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ABSTRACT

Introduction: In Ethiopia, despite existent intensive efforts to improve maternal health, the proportion of births delivered at home remains high and is still the top priority among the national health threats. The study aimed to examine effects of individual and community-level factors in women's decision to deliver at home versus in a health facility.

Methods: Data for this study were obtained from the nationally representative 2011 Ethiopia Demographic and Health Survey (EDHS 2011) and focused on a sample from 576 communities of 7,908 women whose most recent births were within five years preceding the survey. The data were analyzed using a two level-mixed-effects logistic regression model to determine the individual and community-level factors associated with place of delivery.

Results: In Ethiopia, 88% of deliveries took place at home. Both individual and community-level factors were associated with women's choice for place of delivery. Lower educational levels of mothers (OR=2.74; 95% CI: 1.84, 4.70) and their husbands (OR=2.31; 95% CI: 1.68, 3.18) were both positively associated with the odds of giving birth at home. The net odds of home delivery among mothers without antenatal care (ANC) visits for their recent pregnancy was 3.7 times higher than among mothers who made the recommended four or more ANC visits (OR=3.72; 95% CI: 2.85, 4.83). Non-exposure to radio or television messages (OR=1.51; 95% CI: 1.13, 2.01), parity of six or more births, (OR=2.68, 95% CI: 1.96, 3.68) and perceived problems reaching health facilities due to distance (OR=1.29, 95% CI: 1.03, 1.62) were positively associated with home birth. With regard to the community-level characteristics, rural communities (OR=4.67, 95% CI: 3.06, 7.11), pastoralist communities (OR=4.53, 95% CI: 2.81, 7.28), communities with higher poverty levels (OR=1.49; 95% CI: 1.08, 2.22), and those with lower ANC utilization (OR=2.01, 95% CI: 1.42, 2.85) and women in areas with perceived problem of distance to health facilities (OR=1.29; 95% CI: 1.03, 1.62) had a positive influence on women to give birth at home.

Conclusion: Not only individual characteristics of the women but also community-level factors determine women's decision to deliver at home. Thus efforts to decrease the proportion of births delivered at home in Ethiopia should focus both on individuals and on communities.

Keywords: Community-level factors, Home delivery, Individual factors, Institutional delivery, multilevel analysis

ACRONYMS

ANC	Antenatal Care
CI	Confidence Interval
CMC	Century Month Code
CSA	Central Statistical Agency
EA	Enumeration Area
EDHS	Ethiopia Demographic and Health Survey
HMIS	Health Management Information System
ICC	Intra Class Correlation
MMR	Maternal Mortality Ratio
OR	Odds Ratio
PCA	Principal Components Analysis
PCV	Proportional Change in Variance
SNNP	Southern Nations, Nationalities and Peoples
SSA	Sub-Saharan Africa
VIF	Variance Inflation Factor
WHO	World Health Organization

1 INTRODUCTION

Globally, the maternal mortality ratio (MMR) has fallen by 45% between 1990 and 2013. There were an estimated 289,000 maternal deaths in 2013, yielding a MMR of 210 maternal deaths per 100,000 live births. Developing countries accounted for 99% of global maternal deaths; sub-Saharan Africa (SSA) alone accounted for 62% of them. The MMR in developing countries was 14 times higher than in developed regions.

Ethiopia is one of the ten countries that comprised 58% of global maternal deaths estimated in 2013 (WHO et al. 2013). Based on data in the 2011 Ethiopia Demographic and Health Survey (EDHS 2011), the MMR was estimated at 676 maternal deaths per 100,000 live births (CSA et al. 2012). This makes it very difficult to achieve the Millennium Development Goal (MDG) of 267 maternal deaths per 100,000 live births by 2015 (FMOH 2010).

Different reasons account for the high MMR in sub-Saharan countries, including Ethiopia. A lack of decision-making power among women within the family remains a challenge in many countries (Friberg et al. 2010; Kinney et al. 2010). Moreover, low levels of female education and little availability of medical services during pregnancy prevent women from 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 (Carroli et al. 2001; Kinney et al. 2010; Koblinsky et al. 2010). These factors could also influence women's decision to give birth at home rather than in a health facility.

Studies in some countries have reported that home deliveries range from 22% in Senegal to 65% in Tanzania, and to 88% in Bangladesh (Rockers et al. 2009; Faye et al. 2011; Wahed et al. 2010). The EDHS 2011 shows that home delivery comprises 90% of all deliveries in the country, regardless of expansion of strategies to increase service utilization and to improve maternal and child health (Gurmesa and Abebe 2008). Small studies in different regions of the country also support this figure. Similar to studies conducted Bangladesh and Nigeria, small studies in Ethiopia show that the most frequent reasons for high rates of home delivery are distance to health facility, problems in transportation, lack of decision-making power among women, low levels of antenatal care (ANC), and poor educational attainment (Yalem and Miguel 2010; Paul and Rumsey 2002; Idris et al. 2006; Fikre and Demissie 2012; Mekonnen et al. 2012). To overcome the variability of these findings, however, providing representative evidence using

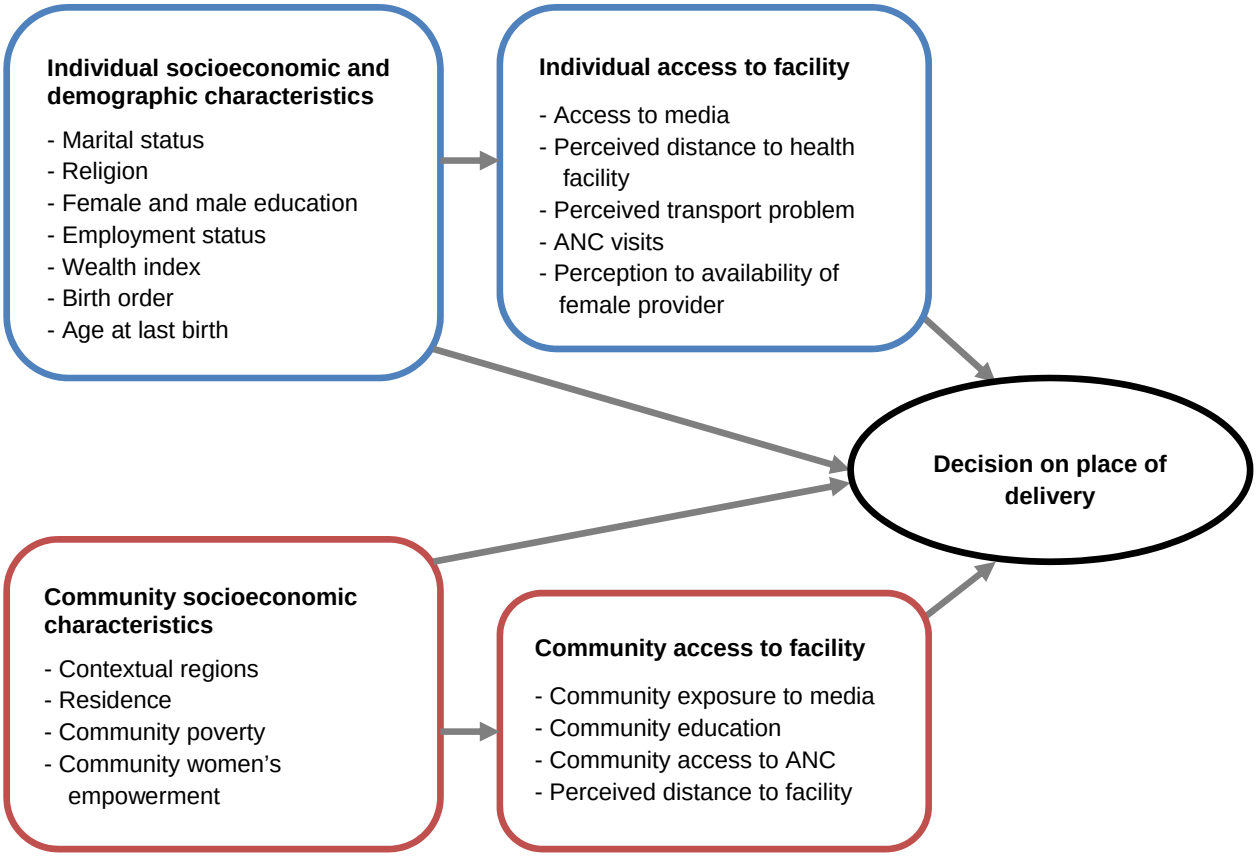
robust methods is required to identify the effects of individual and community-level factors on home delivery in Ethiopia.

In addition to examining individual women's characteristics, it is important to consider community-level factors in the analysis of women's decision concerning place of delivery. The composition and characteristics of communities may determine whether individual women living within the community utilize institutional delivery or not. Few studies have attempted to identify the socioeconomic and demographic factors but instead have focused only on effects of individual characteristics on women's decision concerning place of delivery (Yalem and Miguel 2010; Kyomuhendo 2003; Fikre and Demissie 2012; Mekonnen et al. 2012; Mrisho et al. 2007); none of the studies has looked at the effects of community factors.

Therefore, this study aims to examine the fixed effects of individual and community-level factors and the random effect of between-cluster variability on women's decision to deliver at home, using multilevel modeling based on the EDHS 2011 data. The findings of this study would present better evidence for policymakers and stakeholders, which in turn may help in designing and implementing appropriate interventions at different levels to decrease the prevalence of home delivery and to improve the health system in general.

For this study we used a conceptual framework (Figure 1) to detect the effects of individual and community-level factors on place of delivery among women in Ethiopia. The EDHS did not capture all factors such as myths and beliefs, culture, and tradition that are deeply rooted in the community, and these may be associated with place of delivery. The study customized the conceptual framework to the existing data on individual and community-level characteristics and access to health facilities in the EDHS that may be associated with women's decision on place of delivery.

Figure 1. The conceptual framework for women's decision on place of delivery in Ethiopia



2 OBJECTIVES

The study aimed to:

- Determine individual and community-level factors associated with home delivery in Ethiopia
- Estimate the contribution of community-level factors in explaining between-cluster variation in home delivery

3 METHODS AND DATA

3.1 Data Source

We used data from the EDHS 2011, particularly data on individual women. The individual-level data included information on socioeconomic and demographic characteristics, maternal age at last birth, and perception of access to health facilities among women age 15-49 whose last birth was within five years preceding the survey. The recode data were accessed at www.measuredhs.com on request with the help of ICF International.

3.2 EDHS Sample Design and Population

The EDHS 2011 used a two-stage cluster sampling design with rural-urban and regions as strata. A sample of 624 clusters was drawn by the Ethiopian Central Statistical Agency from its master sampling frame of the 2007 census. Each cluster contained 150-200 households. Households were systematically sampled using random selection. All women of reproductive age who were either usual members of the selected households or who slept in the household the night before the survey were eligible for interview. The EDHS is representative nationally, regionally, and by urban-rural residence. The survey was conducted from December 27, 2010 to June 3, 2011 in all the nine regions and two City Administrative Councils of Ethiopia.

3.3 Sample Size

The EDHS sample design considers different parameters for the indicators to estimate the final sample size. Accordingly, 16,515 women were interviewed from 17,817 households presumed to represent the Ethiopian population with respect to the selected indicators. But this study focused only on 7,908 women (weighted) from 576 clusters (weighted) who had live a birth within the five years preceding 2011. For mothers with more than one birth, we used the most recent birth for the study.

3.4 Study Variables

<u>Dependent factor</u>

Place of delivery: The responses for place of delivery collected in the EDHS 2011 included: home, different governmental health facilities, different types of private health

facilities, and others. These places of delivery were grouped into two categories: health institution, and home. The prediction of the place of delivery over the individual and community-level factors was run with respect to home delivery.

Independent factors

From the EDHS data, we considered the following individual and community-level factors hypothesized to influence women's decision on place of delivery.

Women's individual factors

Marital status: We encoded the marital status of women in two categories: living with partner; not living with partner. The former included women formally married and women living with a partner as married, while the latter contained never-married women as well as those widowed, divorced, or separated.

Religion: The dominant religions (Protestant, Orthodox, and Muslim) were encoded separately, but the minorities such as Catholic and traditional religions were merged into one category and labeled as 'others'.

Women's and partners' educational level: For both these variables, the original category in the EDHS was adopted with no change as: no education; primary education; secondary education; higher. However, for the prediction model, we combined the categories secondary and higher education, since their proportions were small and with the assumption that mothers who attained secondary school and mothers with higher levels of education may not differ significantly in the decision as to place of delivery.

Women's and partner's employment status in the last 12 months: The EDHS collected data on women and partner's employment as 'no job' or as a list of different jobs. The sorts of jobs collected for both women and husbands ranged from unskilled manual to professional. In the current study, the responses were coded into 'no job' or 'have job' regardless of the type of job. The 'no job' category does not mean that women do not perform any activities; rather, women are limited to household activities.

Household wealth quintile: The wealth index classifications were in quintiles: poorest; poor; middle; rich; richest. These were computed using principal component analyses (PCA).

This variable was derived from the different assets of the households in order to assess the household's cumulative living standard.

Maternal age at last birth: Maternal age at birth was recalculated from the date of the last birth and date of birth of the mothers, using the century month code (CMC). The data were coded into three groups: underage 20; age 20-34; age 35-49.

Perceived distance to health facility: The responses for this variable were neither quantitative nor specific to services for delivery. The survey question asked women if distance was a problem for them to get any medical help from health institutions, not limited to delivery care. The responses were coded as: 'yes, big problem': or, 'not big problem'. We used the same codes for the current study.

Perceived transport access: Likewise, this attribute measured whether or not women perceived that they had problems taking transport whenever they needed to reach health facilities for any medical help.

Women's preference of female health provider: Similar to the distance and transport variables, this variable was coded as: 'yes, big problem'; or, 'not big problem'. This variable assesses whether women would prefer a female health professional for medical services.

Number of ANC visits during pregnancy: This variable aimed to assess how many ANC visits women had in their recent pregnancy, regardless of type of provider. It was coded as: none; 1-3; 4 and more.

ANC by skilled health provider: This variable measured ANC visits provided by health professionals- doctor, midwife, and nurse. Though mothers might have made ANC visits, these visits were not counted if the women received ANC services from non-professionals. The responses were: 'yes'; 'no'.

Birth order of the last birth: This variable indicated the order of the last birth. Indirectly, it pointed out the parity of the mothers.

Exposure to media: This variable concerned frequency of listening to radio and watching television. We categorized it into three parts: no exposure to either media channel; exposure to either one of the two channels; exposure to both. The study excluded exposure to magazines and

newspapers, as the proportion of uneducated women in Ethiopia is high and thus there is little exposure to print media.

Women's empowerment: We focused on four attributes from the EDHS data to describe women as empowered, partially empowered, or not empowered. These were: (i) person who usually decides on respondent's health care; (ii) person who usually decides on large household purchases; (iii) person who usually decides on visits to family or relatives; and (iv) person who usually decides what to do with money husband earns. The categories of the women's empowerment variable were based on the number of these decisions, in which women participate, as: involved in four of the decisions; involved in three of the decisions; involved in two of the decisions; not involved in any of the decisions. In the current study, a woman was considered to be empowered if the decision on any of the above items was made by the woman alone or together with her partner.

Community-level factors

Contextual region: The interest of the current study was not in the regions delineated for administrative purpose, which might not necessarily be related to the health status of the population. In the current study the regions were categorized into agrarian, pastoralist, and city, based on their settings that may have a strong relationship with health-seeking behavior, particularly institutional delivery. The regions of Tigray, Amhara, Oromiya, SNNP, Gambella, and Benshangul Gumuz were recorded as agrarian. The Somali and Afar regions were combined to form the pastoralist region and the city administrations- Addis Ababa, Dire Dawa, and Harar- were combined as city. Though Gambela and Benshangul Gumuz have been considered as pastoralists since recent times, their living settings actually approached the agrarian.

Place of residence: This variable in the EDHS can explain characteristics of the clusters directly. The two categories were: urban; rural.

Community aggregates

The EDHS did not capture data that can directly describe the characteristics of the clusters. Yet, we created community variables by aggregating the individual mothers' characteristics within their clusters. The aggregates were computed using the mean values of the proportions of women in each category of a given variable. Since the aggregate values may not

have pragmatic meaning, we categorized the aggregate values of a cluster into groups based on national median values, since all aggregates were not normally distributed. We used the same procedure for all of the following community factors.

Community education: This is the aggregate value of the educational levels of women based on the average of proportions of educational levels in the community. The aggregate could show the overall female educational attainment of the clusters. There were two values for this variable, with reference to the national median value: higher educational attainment; lower educational attainment.

Community poverty: This variable was created from mean values of wealth index categories of the individual mothers. The two values for the community poverty level were: higher poverty; lower poverty.

Community media exposure: With a similar approach, this variable was derived from the individual responses for exposure to radio or television. We defined the community media exposure variables as: higher exposure to media; lower exposure to media.

Community ANC utilization: The attribute was derived from the individual values for ANC utilization. The aggregate values were grouped into two categories: higher ANC utilizing; lower ANC utilizing.

Community women's empowerment: The aggregate values of the variable of women's empowerment were computed based on national median values of the aggregates and were coded as: higher empowerment; lower empowerment.

Community distance to health facility: This variable was created from the individual women's characteristics and was customized to a community variable as: 'distance a big problem'; 'distance not a big problem'.

3.5 Data Analyses

<u>Description of individual and community factors</u>

The data were analyzed using STATA 11 (STATA Corporation, College Station, TX, USA). The different characteristics of the women and the communities were described using descriptive statistics. The EDHS samples were not self-weighted due to the need for data for

specific regions or areas of the country that often need to be over-sampled. Thus, we applied sample weights to the data when we computed the univariate analyses.

The sampling procedure for DHS data was a stratified two stage-cluster sampling; that is, the selection procedure deviated from the assumption of randomness. To account for the underestimation of the standard errors of the final estimates, we analyzed the crude associations of individual and community factors with place of delivery by considering sample design of the EDHS using cluster and strata as primary and secondary sampling units respectively.

Cross tabulations

To examine the crude association between the individual and community-level factors separately with the place of delivery, Pearson's chi-squared test was used. A P-value less than 0.05 was set for statistical significance of an association.

Multilevel regression analysis

Since DHS data are hierarchical, i.e. mothers are nested within households, and households are nested within clusters, use of flat models could underestimate standard errors of the effect sizes, which consequently affect decision on null hypothesis. With such data, mothers within a cluster may be more similar to each other than mothers in the rest of the country. This violates the assumption of flat models—independence of observations and equal variance across the clusters. This implies a need to consider the between-cluster variability. All these issues motivated us to use the multilevel modeling, which was able to compute mixed effects—that is, a fixed effect for both the individual and community factors and a random effect for the between-cluster variation simultaneously. As the responses to women's decision about place of delivery were dichotomous, we opted to run a two-level mixed-effects logistic regression model. The two levels were at individual and cluster levels. In fact, it would be possible to use the flat logistic model by considering the effect of sample design using survey commands or also the cluster robust standard error methods, but it is not possible to see the variation between clusters using the latter methods.

We ran four models to estimate both fixed effects of the individual and community-level factors and random intercept of between-cluster variation.

Empty model: This model was run without any factors, to test the random effect of between-cluster variability. Derived from the between-cluster and within-cluster variability, intra-class correlation coefficient (ICC) was estimated to determine if the data justified using a multilevel approach for analyses by depicting the magnitude of between-cluster variability.

Individual-level factors model: The second model examined effects of individual characteristics on women's decision on place of delivery. Besides, the ICC was estimated and observed if there was a decline in the between-cluster variability upon adding individual factors to the empty model.

Community-level factors model: This model contained only characteristics of clusters, not individuals. The unit of analysis for this model was the cluster.

Combined model: The important characteristics of individual women and clusters were concurrently fitted to one model to reveal their net fixed and random effects.

The data were fitted into the model:

$$Log\left[\frac{\pi_{ij}}{(1-\pi_{ij})}\right] = \beta_0 + \beta_1 X_{1ij} + ... + \beta_n X_{nij} + uo_j + e_{ij}$$

Where

- π_{ij} is probability of the presence of home delivery
- $(1-\pi_{ij})$ is probability of institutional delivery
- β_0 is log odds of the intercept
- $\beta_1, \ldots \beta_n$ are effect sizes of individual and community-level factors
- $X_{1ij} \ldots X_{nij}$ are independent variables of individuals and communities
- The quantities u_{Oj} are random errors at cluster levels

The distribution of u_{0j} is normal with mean 0 and variance σ^2_{u0}. The random effect was explained using ICC, which was calculated using between-cluster variance and within-cluster variance [ICC = $\sigma u^2 / (\sigma u^2 + \pi^2/3)$]. In log distribution, the residual variance of women within a cluster is zero but variance is considered constant at $\pi^2/3$. The ICC was used to show the level of between-cluster correlation within a model and to compare the successive models by looking at

the decline of the ICC value. The Proportional Change in Variance (PCV) was computed for each model with respect to the empty model to show power of the factors in the model to explain women's decision about place of delivery. The PCV was calculated by PCV = $(V_e-V_{mi})/V_e$ where V_e is variance in women's decision in the empty model and V_{mi} is variance in successive models.

We used the Variance Inflator Factor (VIF) to examine instability of effect size of predictors as the result of high collinearity among the factors. The fixed-effect sizes of individual and community-level factors on place of delivery were expressed using the Odds Ratio (OR) and the community effect sizes were estimated using the 95% Confidence Interval (95% CI).

4 RESULTS

4.1 Background Characteristics of Individual Women and Clusters

This study focused on a sample of 7,908 women in Ethiopia for the most recent birth within the five years preceding the EDHS 2011. Table 1 shows the distribution of women in the sample by background characteristics.

A large proportion of the woman (67%) had no formal education. Only 5% had attended secondary school or higher. Nearly half (45%) of the women were unemployed—that is, they were limited to household activities. In contrast, almost all (99%) of their husbands had jobs ranging from unskilled manual labor to professional occupations. Estimated using the DHS wealth index based on household ownership of selected assets, grouped in five quintiles, the proportion of women was nearly equal among the wealth quintiles, from 17% in the richest to 22% in the poorest (Table 1).

When any medical help was sought, distance to reach a health facility was reported as a big problem among 72% of the women; and 78% of them reported that it was a big problem to take transport to reach any health institution for medical service. By media exposure, 41% of the women did not listen to radio or watch television, while the rest listened to radio or watched television, or both, in the course of a week. The DHS included questions to assess women's empowerment in terms of involvement in major household decisions, either alone or with their husband. Ten percent of women were not involved in any of the decisions, while the rest participated in at least one decision. Forty-eight were involved in all four household decisions asked about in the survey, either alone or together with their husbands (Table 1, Figure 2).

In addition to the number of ANC visits, the quality of ANC can also be measured by the qualifications of the service provider. Nearly 42% of the women had attended ANC at least once from any provider, while 34% received ANC from a doctor, nurse, midwife, or health officer.

Table 1. Background characteristics of women who had a live birth in the five years preceding the EDHS 2011, Ethiopia

Individual characteristics	n	%
Marital status		
Not having (living with) partner	722	9.1
Had (living with) partner	7,185	90.9
Religion		
Orthodox	3,327	42.1
Protestant	1,763	22.3
Muslim	2,563	32.4
Others (Catholic, traditional,…)	250	3.2
Educational status of woman		
No education	5,270	66.6
Primary	2,270	28.7
Secondary	225	2.8
Higher	142	1.8
Educational status of partner		
No education	3,923	50.1
Primary	3,183	40.6
Secondary	434	5.5
Higher	297	3.8
Employment status of woman		
No	3,585	45.3
Yes	4,323	54.6
Employment status of partner		
No	103	1.3
Yes	7,733	98.7
Perceived distance to a health facility to get medical help		
Not a big problem	2,142	27.1
Big problem	5,757	72.9
Preference for a female health provider		
Not a big problem	3,462	43.8
Big problem	4,446	56.2
Perceived transport problem for getting medical help		
Not a big problem	1,783	22.5
Big problem	6,125	77.4
Place of delivery		
Health Institution	928	11.7
Home	6,980	88.3

(Continued...)

Table 1. – *Continued*

Individual characteristics	n	%
Age at last birth		
<20 yrs	954	12.0
20-34	5,645	71.4
35-49	1,309	16.5
Number of ANC visits		
None	4,543	57.4
1-3	1,856	23.4
4+	1,508	19.1
ANC by quality		
No ANC/provided by non-professional	5,234	66.2
ANC provided by doctor/nurse/midwife	2,674	33.8
Birth order of the last birth		
1st	1,399	17.7
2nd or 3rd	2,462	31.1
4th or 5th	1,814	22.9
6th+	2,233	28.2
Exposure to mass media		
Did not listen to/watch radio/ TV	3,217	40.7
Either listened to radio or watched TV	2,599	32.9
Listened to/watched both radio and TV	2,091	26.4
Woman's empowerment based on participation in major decisions on household issues[1]		
No involvement	677	9.5
Involved in one decision	723	10.1
Involved in two decisions	904	12.6
Involved in three decisions	1,412	19.7
Involved in four decisions	3,446	48.1
Wealth Index of household		
Poorest	1,739	22.0
Poorer	1,696	21.4
Middle	1,628	20.6
Richer	1,493	18.9
Richest	1,351	17.1
Total	7,908	100.0

4.2 Background Characteristics of Clusters

The unit of analysis for the characteristics of community-level factors was the cluster. For this study, we included 576 clusters in which all the women had lived. In each of the clusters, there were 1 to 26 eligible women for this study. Consistent with higher rural than urban proportion of the population in Ethiopia, 76% of the clusters were in rural areas. In this study, the different regions were categorized into three groups based on their living conditions, regardless of their administrative delineations. As such, 92% of the clusters were agrarian regions, while the rest were either pastoralist regions or cities. The current study attempted to form community-level factors by aggregating values of different individual characteristics. Accordingly, 55% of the clusters had higher poverty status and lower levels of women's empowerment, based on the aggregate values derived from the EDHS data on the wealth index and women's household decision-making.

Nearly half of the clusters had lower female educational attainment and lower community media exposure to radio or television. Distance from the community to any health institutions seemed to vary across clusters, and in 55% of them distance to get access to a health institution was a big problem. Similarly, a higher proportion of the clusters (57%) had lower ANC utilization (Table 2).

Table 2. Characteristics of clusters in EDHS 2011, Ethiopia

Community characteristics	Category	%
Contextual regions	Agrarian	91.2
	Pastoralist	3.2
	City dwellers	5.6
Place of residence	Urban	23.5
	Rural	76.5
Perceived distance of a community to a health facility to get medical service[1]	Not a big problem	44.8
	Big problem	55.2
Community poverty status	Higher	54.9
	Lower	45.1
Female educational attainment of communities	Lower	50.6
	Higher	49.4
Community media exposure	Lower	49.2
	Higher	50.8
Community ANC utilization	Lower	57.3
	Higher	42.7
Women's empowerment in communities	Lower	45.6
	Higher	54.4

[1] Big problem: a cluster where at least half of the women say distance is a big problem to reach health facility. Not a big problem: a cluster where less than half of the women say that distance is a big problem to reach health facility.

4.3 Place of Delivery by Individual Women and Community-Level Characteristics

In our study, 88% of mothers delivered at home. Only 12% of the women delivered their most recent birth in a health institution. Independently, each of the individual and community-level factors was tested for presence of association with women's decision as to place of delivery. As Table 3 shows, the education levels of women and their partners were significantly associated with place of delivery ($P<0.001$). Women with no education (or whose partners had no education) were more likely to give birth at home, at 95%. The likelihood of giving birth at health institutions increased with the education level of women or their partners. As such, among

women who attended higher education, 76% delivered in a health institution, as did 60% of the women whose husbands attended higher education (Table 3).

The wealth index was highly associated with place of delivery (P<0.001). The proportion of women who gave birth at home declined as the level of wealth increased, from poorest (98%) to richest (49%). Antenatal care, both by number of visits and quality of care, were found to influence women's decision as to place of delivery (P<0.001). The number of ANC visits was negatively correlated with home delivery. About one-third (34%) of women who made at least the minimum four ANC visits recommended by WHO delivered in a health institution, compared with only 3% who made no ANC visits during pregnancy. Parity was highly significant to women's decision about place of delivery. Multiparous women were more likely to give birth at home than uniparous women, at 96% among birth orders six or higher versus 74% among first births (Table 3).

The problems of distance and inaccessibility of transport forgetting any medical services were associated with higher chances of home delivery, at 94% and 93% of women respectively, compared with women with no problems related to distance and transport. Women's perception of preference for a female health professional was also associated with home delivery. Given that most media broadcast promotions about using health services, it is not surprising that women with no exposure to television and radio were more likely to give birth at home, while better exposure to these media was associated with higher chances of giving birth in a health institution (Table 3). In addition, women's level of involvement in decisions regarding household issues had an influence on their decision as to place of delivery (P<0.001). The proportion of women who gave birth at home increased as their participation in making household decisions decreased; for 97% with no involvement their most recent birth was at home, compared with 85% who were involved in all of the household decisions (Figure 2).

Table 4 shows women's place of delivery by community-level characteristics. The likelihood of giving birth at home or delivering in a health facility differed significantly among the contextual regions (P<0.001). The proportion of clusters with home delivery was higher in rural communities than urban, 95% versus 49%. Similarly, a higher percentage of home births occurred in pastoralist communities (92%), followed by agrarian communities (88%). Pertaining to the poverty status of the clusters, more home births occurred in high-poverty communities

than in communities with low poverty levels, 97% versus 69%. By the same token, clusters with lower levels of female educational attainment had a higher proportion of home deliveries.

The presence of more women in a community with good health-seeking practices appears to influence the health practices of the other women in their community, both positively and negatively. Accordingly, the presence of higher levels of ANC utilization in the clusters had a positive influence on women living in those clusters to have institutional delivery. In communities with lower levels of ANC utilization, a higher proportion of women delivered at home. Similarly, regardless of the exposure of individual women to mass media, merely living in communities where a lower proportion of people watched television or listened to the radio was associated with a higher proportion of home delivery compared with communities with better exposure to television and radio, 97% versus 72% (Table 4).

Figure 2. Percentage of women with a live birth in the five years preceding EDHS 2011 who delivered at home, according to the levels of women's involvement in household decision-making, Ethiopia

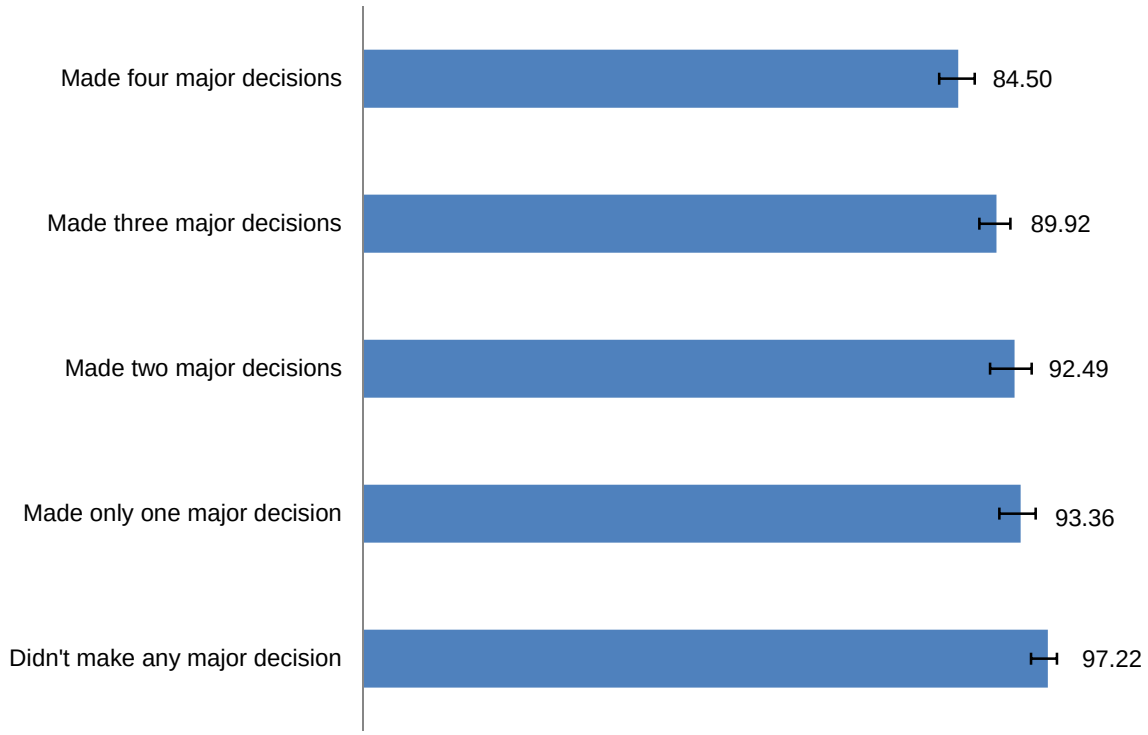


Table 3. Percent distribution of women with a live birth in the five years preceding 2011 EDHS by place of delivery according individual characteristics, Ethiopia

Individual characteristics	Category	Place of delivery: Health facility	Place of delivery: Home	X^2-test
Current marital status	Have (or living with) partner	15.8	84.2	12.3**
	Have no (not living with) partner	11.3	88.7	
Husband's education[1]	No education	4.5	95.5	1,198.3***
	Primary education	11.9	88.1	
	Secondary	40.7	59.3	
	Higher	59.5	40.5	
Woman's education	No education	4.8	95.2	1,613.7***
	Primary education	17.8	82.1	
	Secondary	70.9	29.1	
	Higher	75.5	24.5	
Birth order of the last birth	1st	25.9	74.0	452.9***
	2nd - 3rd	14.3	85.7	
	4th - 5th	6.8	93.2	
	6th+	4.0	96.0	
Number of ANC visits	None	3.2	96.9	1,064.0***
	1-3	14.4	85.6	
	4+	34.4	65.6	
ANC by quality	No ANC/ANC by non-health professional	3.1	96.9	1,102.1***
	ANC by doctor/nurse/midwife	28.7	71.3	
Perceived distance to heath facility[2]	Not a big problem	26.1	73.9	581.4***
	Big problem	6.3	93.7	
Perception of women toward the preference of female health providers	Not a big problem	16.9	83.1	156.3***
	Big problem	7.7	92.3	
Perceived problem of transport for getting medical help	Big problem	7.0	93.0	577.3***
	Not a big problem	28.0	72.0	

(Continued...)

Table 3. – *Continued*

Individual characteristics	Category	Place of delivery		X^2 -test
		Health facility	Home	
Age at last birth	<20 yrs	11.6	88.4	33.1**
	20-34	12.8	87.2	
	>34	7.1	92.9	
Media exposure	No exposure to radio or TV	3.9	96.1	599.3***
	Exposure to radio or TV	10.0	90.0	
	Exposure to both radio and TV	26	74.0	
Household wealth index	Poorest	2.5	97.5	391.2***
	Poorer	3.3	96.7	
	Middle	3.3	96.7	
	Richer	7.4	92.6	
	Richest	49.0	51.0	

* P< 0.05, **P< 0.01, *** P< 0.001

[1] 69 missing values in husband education

[2] 9 missing values in distance to health facility

Table 4. Distribution of place of delivery according to community-level characteristics, five years preceding EDHS 2011, Ethiopia[1]

		Place of delivery		
Community-level characteristics	**Category**	**Health facility**	**Home**	**X^2-test**
Place of residence	Urban	50.6	49.4	169.2***
	Rural	4.9	95.1	
Contextual region	Agrarian	12.1	87.9	103.0***
	Pastoralist	7.6	92.4	
	City dwellers	77.4	22.6	
Community ANC utilization	Lower	2.3	97.7	107.9***
	Higher	33.6	66.4	
Community poverty status	Lower	2.8	97.2	90.4***
	Higher	31.3	68.7	
Community women's empowerment	Lower	2.2	97.8	68.2***
	Higher	26.9	73.1	
Female educational attainment of community	Lower	3.8	96.2	64.3***
	Higher	27.7	72.3	
Community media exposure	Lower	3.4	96.6	65.4***
	Higher	27.5	72.5	
Perceived community distance to a health facility to get medical help	Not a big problem	32.7	67.3	106.4***
	Big problem	1.8	98.2	

[1] The total weighted number of clusters was 576

4.4 Multilevel Analysis of Predictors of Women's Decision to Place of Delivery

Table 5 presents the results of multilevel analyses examining the effect of women's individual characteristics and community-level factors in women's decision concerning delivery. Model 1, the empty model, includes only random intercept to capture between-cluster variability. In this model, 75% of the total variance in the odds of giving birth at home was accounted for by between-cluster variation (ICC=0. 75, σ^2_{u0}=10. 17, P<0.001). Similarly, the ICC was computed in each successive model to understand the relative effects of individual-level and community-level factors on women's decision on place of delivery. The between-cluster variability declined over successive models, from 75% in the empty model, to 25% in the individual-level only model, 21% in the community-level only model, and 17% in the combined model (Table 5). Proportional change in variance indicated that addition of predictors to the empty model better explained women's decision as to place of delivery. Similar to ICC, the combined model showed up with higher PCV; that is, 93% of variance in women's decision about place of delivery could be explained by the combined factors at the individual and community levels. Accordingly, the combined model of individual-level and community-level factors was selected for predicting women's decision about place of delivery.

<u>Effect of individual characteristics on place of delivery</u>

Both the educational level of mothers and of their partners were independently and negatively associated with the odds of home delivery. The odds of giving birth at home were 2.7 times (OR=2.74; 95% CI: 1.84, 4.70) and 2 times (OR=2.05; 95% CI: 1.44, 2.94) higher among women with no education compared with those who attended secondary (or higher) school and attended primary school, respectively, after adjusting for individual and community-level factors. Similarly, women partnered with uneducated husbands had 2 times higher odds of giving birth at home after adjusting for individual and community-level factors (OR=2.31; 95% CI: 1.68, 3.18). The wealth status of the household affected women's decision about place of delivery. In all wealth quintiles (from rich to poorest), the chances of home birth were higher compared with the richest quintile in the individual model; but with the same direction of relationship, only the middle quintile was significant in the combined model (Table 5).

Controlling for the effect of other characteristics, multiparous women had higher odds of home delivery than uniparous women. As birth order rose, women were increasingly likely to

have home delivery. The odds of remaining at home for giving birth among mothers with six or more births, 4-5 births, or 2-3 births were 2.7 times (OR=2.68; 95% CI: 1.96, 3.68), 2.5 times (OR=2.44, 95% CI: 1.81, 3.28), and 2 times (OR=1.95, 95% CI: 1.53, 2.49) higher, respectively, than among uniparous women. Both ANC by quality and ANC by frequency were statistically significant predictors of women's decision concerning place of delivery. The net odds of home birth among mothers with no history of ANC visits for their recent pregnancy were 3.7 times (OR=3.72; 95% CI: 2.85, 4.83) higher than among mothers who had four or more ANC visits. Even mothers who made1-3 ANC visits had higher odds of delivering at home than mothers with the recommended four or more visits (Table 5).

To examine the influence that health promotion in the mass media would have on encouraging institutional delivery, the study analyzed the effect of exposure to television or radio on women's decision on place of delivery. Having no exposure to radio or television was associated with 51% higher odds (OR=1.51; 95% CI: 1.13, 2.01) of giving birth at home compared with mothers who watched television or listened to radio at least once a week. Even limited exposure to either radio or television had a positive effect on institutional delivery compared with non-exposure. Also, the perceived problem of distance to get any medical service deterred mothers from delivering in a health facility (Table 5).

Age at first birth, women's perception toward preference for women health providers, and the problem of transport to reach medical care was not statistically significant in the combined model. As shown, a few other variables were also excluded from the combined model as they impaired the prediction power of the model (Table 5).

Effect of community-level factors on place of delivery

The study aimed to show if the characteristics of the clusters in which women lived would have an effect on their decision about place of delivery, regardless of women's individual characteristics. These results are net effects after controlling for the contribution of all the individual and community-level attributes. Related to place of residence, women in rural clusters had higher odds of giving birth at home compared with women in urban clusters (OR=4.67, 95% CI: 3.06, 7.11). Residence in a pastoralist community had a strong positive net effect on home delivery, which exceeded by four-and-a-half times (OR=4.53, 95% CI: 2.81, 7.28) the level among city dwellers. Similarly, women living in agrarian communities had greater odds

(OR=3.22, 95% CI: 2.30, 4.49) of giving birth at home compared with women in city communities (Table 5).

Women in clusters (communities) where distance to a health facility was a big obstacle to seeking medical services had greater odds of delivering at home compared with women in clusters where distance was not a major obstacle (OR=1.29; 95% CI: 1.03, 1.62) . With regard to the cumulative average poverty status of clusters, women in clusters with higher relative poverty levels had greater likelihood of giving birth at home (OR=1.49; 95% CI: 1.08, 2.22) versus women in clusters with lower poverty levels. In addition, in the model with community-level factors only, home delivery was associated positively with low community-level female educational attainment. This was not statistically significant in the combined model of individual and community-level factors, although the result seems unexpected (Table 5).

Women's decision to deliver at home was positively associated with communities having lower levels of ANC utilization. After controlling for all other characteristics, results indicated that residence in a community with a lower level of women's ANC utilization had 2 times (OR=2.01, 95% CI: 1.42, 2.85) higher odds for home delivery compared with living in a community with a higher level of ANC utilization. Unlike the results in the bivariate analysis, women's empowerment and exposure to media did not have a significant effect in the community-level-only and combined models on women's decision-making about place of delivery.

Table 5. Two-level mixed effects logistic regression analysis of individual and community factors on place of delivery among women with a live birth in five years preceding 2011 EDHS, Ethiopia

Individual and community characteristics	Model empty	Model II OR (95% CI)	Model III OR (95% CI)	Model IV OR (95% CI)
Educational level of woman				
No education		2.90*** [1.90,4.40]		2.74*** [1.84, 4.7]
Primary		2.03*** [1.39,2.97]		2.06*** [1.44, 2.94]
Secondary or higher		1.00		1.00
Educational level of partner				
No education		2.28*** [1.61, 3.22]		2.31*** [1.68, 3.18]
Primary		1.79*** [1.33, 2.41]		1.86*** [1.42, 2.44]
Secondary or higher		1.00		1.00
Wealth index quintile				
Poorest		8.92*** [6.01, 13.25]		1.15 [0.72, 1.83]
Poorer		9.38*** [6.17, 14.26]		1.31 [0.82, 2.10]
Middle		9.71*** [6.44, 14.65]		1.73* [1.09, 2.75]
Rich		5.65*** [4.06, 7.89]		1.38 [0.97, 1.98]
Richest		1.00		
Media exposure				
No exposure to TV/radio		1.47* [1.10, 2.00]		1.51** [1.13, 2.01]
Exposure to either TV/ radio		1.37* [1.07, 1.77]		1.27* [1.02, 1.61]
Exposure to both TV and radio		1.00		1.00
Perceived problem of transport to get medical help				
Big problem		1.13 [0.84, 1.53]		0.97 [0.71, 1.25]
Not a big problem		1.00		1.00
Perceived distance to a health facility to get medical help				
Big problem		1.78*** [1.32, 2.38]		1.29* [1.03, 1.62]
Not a big problem		1.00		1.00
Perception toward preference for female health providers				
Not a big problem		1.00		
Big problem		1.01 [0.80, 1.27]		
Birth order of the last birth				
1st		1.00		1.00
2nd and 3rd		1.85*** [1.42, 2.41]		1.95*** [1.53, 2.49]
4th and 5th		2.80*** [2.03, 3.85]		2.44*** [1.81, 3.28]
6th+		3.08*** [2.21, 4.30]		2.68*** [1.96, 3.68]
ANC visits				
None		5.10*** [1.43, 2.41]		3.72*** [2.85, 4.83]
1-3		2.03*** [1.57, 2.61]		1.60*** [1.26, 2.03]
4+		1.00		1.00

(Continued...)

Table 5. – *Continued*

Individual and community characteristics	Model empty	Model II OR (95% CI)	Model III OR (95% CI)	Model IV OR (95% CI)
Woman's empowerment by number of major decisions				
Made no major decisions		1.12 [0.73, 1.70]		
Made one major decision		1.19 [0.81, 1.75]		
Made two major decisions		1.14 [0.81, 1.61]		
Made three major decisions		1.07 [0.82, 1.39]		
Major four major decisions		1.00		
Contextual region				
Agrarian			3.52*** [2.53, 4.88]	3.22*** [2.30, 4.49]
Pastoralist			6.26*** [3.85, 10.20]	4.53*** [2.81, 7.28]
City dwellers			1.00	1.00
Place of residence				
Urban			1.00	1.00
Rural			7.73*** [5.16, 11.58]	4.27*** [2.80, 6.50]
Community distance to heath facility				
Big problem			2.11*** [1.51, 2.95]	1.63** [1.16, 2.29]
Not a big problem			1.00	1.00
Community poverty status				
Higher poverty			1.52* [1.04, 2.20]	1.49* [1.08, 2.22]
Lower poverty			1.00	1.00
Women's educational attainment of community				
Higher			1.00	1.00
Lower			1.94*** [1.34, 2.79]	1.20 [0.83, 1.73]
Community ANC utilization				
Higher			1.00	1.00
Lower			2.82*** [1.98, 3.99]	1.90*** [1.34, 2.60]
Community media exposure				
Higher			1.00	1.00
Lower			0.90 [0.63, 1.30]	0.73 [0.50, 1.05]
Community women's Empowerment				
Higher			1.00	1.00
Lower			1.12 [0.86, 1.54]	1.13 [0.84, 1.51]
Random effects				
ICC	0.75	0.25	0.21	0.17
PCV[1]	N/A	88.7%	91%	93%

** P<0.05; ** P<0.01; *** P<0.001*

[1] PCV was calculated for successive models with reference to null model to look at relative contribution of each model to explain women's decision to place of delivery

5 DISCUSSION

About nine births in every ten in Ethiopia are delivered at home[1]. This high proportion of home delivery reflects different individual and community factors that affect women's decision to deliver at home. At the individual level, lower status of women and partners' education, non-exposure to mass media, making no visits or only a limited number of ANC visits, higher parity, and inaccessibility of health facility in terms of distance are associated with home delivery. At the community level, women living in communities in pastoralist regions, rural areas, communities with higher poverty levels, those with lower ANC utilization, and areas where the distance to a health facility is big problem are more likely to give birth at home.

When contrasted with the national estimates of Tanzania, Zambia, Kenya, and Uganda, and most of SSA, Ethiopia is at the top in terms of the proportion of women delivering at home. This may contribute to the higher MMR in Ethiopia since mothers delivering at home could be exposed to life-threatening risks such as bleeding, pregnancy-induced hypertensive disorders, sepsis, obstructed labor, and others.

Lower educational levels of mothers and their partners were associated with home delivery. This finding is consistent with different studies undertaken in Ethiopia (Abdella et al. 2012; Alemayehu et al. 2012; Awoke et al. 2013; Abebe et al. 2011), as well as in other countries (Jat et al. 2011; Aremu et al. 2012; Lwelamira and Safari 2012; Nair et al. 2012). Though slight, the decrease in proportion of home delivery in Ethiopia from 2005 to 2011 could be explained by the increasing reach of education in the country, through community mobilization and expansion of the schools. Education could influence women's overall empowerment, enhancing their ability to have self-determination, access to information, and financial freedom to support themselves to take transport to quality services and (if applicable) to pay for services, as well as to easily absorb health messages through the media and from health professionals. These could collectively influence mothers' awareness to seek better medical services, including delivering in health facilities.

[1] The place of delivery in this study is 88%, which is slightly below the 90% reported in the EDHS 2011 report. The slight discrepancy is attributable to difference in denominator, as the current study considered place of delivery only for the recent birth unlike the EDHS report, which measured place of delivery for all children born within five years preceding the EDHS 2011.

This study found that non-exposure to television and radio is associated with mothers giving birth at home, while exposure to media is associated with institutional delivery. Even a limited exposure to either radio or television has a positive effect on institutional delivery. This finding is consistent with other studies in Ethiopia, Pakistan, Indonesia, and India (Begum et al. 2012; Asmeret 2013; Mahapatro 2012). The effect could be explained by the fact that most media programs broadcast promotion of institutional delivery repeatedly, which may influence mothers to develop positive behavior toward delivering in a health facility. In Ethiopia, however, low levels of electricity distribution in rural areas, where nearly 85% of the population lives, and low educational levels could combine to reduce exposure to the media, and thus women could fail to get the advantages of health promotions through media.

The more births that women have, the more likely they are to give birth at home. Other studies also support these results (Aremu et al. 2012; Asmeret 2013; Kamal 2013; Nair et al. 2012). This result could be because multiparous women might think that every subsequent birth is safe if they did not have complications in their previous births. Also, women with more births are likely to be older, and the vast majority have no education (CSA and ICF International 2012). As the result, multiparous women are at high risk of having home delivery.

Many factors can deter women from getting medical advice or treatment for themselves when they need to. Information on such factors is particularly important in understanding and addressing the barriers that women may face in seeking care during pregnancy and at the time of delivery. The study found that the problem of perceived distance to reach a health facility was associated with higher odds of home delivery. This seems to agree with the actual situation in Ethiopia. The most decentralized health facilities to the community level are health posts, which serve nearly 5,000 people within their catchment areas and are staffed with health extension workers- community health workers with one year of training. However, these health facilities are not able to render delivery service; rather, they focus only on community mobilization, health promotion, and preventive care, including prenatal care. The next nearest structure that offers delivery service is the health center. But most of the health centers are not accessible within a short distance, especially in the rural areas. With little transport available to travel 10 or 20 kilometers and mountainous topography, women facing labor pain would find institutional delivery to be very challenging and would be likely to stay at home for delivery. In addition, a

low level of ANC utilization and poor birth preparedness would lead women to have home delivery.

Antenatal care is a proximate predictor of women's decision about place of delivery. That is, women who have had no antenatal care in a health facility are more likely to give birth at home. Regardless of who provides the service, making more ANC visits increases institutional delivery. Especially, making the minimum number of ANC visits recommended by WHO makes it more likely for mothers to give birth in a health facility (Abdella et al. 2012; Alemayehu et al. 2012; Aremu et al. 2012; Mulumebet et al. 2011; Asmeret 2013; Lwelamira and Safari 2012; Kabakyenga et al. 2012). As reported in a DHS analysis of six African countries and in India, mothers who seek care for their pregnancy are more likely to seek care for their delivery (Stephenson et al. 2006; Nair et al. 2012). Antenatal care is the most favorable contact point for mothers to get more information about risks and problems they may encounter during delivery. Consistent findings are reported in Tanzania and Rwanda studies (Johnson et al. 2009) in which mothers who are informed about pregnancy complications during their ANC visits are more likely to deliver in a health facility.

We also found that characteristics of clusters in which the women live have an effect on women's decision about place of delivery, independent to their individual characteristics. For instance, living in a different contextual region makes a difference as to place of delivery. The 11 regions of Ethiopia, which are basically delineated for administrative purposes, were categorized into three contextual regions- pastoralist, agrarian and city- defined based on the basis of the living conditions of their population. As such, living in a pastoralist community is associated with higher chances of home birth, followed by an agrarian community. Home delivery is to be expected in a pastoralist community because pastoralist people are very hard to reach and mostly wander to distant areas to look for animal foods, in addition to having poor infrastructure. Generally, while the disparity in home delivery across the regions could be attributable to the differences in access to health services, media and information, geography, and social and cultural attributes, the most important difference is the living conditions of their population. The reliability of this finding is assured by its consistency with previous studies conducted in Ethiopia (Asmeret 2013) and other African countries (Utomo et al. 2011; Palamuleni 2013; Aremu et al. 2012; Kamal 2013).

As expected, unlike urban communities, rural communities are at high risk of having home births, which is similar to findings in other studies (Jat et al. 2011; Alemayehu et al. 2012; Mulumebet et al. 2011; Kabakyenga et al. 2012). The nature of urban and rural areas explains this discrepancy. Urban areas are accessible to health facilities, with a higher proportion of informed and educated people, and better infrastructure. In contrast, rural areas generally have poor infrastructure, hold deeply-rooted negative beliefs and myths regarding institutional delivery, are physically inaccessible, and have fewer health facilities and inadequate health services. Collectively, the better situations of urban communities enhance health-seeking behavior of the population in general, not only for institutional delivery.

Communities where perceived distance to reach a health facility is big problem are associated with a high proportion of women delivering at home. If a health facility is not located close to the cluster, most mothers living in that cluster invariably are unlikely to give birth in a health facility. This finding is supported by the literature, which has reported similarly that distance not only reduces the chance of institutional delivery but also reduces the health-seeking behavior of the community (Gabrysch et al. 2011; Gebrehiwot et al. 2014; Moore et al. 2011; Lwelamira and Safari 2012; Kabakyenga et al. 2012).

Regardless of the wealth status of individual women, poverty status of the cluster in which the women live determines the decisions of women regarding place of delivery. Relatively poor clusters are associated with a higher proportion of home delivery, and this finding is similar to other studies (Aremu et al. 2012). In addition, women's decision to give birth at home is positively associated with clusters that have lower levels of ANC utilization. Not only does ANC utilization by individuals have a positive effect on their going to a health facility for delivery, but also a higher community level of ANC utilization may influence other women in the same community to give birth in a health facility. If a cluster has a high proportion of women who go for ANC, the information they receive during their ANC visits is likely to reach their neighbors and influence other women to seek medical services, including institutional delivery.

Regarding strength of the methodology to handle the hierarchical nature of the data, a two-level mixed effects logistic regression was used to handle both the fixed effects of individual and community factors and random intercept to explain the between-cluster differences simultaneously. Furthermore, it is noted that EDHS often collects individual data; it doesn't

capture data that describe the clusters directly except region and place of residence. As the result, this study endeavored to generate variables that can characterize communities by aggregating individual data into cluster values. This enabled the study to test whether community factors could influence the decision as to place of delivery, in addition to individual factors. With estimation adjustments for representativeness, such as applying weighting and considering sample designs, results produced based on EDHS data are assumed to be representative of the Ethiopian population.

Nevertheless, the study has some limitations. The EDHS didn't collect all data that may direct influence women's decision about place of delivery. In small-scale studies, for example, beliefs and myths, cultural tradition and rituals, unmet community expectations, and shortages of skilled human resources were found to be barriers to institutional delivery (Gebrehiwot et al. 2014). Such variables were not collected in the EDHS. Statistically, the study also indicated that there is an unobserved variability that still is not explained by the available data in EDHS.

6 CONCLUSIONS AND POLICY IMPLICATIONS

The study revealed that both individual and community-level factors determine women's decision about place of delivery. At the individual level, lower levels of women's and partners' education, limited or lack of exposure to mass media, making no ANC visits or only a limited number of them, higher parity, and inaccessibility of health facility in terms of perceived distance are positively associated with home delivery. At the community level, women living in pastoralist communities, rural areas, communities with higher poverty and lower ANC utilization, and communities where distance is big problem to access health facility are more likely to have home delivery.

To reduce the proportion of women delivering at home, the government of Ethiopia should design strategies for improving both the individual and community-level factors. Education is a key strategy for making improvements in all health indicators. In particular regarding place of delivery, the government of Ethiopia should empower women by increasing access to education through community mobilization and affirmative initiatives to send females to schools. Since decisions are mostly dominated by husbands, educating men could also help in encouraging their wives to access a health facility for delivery. Media is imperative to bring health behavior change in general and institutional delivery in particular. Nevertheless, media is not accessible to all populations in Ethiopia, as most Ethiopians live in rural areas where electricity and media are inaccessible. Therefore, the government should strive to expand access to media, particularly radio and television that can reach uneducated women and their partners, to discourage home delivery and promote facility-based delivery and maternal and child health care.

Obviously, urban women have a higher proportion of institutional delivery because the urban population has better accessible to information, services, education, and infrastructure. In fact, only a small percentage of the Ethiopian women have this access, since most people live dispersed in remote rural areas of the country. To the benefit of increasing institutional delivery and other health, social, and political issues, the government should do more on urbanization of rural villages into proximate areas. Most importantly, this would have the advantage of resettling the pastoralist communities in permanent residences that make it easier access to health and other services.

The link between receiving ANC and women's awareness of health is substantiated by evidence. Not only is the proportion of ANC utilization in Ethiopia low, but also the quality of services is questionable, which may discourage mothers from making visits for ANC. The government should intensify efforts to increase ANC through strengthening health extension programs and expanding health facilities, particularly health centers that could also improve quality. The health management information system (HMIS) in Ethiopia also needs to be improved. Currently, the HMIS demands reports about the first ANC visit only. The system does not report successive visits while in fact at least the recommended four visits should be reported as well. This may limit the efforts of health workers to achieve plans set for first visit, as they are accountable only for this visit.

Although the government of Ethiopia has decentralized health facilities to the community within seven kilometers, through expansion of health posts, these institutions are not allowed to provide delivery services since they are staffed only with health extension workers. Thus, mothers need to go to a health center for delivery. However, physical distance to these institutions, the mountainous topography of rural areas, lack of transport, and poor birth preparedness collectively deter mothers from delivering in a health facility. As a remedy, the government ought to upgrade health posts within the community to train and deploy midwives, and equip them with materials for delivery.

The poorer a community is, the more likely for the people living in the community to have poor health-seeking behavior and to make less use of health services. But poverty is difficult to resolve in a short time, as it reflects a cumulative effect of many factors. Although it may take a longer period of time, integrated efforts through inter-sectoral collaborations with health, agricultural, education, political, and social sectors should be in place to decrease community poverty.

REFERENCES

Abdella, A., G. Abebaw, and B. Zelalem. 2012. "Institutional Delivery Service Utilization in Munisa Woreda, South East Ethiopia: A Community Based Cross Sectional Study." *BMC Pregnancy and Childbirth* 12(105).

Abera, M., A. Gebremariam, and T. Belachew. 2011. "Predictors of Safe Delivery Service Utilization in Arsi Zone, South-East Ethiopia." *J Health Science* 21(Suppl 1): 95-106.

Alemayehu, S.T., M.A. Fekadu, and M.W. Solomon. 2012. "Institutional delivery service utilization and Associated Factors among Mothers Who Gave Birth in the Last 12 Months in Sekela District, North West of Ethiopia: A Community Based Cross Sectional Study." *BMC Pregnancy and Childbirth* 12(47).

Aremu, O., S. Lawoko, and K. Dalal. 2012. "The Influence of Individual and Contextual Socioeconomic Status on Obstetric Care Utilization in the Democratic Republic of Congo: A Population Based Study." *International Journal of Preventive Medicine* 3(4): 278-85.

Asmeret, M. 2013. *Levels and Determinants of Use of Institutional Delivery Care Services among Women of Childbearing Age in Ethiopia. Analysis of EDHS 2000 and 2005 Data.* Calverton, Maryland, USA: ICF International.

Awoke, W., J. Muhammed, and G. Abeje. 2013. "Institutional Delivery Service Utilization in Woldia, Ethiopia." *Science Journal of Public Health* 1(1): 18-23.

Begum, H., A.M. Sayem, and N. Nili. 2012. "Differentials in Place of Delivery and Delivery Assistance in Urban Slum Areas, Bangladesh." *Journal of Family and Reproductive Health* 6(2): 49-58.

Carroli, G., J. Villar, G. Piaggio, D. Khan-Neelofur, M. Gulmezoglu, M. Mugford, P. Lumbiganon, U. Farnot, P. Bersgio, and WHO Antenatal Care Trial Research Group. 2001. "WHO Systematic Review of Randomized Controlled Trials of Routine Antenatal Care." *Lancet* 357(9628): 1565-70.

CSA [Ethiopia], and ICF International. 2012. *Ethiopia Demographic and Health Survey 2011*. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ICF International.

Faye, A., N. Mariama, and I. Ba. 2011. "Home Birth in Women Who Have Given Birth at Least Once in a Health Facility: The Contributing Factors in Developing Country." *Acta Obstet Gynecol Scand* 90(11): 1239-43.

Fikre, A.A. and M. Demissie. 2012. "Prevalence of Institutional Delivery and Associated Factors in Dodota Woreda (District), Oromia Regional State, Ethiopia." *Reproductive Health* 9:33.

FMOH. 2010. *Health Sector Development Program IV 2010/11- 2014/15, Ethiopia.* Addis Ababa, Ethiopia: Federal Democratic Republic of Ethiopia, Ministry of Health.

Friberg, I.K., M.V. Kinney, J.E. Lawn, K.J. Kerber, M.O. Odubanjo, A.M. Bergh, N. Walker, E. Weissman, M. Chopra, R.E. Black, Science in Action: Saving the Lives of Africa's Mothers, Newborns, and Children Working Group, H. Axelson, B. Cohen, H. Coovadia, R. Diab, and F. Nkrumah. 2010. "Sub-Saharan Africa's Mothers, Newborns, and Children: How Many Lives Could Be Saved with Targeted Health Interventions?" *PLoS Med* 7(6): e1000295.

Gabrysch, S., S. Cousens, J. Cox, and O.M.R. Campbell. 2011. "The Influence of Distance and Level of Care on Delivery Place in Rural Zambia: A Study of Linked National Data in a Geographic Information System." *PLoS Med* 8(1).

Gebrehiwot, T., M.S. Sebastian, K. Edin, and I. Goicolea. 2014. "Health Workers' Perceptions of Facilitators of and Barriers to Institutional Delivery in Tigray, Northern Ethiopia." *BMC Pregnancy and Childhealth* 14: 137.

Gurmesa, T., and G.M. Abebe. 2008. "Safe Delivery Service Utilization in Metekel Zone, Northwest Ethiopia." *Ethiopia Journal of Health Science* 17(4): 213-222.

Idris, S.H., U.M.D. Gwarzo, and A.U. Shehu. 2006. "Determinants of Place of Delivery among Women in a Semi-Urban Settlement in Zaria, Northern Nigeria." *Ann of Afric Med* 5(2): 68-72.

Jat, T.R., N. Ng, and M. San Sebastian. 2011. "Factors Affecting the Use of Maternal Health Services in Madhya Pradesh State of India: A Multilevel Analysis." *International Journal for Equity in Health* 10(1):59.

Johnson, F.A., S.S. Padmadas, and J.J. Brown. 2009. "On the Spatial Inequalities of Institutional Versus Home Births in Ghana: A Multilevel Analysis." *Journal of Community Health* 34(1): 64-72.

Kabakyenga, J.K., P.O. Ostergren, E. Turyakira, and K.O. Pettersson. 2012. "Influence of Birth Preparedness, Decision-Making on Location of Birth and Assistance by Skilled Birth Attendants among Women in South Western Uganda." *PLoS ONE* 7(4).

Kamal, S. 2013. "Preference for Institutional Delivery and Caesarean Sections in Bangladesh." J Health Popul Nutr 31(1): 96-109.

Kinney, M., K. Kerber, R.E. Black, B. Cohen, F. Nkrumah, H. Coovadia, P.M. Nampala, J.E. Lawn, Science in Action: Saving the Lives of Africa's Mothers, Newborns, and Children Working Group, H. Axelson, A.M. Bergh, M. Chopra, R. Diab, I. Friberg, O. Odubanjo, N. Walker, and E. Weissman. 2010. "Sub-Saharan Africa's Mothers, Newborns, and Children: Where And Why Do They Die?" *PLoS Med* 7(6): e1000294.

Koblinsky, M., F. Tain, A. Gaym, A. Karim, M. Carnell, and S. Tesfaye. 2010. "Responding to the Maternal Health Care Challenge: The Ethiopian Health Extension Program." *Ethiopia J Health Dev* 24(1): 105-9.

Kyomuhendo, G.B. 2003. "Low Use of Rural Maternity Services in Uganda: Impact of Women's Status, Traditional Beliefs and Limited Resources." *Reproductive Health Matters* 11(21): 16-26.

Lwelamira, J., and J. Safari. 2012. "Choice of Place for Childbirth: Prevalence and Determinants of Health Facility Delivery among Women in Bahi District, Central Tanzania." *Asian Journal of Medical Sciences* 4(3): 105-12.

Mahapatro, S.R. 2012. "Utilization of Maternal and Child Health Care Services in India: Does Women's Autonomy Matter?" *The Journal of Family Welfare* 58(1): 22-33.

Mekonnen, M.G., K.N. Yalew, J.Y. Umer, and M. Melese. 2012. "Determinants of Delivery Practices among Afar Pastoralists of Ethiopia." *Pan Afar Med J* 13(Supp 1): 17.

Moore, B.M., B.A. Alex-Hart, and I.O. George. 2011. "Utilization of Health Care Services by Pregnant Mothers during Delivery: A Community Based Study in Nigeria." *Journal of Medicine and Medical Science* 2(5): 864-867.

Mrisho, M., J.A. Schellenberg, A.K. Mushi, B. Obrist, H. Mashinda, M. Tanner, and D. Schellenberg. 2007. "Factors Affecting Home Delivery in Rural Tanzania." Trop Med Int Health 12(7): 862-872.

Nair, M., P. Ariana, and P. Webster. 2012. "What Influences the Decision to Undergo Institutional Delivery by Skilled Birth Attendants? A Cohort Study in Rural Andhra Pradesh, India." *The international journal of rural and remote health research* 12: 2311.

Palamuleni, M. 2013. "Determinants of Non-Institutional Deliveries in Malawi." *Malawi Medical Journal* 23(4): 104-8.

Paul, B., and D. Rumsey. 2002. "Utilization of Health Facilities and Trained Birth Attendants for Childbirth in Rural Bangladesh: An Empirical Study." *Soc Sci Med* 54(12): 1755-65.

Rockers, P.C., M.L. Wilson, G. Mbaruku, and M.E. Kruk. 2009. "Source of Antenatal Care Influences Facility Delivery in Rural Tanzania: A Population-Based Study." *Matern Child Health J* 13(6): 879-85.

Rwanda Biomedical Center/Institute of HIV/AIDS, Disease Prevention and Control Department (RBC/IHDPC), School of Public Health (SPH), UNAIDS, and ICF International. 2012. *Estimating the Size of Populations through a Household Survey*. Calverton, Maryland, USA: RBC/IHDPC, SPF, UNAIDS, and ICF International.

Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise. 2006. "Contextual Influences on the Use of Health Facilities for Childbirth in Africa." *American Journal of Public Health* 96(1): 84-93.

Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF International. 2013. Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and ICF International.

Utomo, B., P.K. Sucahya, and F.R. Utami. 2011. "Priorities and Realities: Addressing the Rich-Poor Gaps in Health Status and Service Access in Indonesia." *International Journal for Equity in Health* 10(47).

Wahed, T., A.C. Moran, and M. Iqbal. 2010. "The Perspectives of Clients and Unqualified Allopathic Practitioners on the Management of Delivery Care in Urban Slums, Dhaka, Bangladesh: A Mixed Method Study." *BMC Pregnancy Childbirth* 10: 50.

World Health Organization, UNICEF, UNFPA, The World Bank, and the United Nations Population Division. 2014. *Trends in Maternal Mortality: 1990 – 2013. Estimates by WHO, UNICEF, UNFPA, The World Bank, and the United Nations Population Division.* Geneva, Switzerland: WHO.

Yalem, T.A., and S. Miguel. 2010. *Determinants of Antenatal Care, Institutional Delivery and Skilled Birth Attendant Utilization in Samre Saharti District, Tigray, Ethiopia.* Umea, Sweden: Umea University.

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