give birth at health institution than who do not attend antenatal care. As a policy implication, health policy makers should ensure the provision of adequately equipped health care facilities that are readily affordable and accessible for the hard-to-reach. The government should make provision for free medical treatments of pregnant women right from pregnancy stage to postpartum stage particularly for the poor.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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