Vol. 18(1), pp. 1-9, January 2019
DOI: 10.5897/AJMHS2018.0008
Article Number: 28A656859983
ISSN: 2384-5589

http://www.academicjournals.org/ AJMHS

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African Journal of Medical and Health Sciences

Utilization of Postnatal Care Services after home delivery in Ethiopia: A Multilevel Logistic Regression Analysis

Yebelay Berelie*, Endalew Tesfa and Tizazu Bayko

Department of Statistics, Debre Markos University, Debre Markos, Ethiopia.

Received 22 October, 2018: Accepted 12 December, 2018

Despite postnatal care services significant role in improving maternal and new-born health, services are underutilized in most developing countries including Ethiopia. Utilization of postnatal care services in many countries is very low. This study aimed to determine the prevalence of postnatal care service utilization and also, identify determinant factors of utilization of postnatal care services and assess the variation in the use of this service among different regions of Ethiopia. This was a cross-sectional study using 2016 Ethiopian Demographic and Health Survey data collected from January 18 to June 27, 2016. A total of 7,174 women (age 15-49) were included in the study. The outcome variable was the utilization of postnatal care services. A multilevel logistic regression model was fitted to select factors affecting utilization of postnatal care services in Ethiopia. A 50:50 mixture chi-square distributions were used to test random effects. Among 4385 women that deliver at home only 208 (4.7%) women received postnatal care within 42 days after their most recent delivery. Women who had at least four ANC visits during their last pregnancy (AOR=1.48, 95% CI: 1.05-2.09) were more likely to use postnatal care services than those who had no antenatal care visits. Women residing in urban were 2.67 times (95% CI: 1.41, 5.05) more likely to utilize postnatal care services within 42 days after delivery compared to their counterparts in the rural area. Low postnatal care utilization of mothers in Ethiopia was noticed. Programs to improve postnatal care services in Ethiopia must be designed with giving attention to women having low antenatal care visits, residing in rural area, having low wealth index and low educational level and also give attention to all geographical regions to allow pregnant women to fully benefit from postnatal care services.

Key words: Postnatal care, multilevel regression analysis, Ethiopia.

INTRODUCTION

Maternal mortality is the death of women related to pregnancy (WHO, 2010a) and it is the leading cause of death among women of reproductive age in most of the developing world. In an estimated maternal mortality ratio 500 per 100,000 live births globally, sub-Saharan African countries have the highest maternal mortality ratio accounting for 56% of the world's total maternal deaths (Ononokpono and Odimegwu, 2014)). The maternal mortality ratio (MMR) in developing regions is 15 times higher than in the developed (Tarekegn et al, 2014). Ethiopia is one of the developing countries with high maternal mortality ratio with 412 maternal deaths per

*Corresponding author. E-mail: yebelay.ma@gmail.com.

100,000 live births (EDHS, 2016). Postnatal care services areamongst the major interventions aimed at reducing maternal and newborn deaths worldwide and it enable health professionals to identify post-delivery problems, including potential complications, and to provide treatments promptly (Titaley et al, 2010; WHO, 2013). The postnatal period just after delivery to 42 days after delivery is critical for the health and survival of both mother and newborn alike (Gu et al, 2018). Despite postnatal care services significant role in improving maternal and new-born health, services are underutilized in most developing countries including Ethiopia (Abebo and Tesfaye, 2018).

Mothers should be encouraged to attend the postnatal examination as failure to do so, could affect future pregnancies (WHO, 2002). Postpartum care for the mother has conventionally focused on routine observation and examination of vaginal blood loss, uterine involution, blood pressure and body temperature. The WHO recommends that women should be given postnatal care (PNC) within the first 24 h, followed by check-ups on the second or third day, and then on the seventh day after giving birth (WHO, 2010b) . Also, women who had never used antenatal care (ANC) and those who had safe delivery were less likely to use PNC and women experiencing health problems were strongly motivated to seek postnatal care (Rutaremwa et a,l 2015). Increasing the percentage of women receiving PNC services is the central goal of the safe motherhood and child survival movements (Tafesse and Abota, 2015; Kesterton et al, 2010). Despite Ethiopia has developed many strategies and programs to improve use of maternal health services, only 17% of mothers had PNC uptake (EDHS 2016). The focus of this study is on women who delivered at home because women who deliver at a health facility are more likely to receive postnatal care, which is initiated by health care providers and thus does not measure women's health seeking behavior. Hence, it is important to identify factors that facilitate or impede postnatal care services utilization. Evidence showed that PNC services utilization is influenced by factors such as number of ANC visits, maternal age, educational level of the women, employment status, place of residence, the number of pregnancies and wealth index (Workineh and Hailu, 2014; Doku et al (2012). However, little is known about regional variation and determinants of PNC service utilizations in Ethiopia. Thus, this study aimed to determine the prevalence of PNC service utilization and also, identify determinant factors of utilization of PNC services and assess the variation in the use of this service among different regions of Ethiopia.

MATERIALS AND METHODS

Study design and setting

This is a community based, cross-sectional study using 2016 Ethiopian Demographic and Health Survey data collected from January 18 to June 27, 2016. The survey was designed to provide estimates for the health and demographic variables of interest on eleven geographical regions. The main focus was a number of specific questions asked of women about their most recent pregnancy and live birth in the five years preceding the survey. The selected 7,174 women (age 15-49) had at least one live birth in the last five years prior to the survey were eligible for the study. The 2016 EDHS data set has hierarchical structure as women are nested within geographical regions. The hierarchy for this study follows individuals as level-1 and regions as level-2.

Variable description

The outcome variable was utilization of institutional delivery care, which was dichotomous. Thus, the binary response of the outcome variables is coded by 0 and 1. Postnatal care (PNC) =1 if the mother received PNC within 42 days after home delivery and 0 otherwise.

The independent variables considered in the study with their categories: ANC visits (No, 1-3, 4 or more), age of the women at birth, residence (rural, urban), women's education levels (not educated, Primary, Secondary, Higher), sex of household (male, female) parity (1, 2-4, 5^{+}), birth type (single birth, multiple birth), wealth index (poor, Middle, rich), religion (Orthodox, Catholics, Protestants, Muslims, others), desire of pregnancy (yes, no) employment status (yes, no).

Multivariable multilevel logistic regression analysis

Multilevel logistic regression model is appropriate for research designs where data for respondents are organized more than one level (that is, nested data) (Snijders and Bosker, 1999). The units of analysis are usually individuals at a lower level nested within aggregate units at a higher level. The multilevel logistic regression extends from single level logistic regression model by including random effects from the model(Snijders and Bosker, 1999). In this study, a two level logistic regression model was used as women were considered as level 1 and region were considered as level 2 to conceive of the unexplained variation within groups and the unexplained variation between groups as random variability. Because not only unexplained variation in utilizing PNC services between women, but also unexplained variation between regions is regarded as random variable. Three models were estimated. In model 1 (empty model) no explanatory variable was included. This model represented the total variance in the use of PNC services between regions. In Model 2, only individual-level factors were included. Model 3 were about the effects of individual-level and region level factors.

The empty logistic regression model

The empty level-2 model for a dichotomous outcomes variable refers to a population of regions and specifies the probability distribution for region-dependent probabilities P_j without taking further explanatory variables into account. It represents the heterogeneity between groups in the overall response. It can be expressed with logit link function as follows:

$$\text{logit}(P_j) = \beta_0 + u_{0j},$$

where β_0 is the average of the outcome variable (intercept) of the transformed probabilities and u_{0j} the random deviation from this average for region *j*.

The random intercept logistic regression model

The logistic random intercept model expresses the log-odds, that is, the logit of P_{ij}, as a sum of a linear function of the explanatory variables and the random part of the model. That is,

$$\text{logit}(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \beta_{0j} + \sum_{k=1}^{K}\beta_k x_{kij}$$

where, $\beta_{0j} = \beta_0 + u_{0j}$.

As a result:

$$\text{logit}(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \beta_0 + \sum_{k=1}^{K}\beta_k x_{kij} + u_{0j},$$

where β_0 is the log-odds that $y = 1$ when $x = 0$ and u = 0, β_k is effect on log-odds of one unit increase in X for individuals in same group (same value of u), $exp(\beta_k)$ is an odds ratio, comparing odds for individuals spaced 1-unit apart on X but in the same region. u_{0j} is the effect of being in region j on the log-odds that $y = 1$ also known as a level 2 residual. $\beta_0 + \sum_{k=1}^{K}\beta_k x_{kij}$ is the fixed part of the model, because the coefficients are fixed. The remaining part, u_{0j}, is called the random part of the model (18).

The random coefficients logistic regression model

In the random intercept logistic regression model the intercept is the only random effect meaning that the groups differ with respect to the average value of the dependent variable. But we have assumed that the effects of the explanatory variables are the same for each region. This model is considered by allowing the difference between explanatory variables across regions. The model, with 10 level-1 predictors and two level-2 predictors (place of residence and wealth index), can be expressed as:

$$\text{logit}(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \beta_{0j} + \sum_{k=1}^{10}\beta_k x_{kij} + \sum_{p=1}^{2} u_{pj}x_{pij},$$

where, $\beta_{0j} = \beta_0 + u_{0j}$,$u_{0j} \sim iid(0, \sigma_0^2)$ and $u_{pj} \sim iid(0, \sigma_p^2)$.

Now the equation is written as:

$$\text{logit}(P_{ij}) = \log\left(\frac{P_{ij}}{1-P_{ij}}\right) = \beta_0 + \sum_{k=1}^{10}\beta_k x_{kij} + u_{0j} + \sum_{p=1}^{2} u_{pj}x_{pij}$$

The first part of the equation, $\beta_0 + \sum_{k=1}^{10}\beta_k x_{kij}$, is called the fixed part of the model and the second part $u_{0j} + \sum_{p=1}^{2} u_{pj}x_{pij}$ is called the random part (18).

Intra-class correlation coefficient (ICC)

The intra-class correlation coefficient (ICC) measures the proportion of variance in the outcome explained by the grouping structure. ICC can be calculated using an intercept-only model (Model 1), which results in the following equation:

$$\text{ICC} = \frac{\sigma_{u0}^2}{\sigma_{u0}^2 + \sigma_e^2}$$

where σ_e^2 is variance of individual (lower) level units. Since the logistic distribution for the level one residual variance implies a variance of $\pi^2/_3 \approx 3.29$.

RESULTS

Descriptive results of predictor variables with postnatal care

Table 1 show that the proportion of PNC service with independent variables and their association at 25% level of significance. Using chi-square statistics, except women's age at birth child size and parity, the rest variables were significantly associated with utilizing postnatal care services. Among 4385 women home deliver, only 208 (4.7%) women received postnatal care within 42 days after their most recent delivery.

Among women who utilized postnatal care services after home delivery, 8.8% of women attend ANC services at least four times and 5.3% women did not attend ANC services at all.

Women (4.4%) of age group 15 to 24, 5% of women age group 25 to 34, and 4.5% of women age group 35 to 49 used postnatal care services. The proportion of utilizing postnatal care was higher in women who lived in urban (12.6%) than the women who lived in rural (4.3%). The proportion of women with no education, primary, secondary and higher education level who received PNC within 42 days after delivery at home were 4.1, 3.3, 11.4 and 61.4%, respectively. Women with female household head (7.0%) use postnatal care than women with male household head (4.1%). The proportion of women who received PNC services was4.2% for the first birth order, 4.4% for birth order two to four, and 5.2% for five and higher birth order.

The proportion of received PNC after home delivery for women who had a singleton birth type was 4.0% and for women who had a multiple birth type were 38.3%. The proportions of received PNC after delivery at home within 42 days for women with poor, middle, and rich wealth index were 3.2%, 7.4 and 7.6%, respectively. Regarding religion, the majority of respondents were Muslim 2287 (52.2%) followed by Orthodox 1047 (23.9%) and lower in Catholic 70 (1.6%). 4064 (92.7%) of women wanted their pregnancy and received PNC after home delivery within 42 days whereas 321 (7.3%) women did not want their pregnancy and did not receive PNC. Finally with regard to employment status, the majority of the respondents

Table 1. Descriptive results of predictor variables with PNC use after home delivery from the 2016 Ethiopian Demographic and Health survey (n=4385).

Variable	Category	Total (%)	PNC use		Chi^2 (P-value)
			No (%)	Yes (%)	
ANC visits	No visits	2271 (51.8)	94.7	5.3	79.414 (0.000)
	1-3	1208 (27.5)	99.3	0.7	
	4+	906 (20.7)	91.2	8.8	
Age at birth	15-24	1082 (24.7)	95.6	4.4	0.718 **(0.698)**
	25-34	2089 (47.6)	95.0	5.0	
	35-49	1214 (27.7)	95.5	4.5	
Place of residence	Rural	4131 (94.2)	95.7	4.3	36.817 **(0.000)**
	Urban	254 (5.8)	87.4	12.6	
Educational level	Not educated	3328 (75.9)	95.9	4.1	329.931 **(0.000)**
	Primary	899 (20.5)	96.7	3.3	
	Secondary	114 (2.6)	88.6	11.4	
	Higher	44 (1.0)	38.6	61.4	
Sex of household	Female	943 (21.5)	93.0	7.0	13.526 **(0.000)**
	Male	3442 (78.5)	95.9	4.1	
Parity	First	566 (12.9)	95.8	4.2	1.464 **(0.481)**
	2-4	1824 (41.6)	95.6	4.4	
	5^+	1995 (45.5)	94.8	5.2	
Birth type	Single	4291 (97.9)	96.0	4.0	239.359 **(0.000)**
	Multiple	94 (2.1)	61.7	38.3	
Wealth index	Poor	2807 (64.0)	96.8	3.2	42.733 **(0.000)**
	Middle	646 (14.7)	92.6	7.4	
	Rich	932 (21.3)	92.4	7.6	
Religion	Orthodox	1047 (23.9)	94.2	5.8	133.332 **(0.000)**
	Catholic	70 (1.6)	67.1	32.9	
	Protestant	888 (20.3)	95.9	4.1	
	Muslim	2287 (52.2)	96.2	3.8	
	Others	93 (2.1)	98.9	1.1	
Pregnancy	Wanted	4064 (92.7)	95.8	4.2	35.268 (0.000)
	Not wanted	321 (7.3)	88.5	11.5	
Employment status	Yes	2659 (60.9)	96.2	3.8	14.436 **(0.000)**
	No	1726 (39.4)	93.7	6.3	

who received PNC services after home delivery 2659 (60.9%) were employed whereas 1726 (39.1%) women were unemployed.

Multivariable multilevel logistic regression analysis

In this study, Multilevel Binary Logistic Regression model was employed to analyze the relationships between the utilization of PNC services and each of the independent variables which are incorporated in the model and to compare the existence of variation with regard to utilization of maternal health care services among and within geographical regions of Ethiopia. There were 11 geographical regions considered as the second-level units and 4,384 women who delivered at home for PNC.

Table 2. Summary results of model selection criteria.

Model selection criteria	Null model	Random intercept Model	Random coefficient model
Deviance-based χ^2	33.70 (0.000)	11.32(0.0004)	21.05 (0.018)
Deviance	1640.407	1279.12	1269.387
AIC	1644.407	1333.12	1323.387

Three multilevel logistic regression models; namely, empty model, random intercept with fixed effects model and random coefficient with random intercept model were used to describe the data at both levels. the overall significance of the three multilevel models of PNC should be assessed before interpreting the coefficients.

Goodness of fit test

The deviance and AIC values were used to select the best fitting model among the three fitted two-level logistic regression models for all outcome variables, respectively. In Table 2, the deviance of the null model is 1640.407 and random intercept with fixed coefficient model is 1279.12. These indicate that the random intercept with fixed coefficient model is better than the null model. And also, the deviance of the random coefficient model 1269.387 shows that the random coefficient model is better than the random intercept with fixed coefficient model. The values of the Akaike Information Criterion (AIC) were also used to make an overall comparison of the three models. The computed AIC value for the random coefficient model, AIC = 1323.387 was less than that of the fixed slope model with random intercept (AIC = 1333.12) and the empty model with random intercept 1644.407. This indicated that the random coefficient model was a better fit as compared to the empty model with random intercept and the random intercept and fixed effect model.

Null model

An empty model (Model 1) with no explanatory variable (intercept-only model) that predicts the probability of women (aged 15-49) who utilized PNC after delivery at home was first fitted (Table 3) services. The simplest non-trivial specification of the hierarchical linear model is a model in which only the intercept varies between level two units and no independent variables are entered in the model. The empty model contains no explanatory variables and it can be considered as a parametric version of assessing heterogeneity among regions with respect to utilization of PNC.

The log-odds of utilizing PNC services given in all regions under investigation $^{(u_{0j}=0)}$ is estimated as -2.81 (odds ratio = 0.06). The intercept for region j is 2.81+u_{0j}, where the variance of u_{0j} is estimated as $\hat{\sigma}^2_{0j}$=0.38.

In addition, the between-region intra class correlation coefficient (ICC) obtained from the empty model with random effect was 0.38/(0.38+3.29) =0.1035 (Table 3). These values are called the intra-class correlation coefficient (ICC) and interpreted as 10.35% of the variation in the utilization of PNC services can be explained by grouping the women aged 15 to 49 with respect to their geographical regions. The remaining value, 89.65%, is the variation in utilization of PNC can be explained within individuals (women) as lower level units.

Testing random effects

Random effect tests examine the hypothesis that whether or not the random intercept or between- regional variance were needed in the model or statistically: Ho: $\sigma^2_{u0} = 0$ Vs. H_1: $\sigma^2_{u0} > 0$.

Because the constrained variance component test lies on the boundary of the parameter space (variance is not expected to go below zero), the likelihood ratio test can break down asymptotically (Verbeke and Molenberghs, 2000). It has been shown that tests for a single variance component can be carried out using mixtures of chi-square distributions. In this study, it was shown that the null distribution of this one sided LRT statistic converges to a 50:50 mixture of chi-square distributions with 0 and 1 degree of freedom given as 0.5χ^2_0+0.5χ^2_1. P-value that LRT > 0.5$Pr(\chi^2_{0:1})$ is LRT>0.5$P\chi^2_0$ + LRT>0.5Pχ^2_1. Therefore, to see whether random effect (regional effect) is needed in utilization of PNC services, the deviance based chi-square (Table 3) is 33.70. In this case the average p-value 33.70 > 0.5χ^2_0+0.5χ^2_1 is less than 0.0001, which means we are confidentially rejecting the null hypothesis $\sigma^2_{u0} = 0$. This indicated that adding the random intercept or between-regional variance in the model was necessary in order to detect the effect of utilization of the PNC services among women.

Table 3. Multivariable multilevel logistic regression results of factors associated with utilization of PNC among women (age 15-49) from the 2016 Ethiopian Demographic and Health survey (n=4385).

Variable	Category	PNC Use after home delivery		
		Model 1	Model 2	Model 3
		Odds Ratio (95% CI)	Odds Ratio (95% CI)	Odds Ratio (95% CI)
ANC visits	0(Ref)	-	-	-
	1-3	-	1.12 (0.61,1.25)	1.12 (0.63,1.26)
	4+	-	1.46 (1.04,2.05)	1.48 (1.05,2.09)
Age at birth	15-24(Ref)	-	-	-
	25-34	-	0.82 (0.52,1.30)	0.82 (0.51,1.30)
	35-49	-	0.48 (0.27,0.87)	0.48 (0.27,0.86)
Place of residence	Rural(Ref)	-	-	-
	Urban	-	2.61 (1.54,4.41)	2.67 (1.41,5.05)
Educational level	Not educated(Ref)	-	-	-
	Primary	-	0.61 (0.39,0.97)	0.62 (0.39,0.99)
	Secondary	-	1.72 (0.81,3.67)	1.75 (0.81,3.80)
	Higher	-	11.29 (4.72,27.05)	10.96 (4.43,27.11)
Sex of household head	Female(Ref)		-	-
	Male	-	0.51 (0.36,0.72)	0.51 (0.36,0.73)
Parity	First(Ref)	-	-	-
	2-4	-	1.12 (0.63,1.98)	1.07 (0.60,1.91)
	5^{+}	-	1.76 (0.92,3.35)	1.75 (0.92,3.34)
Birth type	Single (Ref)	-	-	-
	Multiple	-	5.58 (2.93,10.63)	5.75 (2.96,11.16)
Wealth index	Poor (Ref)	-		
	Middle	-	2.31 (1.47,3.62)	2.29 (1.31,4.00)
	Rich	-	3.0 (2.01,4.47)	2.82 (1.30,6.15)
Religion	Orthodox (Ref)	-		
	Catholic	-	10.13 (4.89,20.95)	10.63 (5.08,22.24)
	Protestant	-	1.0 (0.54,1.86)	1.04 (0.55,1.96)
	Muslim	-	1.29 (0.79,2.12)	1.20 (0.70,2.06)
	Others	-	0.24 (0.02,2.64)	0.23 (0.02,2.66)
Pregnancy	wanted (Ref)	-	-	-
	Not wanted	-	2.90 (1.84,4.58)	2.95 (1.85,4.69)
Employment status	Yes (Ref)	-		
	No	-	1.42 (1.01,1.99)	1.40 (0.98,1.99)
Intercept	-	0.06 (0.04,0.08)	0.03 (0.02,0.07)	0.03 (0.01,0.07)
Estimation of random effect		**Estimate (95% Wald type approximate CI)**	**Estimate (95% Wald type approximate CI)**	**Estimate (95% Wald type approximate CI)**
Between-region variance, $\hat{\sigma}^2_{0j}$		0.38 (0.12,1.25)	0.18 (0.05,0.68)	0.31 (0.07,1.33)
$\hat{\sigma}^2_{1j}$ = variance of residence		-	-	0.27 (0.01,6.95)
$\hat{\sigma}^2_{2j}$ = variance of wealth index		-	-	0.25 (0.06,1.09)
$\hat{\sigma}^2_{\varepsilon}$			3.29	

Multivariable multilevel logistic regression analysis of postnatal care

In Table 3, multilevel logistic regression analysis reveals, ANC visits, place of residence, women's educational level, sex of household head, birth type, wealth index, religion of mothers and desire of pregnancy were significantly associated with postnatal care utilization. Women's utilization of ANC services was highly correlated with postnatal care services. Women who had at least four ANC visits during their last pregnancy (AOR=1.48, 95% CI: 1.05-2.09) were more likely to use postnatal care services than those WHO had no ANC visits. Women residing in urban were 2.67 times (95% CI: 1.41 - 5.05) more likely to utilize postnatal care services within 42 days after delivery as compared to their counterparts in the rural area. Women with secondary (AOR=1.75, 95% CI: 0.81-3.80) and higher (AOR=10.96, 95% CI: 4.43-27.11) education were more likely to use postnatal care services than non-educated women 0.51 (0.36, 0.73). The odds of utilizing postnatal care services for women where the household head is male was reduced by 49% as compared to those where the household head is female.

Women having a multiple gestation were 5.75 times (AOR=5.75, 95% CI: 2.96-11.16) more likely to utilize PNC services within 42 days after home delivery than those having single gestation. Mothers, whose wealth index is in middle-income (AOR=2.29, 95% CI: 1.31-3.40) and rich (AOR=2.82, 95% CI: 1.30-6.15) were more likely to use PNC services compared to those whose wealth index is poor. Women who desire pregnancy were 2.95 times (AOR=2.95, CI: 1.85-4.69) more likely to use PNC services within 42 days after home delivery. However, women's age at birth, parity and women's employment status were insignificant with postnatal care service use.

DISCUSSION

This study attempted to identify the determinant factors of utilization of PNC services in Ethiopia. The study showed that among 4,385 women who deliver at home, only 208 (4.7%) women received postnatal care within 42 days after their most recent delivery. With the help of chi-square test, except women's age at birth and parity, all variables considered under the study were significantly associated with utilization of PNC services at 25% level of significance. Multilevel logistic regression techniques were employed to analyze factors of utilization of PNC and revealed that, number of ANC visits, mother's place of residence, sex of household head, women's educational level, birth type, wealth index, religion of mothers, and desire of pregnancy were significantly associated with postnatal care utilization within 42 days after home delivery (Table 3). This study found that ANC attendance had an effect on postnatal care attendance. Mothers who attended four or more ANC visits were more likely to use postnatal care. This result is supported by other studies (Khanal et al, 2014; Solanke et al, 2017; Phyu et al, (2018). This might be mothers get adequate counseling about benefits of postnatal care services during ANC attendance and also demonstrated some acceptance of the healthcare system (Rahman et al, 2011). Mother's place of residence was significantly associated with the utilization of PNC services. A mother residing in urban had a higher chance of utilization of PNC than rural residents and this is in line with other studies (Khanal et al, 2014; Somefun and Ibisomi, 2016; Bwalya et al, 2017; Tesfahun and Worku, 2014). This might be explained by the fact that urban women are more exposed to media messages related to the benefits of attending PNC and due to health institutions being close to home whereas in rural areas of Ethiopia, women have less access to public services, such as media message, roads, transport and health services (Shrestha et al, 2012).

The finding that mothers with higher education were more likely to attend postnatal care services and this finding is in line with other studies (Solanke et al, 2017; Dimbuene et al, 2017; Babalola and Fatusi, 2009). This might be explained by mothers with higher levels of education are more likely to be informed about health risks, demand and gain access to healthcare and also, brings higher level of awareness and better knowledge of PNC services and enhanced level of autonomy. Sex of household head is also significantly associated with postnatal care services utilization. A woman from a male household head had less chance of utilizing postnatal care services compared to those with a female household head. The utilization of PNC in mothers having a multiple gestations was 5.75 times higher than those having single gestation. The result is in line with other studies (Abebo and Tesfaye, 2018). Women with high wealth index were more likely to utilize postnatal care services. This is supported by other studies (Bwalya et al, 2017; Agho et al 2016; Angore et al 2018; Medicine et al, 2014). This might be money is needed to access healthcare services, to pay for transportation and additional costs. So, only those women who can afford to pay for such costs are able to visit health facilities. A woman who desires the last pregnancy was more likely to utilize PNC services within 42 days after home delivery and this result is in line with studies (Teka et al 2018; Babalola 2014). This might be that a woman who desires the last pregnancy or child gives more care of the survival of both mother and her child so that she received checkups after home delivery.

Conclusions

Low postnatal care utilization of mothers in Ethiopia was noticed. Significant factors of utilization of postnatal care

services were number of ANC visits, place of residence, women's educational level, sex of household head, birth type, wealth index, religion and desire of pregnancy. Mothers should attend postnatal care services during the time of pregnancy to survive and the well-being of both the mother and her child. Programs to improve postnatal care services in Ethiopia must be designed with giving attention to women having low ANC visits, residing in rural area, having low wealth index and low educational level and also give attention to all geographical regions to allow pregnant women to fully benefit from PNC services.

LIMITATIONS

Since EDHS data which is collected retrospectively was used, there may be recall bias given that the events took place 5 years following the survey. For instance, women may forget or may not accurately recall during the interview the number of postnatal care visits attended.

ACKNOWLEDGEMENTS

The authors would like to acknowledge EDHS for allowing access to the 2016 EDHS dataset. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ABBREVIATIONS

ANC, Antenatal care; **AOR,** adjusted odds ratio; **CI,** confidence interval; **EDHS,** Ethiopian demographic and health survey; **PNC,** postnatal care; **ICC,** intra-class correlation coefficient; **MMR,** maternal mortality ratio.

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