Factors Related With the Frequency of Antenatal Care Utilization in Ethiopia: An Application of Count Regression Models

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Abstract

Background: Adequate antenatal care (ANC) is vital because it contributes to the reduction of infant and maternal mortality. The coverage and quality of ANC plays significant role in maternal health. Delivery without adequate antenatal healthcare service is risk for both mother and baby. The purpose of this study was to identify and assess the socio-economic, demographic and health service factors related with the frequency of ANC services utilization in Ethiopia.

Methods: This study used EMDHS 2019 data. A total of 3,927 mothers who gave birth within the five years preceding the 2019 EMDHS were included. Since the number of ANC care visits is a count outcome, this study employed count regression models to identify and explore the factors that are associated with the frequency of ANC services utilization.

Results: From among the entire women who gave a live birth in the five years prior to the survey, about 74% received ANC from a skilled provider at least once for their last pregnancy. Among the various count regression models considered in this study, the Zero-Inflated Poisson (ZIP) regression model was found to be the best-fit model. The study identified region, age, place of residence, education, religion, wealth index and marital status of mothers as statistically significant factors associated with the frequency of ANC visits.

Conclusion: The expected number of ANC visits was significantly lower for women from rural areas, uneducated mothers, older women and those women at the lower wealth index quantiles. Therefore, policy makers and concerned bodies should implement health service policies that target these disadvantaged women.

Keywords: *EMDHS-2019, antenatal care, frequency of ANC visits, count regression models*

1. Introduction

Antenatal care (ANC) is an uptake of healthcare provided by trained professionals to pregnant women to ensure the best health conditions for the mother and her baby during pregnancy. ANC includes the components of risk identification, prevention and management of pregnancy-related or coexisting diseases, health education and health promotion services (WHO, 2016). ANC can assist women to prepare for delivery and to recognize warning signs during pregnancy and childbirth. It can also be used to easily identify pregnancy complications (UNICEF, 2016). At least four ANC visits during the pregnancy period are recommended by the World Health Organization (WHO). To ensure safe delivery and to reduce maternal mortality, recognizing and managing pregnancy related complications are significant strategies (Requejo et al, 2015).

Ending preventable maternal mortality remains an unfinished agenda and one of the world's most critical challenges. In the transition from the millennium development goals (MDGs) to the Sustainable Development Goals (SDGs), attention to reduction of maternal mortality and morbidity must be accompanied by improvements along the continuum of care for women and children (WHO, 2015).

Over the last two decades, the world made substantial progress in reducing maternal mortality and the number of women dying due to complications during pregnancy. The global maternal mortality ratio (MMR) in 2017 was estimated at 211 maternal deaths per 100,000 live births, representing a 38% reduction since 2000, when it was estimated at 342. However, this is still far below the SDG target of reducing global MMR to less than 70 per 100,000 live births by 2030 (WHO, 2019). Sub-Saharan Africa remains the region with the highest maternal mortality rate in the world. In 2017, Sub-Saharan Africa and Southern Asia accounted for approximately 86% (254,000) of the estimated global maternal deaths with Sub-Saharan Africa alone accounting for roughly 66% (196,000) (WHO, 2019). The maternal mortality rate in Ethiopia is one of the highest in the world (WHO, 2016).

In Ethiopia, most of the women did not have the minimum number of ANC visits recommended by the World Health Organization even though there is improvement in maternal healthcare service utilization including ANC. While adequate care during pregnancy and delivery is essential, healthcare service utilization is extremely low. Most of the previous studies conducted in Ethiopia reflected a low utilization of ANC in the towns and cities (Abosse et al., 2010; Dubale et al., 2017). Among regions, ANC coverage from skilled providers was highest in Addis Ababa (97%) followed by Tigray (90%), while Somali region (44%) had the lowest coverage (CSA, 2016).

A number of studies found out that the factors associated with at least four ANC services include place of residence, region, education level, household wealth index, desire for pregnancy and frequency of reading newspapers, listening to radios & watching TV (e.g., Garoma, 2019). According to a survey conducted in southern Ethiopia in 2003, 26.1% of women had received ANC in the six years prior to the survey. Antenatal healthcare service was less likely to be available to rural women than to urban women (CSA and ORC Macro, 2006; Yared, 2003).

Maternal mortality is caused by various factors and problems. Maternal health is strongly influenced by the availability and quality of ANC. To manage preventive measures and identify potential complications during pregnancy, ANC is essential. Several socioeconomic characteristics can reveal restrictions or constraints preventing women from accessing healthcare services. The promotion of ANC is one the factors that contribute to a better maternal health status. Even though this issue has been extensively researched around the globe, there have been few rigorous efforts to explain factors hindering ANC service utilization in Ethiopia. Recently published researches have not covered all regions of Ethiopia and they concentrate on the utilization of at least four ANC services. Thus, this study is aimed at identifying and examining the effects of socioeconomic and socio-demographic factors on the frequency of utilization of ANC services.

2. Materials and Methods

2.1 Source of data

In this study, data was obtained from the 2019 EMDHS conducted by the Ethiopian Public Health Institute (EPHI), Addis Ababa, Ethiopia. Providing the most up-to-date estimates of key demographic and health indicators was the primary goal of the EMDHS 2019. A total of 8,885 women 15-49 years of age were approached, of which 3,927 were eligible and information was gathered regarding their ANC experiences during their last pregnancy. Specifically, for women aged 15-49 with a live birth in the five years prior to the survey, data on the frequency of ANC visits for their most recent birth was collected. A stratified two-stage cluster design was used to select the 2019 EMDHS sample. The sampling units for the first stage were the enumeration areas (EAs). The second stage of sampling involved households.

2.2 Study variables

Response (outcome) variable: The response variable of this study is the frequency of ANC visits of women during their last pregnancy.

Covariates: The covariates examined in this study are: mothers' age, place of residence, region, level of education, religion, wealth index and marital status.

2.3 Count regression models

Count event is the number of times a given event occurred in a specified place and time. The count dependent variable has nonnegative integer responses which are to be explained in terms of set of covariates. Unlike the classical regression model, the count response variable is discrete in nature with a distribution of probability mass at nonnegative integer values only. Counts of rare events as well as ordered and nominal categorical data usually violate the assumption of normality.

2.3.1 Poisson regression model

Poisson regression model (PRM) is the starting point to model and analyze the number of occurrences of count events. Let y_i denote the value of an event count outcome variable for i^{th} subject with mean (incidence rate) λ_i. The Poisson model assumes that the response variable Y_i has probability mass function given by:

$$P(Y_i = y_i \mid \lambda_i) = \frac{\lambda^{y_i} \exp(-\lambda_i)}{y_i\,!},\ y_i = 0, 1, 2, \ldots,\ \lambda_i > 0 \ \ldots\ldots\ldots\ldots\ldots\ldots\ (1)$$

Following the generalized linear models approach, we relate the parameters λ_i to covariates $X_i = (x_{1i}, x_{2i}, \ldots, x_{pi})'$, $i = 1, 2, \ldots, n$, through (Agresti, 2007; Cameron and Trivedi, 2013):

$$\log(\lambda_i) = X_i'\beta,\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (2)$$

where $\beta = (\beta_1, \beta_2, \ldots, \beta_p)'$ is a vector of unknown regression coefficients. The expected outcome in terms of the inverse of the log-link function is given by:

$$\lambda_i = \exp(X_i'\beta)\ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (3)$$

The Poisson distribution is characterized by the property of "equi-dispersion" that the mean and the variance are equal, that is:

$$E(Y_i = y_i \mid X_i) = Var(Y_i = y_i \mid X_i) = \lambda_i\ \ldots\ldots\ldots\ldots\ldots\ldots\ (4)$$

The Poisson model is the most simple and popular model for count data with the assumption that the mean and variance are equal (Hoffmann, 2004).

2.3.2 Negative binomial regression model

In practice, the Poisson model does not allow for over- or under-dispersion. The PRM is not frequently used to fit count data due to over-dispersion, that is, the PRM underestimates the amount of dispersions in the observed data. Hence, the negative binomial regression model (NBRM) solves this failure by introducing a parameter that accounts for unobserved heterogeneity. Note that, under over-dispersion, the expected rates for a given level of independent variables will be the same in both PRM and NBRM. In other words the mean structure of the PRM and the NBRM is the same. However, the standard errors in the PRM will be biased downward, resulting in apparent large Z-values and small p-values (Cameron and Trivedi, 2013).

For a count response variable with mean μ_i and dispersion parameter α, conditional on the covariates X_i, the negative binomial distribution is given by the following equation (Long, 1997):

$$f(Y_i = y_i \mid X_i) = \frac{(\alpha\mu_i)^{y_i}\Gamma\left(y_i + \frac{1}{\alpha}\right)}{\Gamma(y_i+1)\Gamma\left(\frac{1}{\alpha}\right)(1+\alpha\mu_i)^{\frac{1}{\alpha}+y_i}} \;,\; \lambda_i, \alpha > 0 \;,\; y_i = 0, 1, 2, \ldots \quad \ldots\ldots\ldots (5)$$

The NB distribution has conditional mean:

$$E(Y_i = y_i \mid X_i) = \mu_i \quad \ldots\ldots\ldots (6)$$

and the conditional variance is given by:

$$Var(Y_i = y_i \mid X_i) = \mu_i(1+\alpha\mu_i) \quad \ldots\ldots\ldots (7)$$

If α converges to zero, the NB distribution converges to Poisson distribution. In other words, the NBR is the extension of Poisson that could collapse into Poisson regression when the dispersion parameter is equal to zero. Due to this property, the Poisson and the NB are nested distributions. In general, NBRM is a generalization of the Poisson regression model that allows for over-dispersion by introducing an unobserved heterogeneity term for random observations.

2.4 Over-dispersion and zero-inflated regression models

Equi-dispersion property of the Poisson Model is frequently violated in real life because usually the variance exceeds the mean of the distribution of the response variable. Over-dispersion is closely related with the presence of unobserved inter-individual heterogeneity. Zero event counts sometimes can be dominant outcomes leading to a skewed distribution (Cameron and Trivedi, 2013).

Although the negative binomial model can solve an over-dispersion problem, it may not be well flexible to handle excess zeros. This motivates the development of Zero-Inflated count models to model excess zeros in addition to over-dispersion. When there are excess zeros in the response variable, the problem of standard models in under-predicting zeros and over-predicting the other outcomes is very common. In such cases, zero inflated Poisson (ZIP) and zero inflated negative binomial (ZINB) models can be used to account for excess zeros. The zero values in the ZIP model can be viewed as comprising two parts. One portion of the zero counts arises from the inflated part of the distribution and the other portion comes from what would be expected given a Poisson distribution with parameter λ.

2.4.1 Zero-inflated Poisson regression model

The general form of the zero-inflated probability mass function is:

$$p(Y_i = y_i) = \begin{cases} \phi_i + (1-\phi_i)p(Y=0) & \text{if } y_i = 0 \\ (1-\phi_i)p(Y=y_i) & \text{if } y_i = 1,2,\ldots \end{cases} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

If Y_i are independent random variables having a zero-inflated Poisson (ZIP) distribution, the zeros are assumed to arise in two ways corresponding to distinct underlying states. The first state occurs with probability ϕ_i and produces only zeros, while the other state occurs with probability $(1-\phi_i)$ and leads to a standard Poisson count with mean λ_i. In general, the zeros from the first state are called structural zeros and those from the Poisson distribution are called sampling zeros. This two-state process gives a simple two-component mixture distribution with probability mass function (Cameron and Trivedi, 2013):

$$p(Y_i = y_i) = \begin{cases} \phi_i + (1-\phi_i)e^{-\lambda_i} & \text{if } y_i = 0 \\ (1-\phi_i)\dfrac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} & \text{if } y_i = 1,2,\ldots \end{cases} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

This is denoted by $Y_i \sim ZIP(\lambda_i, \phi_i),\ 0 \le \phi_i < 1$, where λ_i is the mean of the non-zero outcomes that can be modelled with the associated explanatory covariates using the natural logarithmic link function $\ln(\lambda_i) = X_i'\beta$ and ϕ_i is the probability of an excess zero determined by a logit model. To predict membership in the "always- zero" group, we can use the same set of explanatory variables or we can use a smaller subset of the variables or even different variables altogether.

2.4.2 Zero-inflated negative binomial regression model

The main difference between ZIP and Zero-inflated Negative Binomial (ZINB) model is that the Poisson distribution for count data is replaced by the negative binomial distribution. The probability density function of a random variable that follows the ZINB distribution is a simple modification of the ZIP and is given by:

$$p(Y_i = y_i) = \begin{cases} \phi_i + (1-\phi_i)(1+\alpha\lambda_i)^{-\frac{1}{\alpha}} & \text{if } y_i = 0 \\ (1-\phi_i)\dfrac{\Gamma\left(y_i + \frac{1}{\alpha}\right)(\alpha\lambda_i)^{y_i}}{\Gamma(y_i+1)\Gamma\left(\frac{1}{\alpha}\right)(1+\alpha\lambda_i)^{y_i+\frac{1}{\alpha}}} & \text{if } y_i > 0 \end{cases} \quad \ldots\ldots\ldots\ldots (10)$$

where λ_i is the mean of the non-zero responses that can be modelled with the associated explanatory covariates using a natural logarithm link function as defined in equation (2), and ϕ_i is the probability of excess zeros which can be estimated by logistic regression (Long, 1997).

The ZINB model is a special case of a two-class finite mixture model with mean $E(Y_i) = \lambda_i(1-\phi_i)$ and variance $Var(Y_i) = \lambda_i(1-\phi_i)(1+\alpha\lambda_i + \phi_i\lambda_i)$, where the parameters λ_i and ϕ_i depend on the covariates and $\alpha \geq 0$ is a scalar. Thus, we have over-dispersion whenever either ϕ_i or α is greater than zero. Equation (10) reduces to NB when $\phi_i = 0$ and to the ZIP when $\alpha = 0$.

2.5 Model selection

The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) are the most widely used techniques for making model fit comparisons between two competing models. The model with smaller values of AIC and BIC is a better fit for a given dataset. The AIC and BIC criteria with their respective equations given below (Burnham and Anderson, 2002) are used to compare the suitability of competing models:

$$AIC = -2LL + 2r \quad \ldots\ldots\ldots\ldots (11)$$

$$BIC = -2LL + r\ln(n) \quad \ldots\ldots\ldots\ldots (12)$$

where LL is the log-likelihood value, r indicates the number of parameters and n is the sample size.

3. Results

3.1 Descriptive results

Table 1 presents the demographic and socio-economic characteristics of respondents by the status of ANC usage. We can see that 73.6% of women aged 15-49 who gave birth to a live child in the five years before the survey received ANC from a skilled provider, while 25.6% of them had no ANC visits. According to the results, nearly all women with higher education received at least one antenatal healthcare service. This figure was 62.0% for uneducated mothers. Getting ANC from a skilled provider varies by mothers' age: from a high of 76.5% among women aged 20 to 34, to a low of 59.4% among women aged 35 to 49. Moreover, women residing in urban areas were more likely to be treated by a skilled provider than those in rural areas. Region-wise, ANC coverage from a professional provider was maximum in Addis Ababa (97%) and lowest in Somali (30%). And women in the highest wealth quintile were more likely than those in the poorest quintile to obtain ANC from a skilled practitioner (94.6% versus 47.3%).

Table 1: Demographic and socio-economic characteristics of respondents by the status of ANC usage (2019 EMDHS)

Variables	Category	Percentage of mothers with no ANC visits	Percentage of mothers who received ANC from a skilled provider
Age at first birth	<20	26.6	72.8
	20-34	22.5	76.5
	35-49	40.1	59.4
Residence	Urban	15.1	84.5
	Rural	29.3	69.7
Region	Tigray	5.3	94
	Afar	37.1	62.7
	Amhara	15.1	82.6
	Oromia	29.2	70.8
	Somali	69.6	30.2
	Benishangul-Gumuz	16.7	83.3
	SNNPR	29	69.4
	Gambella	13.7	85.7
	Harari	19.3	80.7
	Addis Ababa	3.1	96.6
	Dire Dawa	15.5	83.5
Education	No education	36.3	62
	Primary	18.5	81.4
	Secondary	2.9	97.1
	More than secondary	0.2	99.8
Wealth quintile	Lowest	51.6	47.3
	Second	28.6	71
	Middle	22.7	75.6
	Fourth	18	80.7
	Highest	5.3	94.6
Overall		**25.6**	**73.6**

3.2 Count regression model results

Using the national representative 2019 EMDHS data, this study examined factors related to the use of ANC services in Ethiopia. In this survey, 3927 women who had a live birth in the five years preceding the survey were involved. This study identified the socioeconomic and demographic determinants of the number of ANC visits basing the analysis on count data models. Among the Poisson, negative binomial, zero-inflated Poisson and zero-inflated negative binomial models considered in this study, the ZIP model was found to be the best-fit model based on the Akaike and Bayesian information criteria (Table 2).

Table 2: Model selection among count regression models

Model	AIC	BIC	Log likelihood
Poisson	16715	16765	-8349
NB	16405	16462	-8193
ZIP	14658	14897	-7291
ZINB	16170	16239	-8074

Table 3 pertains to parameter estimates and related statistics of Poisson part of the zero-inflated Poisson model. We can observe that age, place of residence, region, education, religion and wealth index are statistically significant factors associated with the frequency of antenatal care visits. The expected number of ANC visits was 0.63% higher for women whose age was less than 25 years compared to those women aged 25-49 (IRR = 1.00632, 95% CI: 1.002962, 1.009689). When we come to place of residence, the expected number of ANC visits for mothers from rural areas was 11.68% lower than those from urban areas (IRR = 0.8832238, 95% CI: 0.8263619, 0.9439984).

The other significant factor was mothers' education. According to the results of our study, the expected number of ANC visits for women with primary, secondary and higher education was 12.78%, 23.57% and 29.34% higher than those women with no education, respectively. Concerning economic status, women in the lowest wealth index (poorest) had a significantly lower number of ANC visits compared to those in each of the higher wealth indices. The study also found that Coptic (Orthodox) Church followers had a higher number of ANC visits than Protestants and Muslims.

The results in Table 3 also revealed that the number of ANC visits exhibited significant variation across the regions of Ethiopia. The expected number of ANC visits for mothers residing in Addis Ababa was 11.71% higher than those in Tigray region (IRR = 1.11714, 95% CI: 1.018054, 1.22587). On the other hand, the expected number of ANC visits for mothers residing in Somali, Gambella and SNNPR regions were 52.38%, 21.70% and 12.84% lower than those in Tigray region, respectively.

4. Discussion

The results of this study showed that women living in rural areas of Ethiopia were less likely to utilize ANC services than those living in urban areas. This may be attributed to inadequate health facilities and mothers' lack of awareness of ANC services in rural areas. This finding is consistent with other studies which reported that urban women were more likely to receive ANC services compared to rural women (Abuka et al., 2016; Ali et al., 2010; Titaley et al., 2010; Ochako and Gichuhi, 2016).

Table 3: Parameter estimates of Poisson part of the ZIP model

Covariate	Estimate	IRR	95% CI of IRR		Z-value	P-value
			Lower	Upper		
Intercept	0.982269	2.670509	1.976160	3.608778	6.39	0.000
Age (Ref. ≥ 25 years)						
Less than 25 years	0.006300	1.006320	1.002962	1.009689	3.69	0.000
Residence (Urban Ref.)						
Rural	-0.124180	0.883224	0.826362	0.943998	-3.66	0.000
Region (Ref. = Tigray)						
Afar	-0.076620	0.926246	0.830140	1.033478	-1.37	0.070
Amhara	-0.052680	0.948686	0.877063	1.026159	-1.32	0.058
Oromia	-0.062520	0.939391	0.858718	1.027642	-1.36	0.072
Somali	-0.742000	0.476160	0.391944	0.578472	-7.47	0.000
Benishangul-Gumuz	0.003757	1.003764	0.920283	1.094818	0.08	0.468
SNNPR	-0.137470	0.871558	0.791305	0.959951	-2.79	0.005
Gambella	-0.244670	0.782966	0.706261	0.868002	-4.65	0.000
Harari	-0.077430	0.925492	0.840746	1.018779	-1.58	0.114
Addis Ababa	0.110772	1.117140	1.018054	1.225870	2.34	0.019
Dire Dawa	-0.049970	0.951255	0.868257	1.042187	-1.07	0.082
Education (Ref. = No education)						
Primary	0.120243	1.127771	1.072824	1.185531	4.72	0.000
Secondary	0.211628	1.235687	1.154987	1.322026	6.14	0.000
Higher	0.257297	1.293430	1.197851	1.396634	6.57	0.000
Religion (Ref. = Orthodox)						
Catholic	-0.243970	0.783510	0.579993	1.058441	-1.59	0.056
Protestant	-0.080490	0.922707	0.859989	0.989999	-2.24	0.025
Muslim	-0.063590	0.938394	0.887622	0.992071	-2.24	0.025
Traditional	-0.231050	0.793698	0.555702	1.133621	-1.27	0.104
Other	-0.260220	0.770877	0.492771	1.276693	-1.14	0.054
Wealth (Ref. = Poorest)						
Poorer	0.081999	1.085455	1.009503	1.167120	2.22	0.027
Middle	0.089902	1.094067	1.015237	1.179019	2.36	0.018
Richer	0.127719	1.136234	1.054588	1.224201	3.36	0.001
Richest	0.157925	1.171079	1.074201	1.276693	3.58	0.000
Marital status (Ref. = Never in union)						
Married	0.176776	1.193363	0.910949	1.563332	1.28	0.099
Living with partner	0.224929	1.252234	0.895758	1.750572	1.32	0.088
Widowed	0.183986	1.201999	0.875511	1.684878	1.07	0.086
Divorced	0.181081	1.198513	0.900056	1.595937	1.24	0.108
Separated	0.115401	1.122324	0.827201	1.522739	0.74	0.059

According to our results, the number of ANC visits exhibited significant variation across the Regional States of Ethiopia. This finding is in line with other investigations (Titaley et al., 2010; Ponna et al., 2017), and may be attributed to regional variations in healthcare facilities.

The current study revealed that women with primary, secondary and higher education in Ethiopia were more likely to utilize ANC services compared to women with no education. This may be due to the fact that more educated women are more aware of the importance of ANC services to their health as well as the health of their children. Additionally, education empowers women to make informed decisions about seeking healthcare. Abosse et al. (2010), Tsawe et al. (2015) and Ochako & Gichuhi (2016) also came up with a similar finding regarding the association between ANC utilization and women's education.

Our study results showed that women in the lowest wealth index had a significantly lower number of ANC visits compared to those in each of the higher wealth indices. Households in the lowest wealth quantile are less likely to afford care-seeking costs such as transportation, medications, and any ancillary expenses that may arise. Several studies including those by Titaley et al. (2010), Sakeah et al. (2017) and Simkhada et al. (2008) support our findings.

Another factor that affected ANC utilization in Ethiopia over the past five years preceding the 2019 EMDHS was mothers' age at birth. According to the findings of our study, older pregnant women were likely to receive fewer ANC services. Religion of women was also found to be significantly associated with the number of ANC visits.

5. Conclusion and Recommendations

5.1 Conclusion

This study applied count regression models to examine the frequency of antenatal care visits based on data form 2019 EMDHS. The Poisson, NB, ZIP and ZINB regression models were applied to examine the very important factors that influence the number of antenatal care visits. The results indicated that the ZIP model has smaller values for both AIC and BIC. Therefore, the ZIP regression model was the best model to fit the data on the frequency of ANC visits. The results of this study revealed that region, age, place of residence, education, religion, and wealth index are statistically significant factors related to the frequency of ANC visits in Ethiopia.

ANC was more commonly utilized by women from urban areas than those living in rural areas. The results also showed that uneducated mothers were less likely to use ANC than educated women.

Moreover, ANC was more commonly utilized by younger women compared to older women, and by women from Addis Ababa than in other regions. Additionally, it has been observed that women who were in the upper wealth quantiles were more likely to receive ANC than poorest women.

5.2 Recommendations

The study revealed significant differences in the number of ANC visits across regions. Thus, policies and programs must be formulated in addressing regional differences in ANC visits and their implementation. Mothers from urban areas have higher ANC visits than those in rural areas. Therefore, strategies to increase the accessibility and availability of healthcare services should specifically target rural communities. Uplifting the socioeconomic status and education of women is required to promote the healthcare seeking behaviour of communities in the country. Since women with poor household wealth index were less likely to utilizing ANC services, health promotion programs and financial support should be provided to mothers from poor households to enable them increase their ANC services utilization.

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