

Overcoming Barriers, Embracing Opportunities: Antenatal Care Use in Lushoto, Tanzania

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Abstract

Introduction

Antenatal care (ANC) is crucial for reducing maternal mortality rates. Understanding factors affecting ANC utilization in Lushoto District, Tanzania, can improve maternal and infant health outcomes.

Methods

A cross-sectional study surveyed 396 pregnant women and mothers of newborns in Lushoto District health facilities. Purposive sampling was used. Data on ANC use was collected through structured questionnaires.

Results

Logistic regression analysis identified factors associated with ANC utilization. ANC utilization was significantly associated with marital status (being married), education level (primary, secondary, or university), facility type, income level, access to information, and waiting time for care.

Conclusion

This study highlights the importance of addressing factors like long waiting times, facility type, information access, income level, and education to improve ANC utilization in Lushoto District. Continued health education, particularly in rural areas, is essential to reduce maternal mortality.

Keywords: *Antenatal care, Healthcare Utilization, Maternal Health, Maternal Mortality, Tanzania*

INTRODUCTION

Antenatal care (ANC) is the care given to pregnant women who will have a healthy pregnancy, be able to diagnose a disease or complicating obstetric conditions, and provide information about pregnancy and delivery. ANC promotes the health of both the mother and the developing baby. Adequate antenatal care is a crucial factor in addressing high maternal mortality rates. Throughout pregnancy, essential monitoring and support via ANC significantly contributes to mothers' and babies' well-being (Kitole et al., 2023a; Vyawahare et al., 2023; Kitole et al., 2022a). Several studies have discovered that inappropriate antenatal care has been associated with women's pregnancy outcomes. Recently, WHO has advocated a minimum of eight (8) visits: five visits in the third trimester at 30, 34, 36, 38, and 40 weeks of gestation, one visit in the first trimester up to 12 weeks of gestation, and two visits in the second trimester at 20 and 26 weeks of gestation aim to reduce maternal morbidity and mortality (Ali et al., 2018). However, there is growing evidence that a higher frequency of antenatal care (ANC) visits by pregnant women and adolescents is associated with a lower risk of stillbirth. Studies have shown that attending at least eight ANC visits can significantly reduce stillbirth rates. A systematic review by Ota et al. (2020) analyzed the effects of various antenatal interventions on preventing stillbirth. It highlighted the potential benefit of a higher number of ANC visits. A study in Ethiopia by Wake et al. (2023) found that women who received at least four ANC visits had a significantly lower risk of stillbirth compared to those with fewer visits.

Globally, the coverage of antenatal care is an achievement story. At least as soon as approximately 86% of pregnant women attend at least one ANC visit with a skilled health professional, and approximately 62% account for attending at least 4 ANC visits (UNICEF, 2015). The World Health Organization (WHO) recommends a minimum of four antenatal care visits. However, global estimates indicate that only about half of all pregnant women receive this recommended care (WHO, 2016). To ensure mothers receive the most appropriate advice and care, it is recommended that the final prenatal visit be scheduled around 37 weeks or close to the expected due date (Njiku et al., 2017).

The prevalence of ANC varies within and among countries. In Sub-Saharan Africa, it is estimated that about 52% of pregnant women have at least one ANC visit, more than in South Asia, which has 46% visits. Evaluating coverage of at least four antenatal care (ANC) visits is crucial. Effective interventions like tetanus and malaria vaccinations and preventing mother-to-child HIV transmission (Kitole et al., 2023b; Kitole et al., 2022b; Mourtada et al., 2021). In Africa, the proportional percentage of pregnant women attending the recommended four more visits is 6%, which has increased

over ten years. Similarly, over ten years, the proportion of women who received ANC in the first six months of pregnancy increased by 10 % faster than the overall increase in ANC coverage (Lincetto et al., 2015). It indicated that the prevalence of ANC in East Africa is better per country specifics. For example, in Tanzania, available data shows that ANC has increased from 90% in 2011 to 98% in 2016 (TDHS, 2016). Despite the increase in ANC visits, only about 24% of pregnant women were reported to start their visit during the first trimester, as recommended by the World Health Organization (TDHS, 2016). While a Tanzania Demographic Health Survey in 2016 found that 94% of women in Lushoto District attended antenatal care (ANC) services, only 16% adhered to the recommended schedule. This suggests a delay in seeking or completing ANC visits, a common issue in Tanzania. (TDHS, 2016).

Since the 1970s, the Tanzanian government has prioritized healthcare, particularly maternal health, through national guidelines and programs. This focus is evident in initiatives like the Expanded Program of Immunization, Safe Motherhood Initiatives, and Integrated Management of Child Health. Improving maternal health services remains a top priority within the National Road Map Strategic Plan to enhance Reproductive, Maternal, Newborn, Child, and Adolescent Health in Tanzania (One Plan II, 2016/2020). Therefore, this study aimed to examine factors affecting Antenatal Healthcare Utilization in Maternal Health Facilities in Lushoto District, Tanzania

EMPIRICAL LITERATURE

Existing studies in antenatal care utilization are diverse. Most studies used large-scale data sets such as Demographic and Health Surveys to determine maternal health services' determinants. Kibusi et al. (2018) investigated the link between health insurance and the utilization of maternal healthcare services in Tanzania. They analyzed data from the 2011/12 Tanzania HIV/AIDS and malaria indicator survey, employing descriptive statistics and regression techniques. Their findings revealed that more women with health insurance had antenatal care (ANC) visits initiated at the recommended time compared to those without insurance. This suggests that having health insurance increases the likelihood of women attending ANC appointments as advised. Acharya (2018) studied demographic and socioeconomic factors affecting the utilization of antenatal care services in Nepal by examining the chance of the utilization of ANC services in 4 or more visits in terms of women's socioeconomic and demographic popularity. Singh et al. (2018) utilized the NDHS of 2011 by applying bivariate logistic regression evaluation and analyzed the consequences of these variables in 4 or more ANC services used. The author concluded that various factors such as demographic (women's age, abortion), socio-economic (religion, ethnicity,

women’s education, husband’s education, influence of mass media, place of residence), and financial (household wealth, women’s employment status, women’s occupation) have a significant impact on women and their families. Gupta et al. (2014) reported high quality of service, testing, and HIV counseling during ANC, receiving malaria doses during ANC, and some factors were found to be significantly associated with a decrease in ANC utilization, such as the woman's age and geographic zone.

Akowuah et al. (2018) conducted a study exploring the socio-economic determinants of antenatal healthcare utilization by pregnant women in the Third Trimester in Ghana. The study employed a two-stage sampling technique to sample 200 pregnant women in the third trimester. The study used binary logit analysis to show the determinants of the utilization of ANC. The authors found variation in ANC utilization levels among pregnant women and found that the important factors which levels among pregnant women and found that the important factors that influence utilization were distance factor, education of women, aged women, employment status, quality of services, and service satisfaction.

Rurangirwa et al. (2017) also studied the determinants of poor utilization of ANC services amongst recently delivered women in Rwanda, a population-based study. The study used logistic regression, and odds ratios were presented with their 95% confidence interval. The examiner exhibits that the danger of women of older age, people who are unmarried, and people with poor social support had been associated with bad utilization of ANC. They argued that general maternal or ANC awareness be raised on the significance of the timing of visits, and cost must be minimized. However, none of the studies focused on the Factors affecting Antenatal Healthcare Utilization in Maternal Health Facilities. Therefore, this study aims to analyze the factors affecting Antenatal healthcare utilization in Maternal Health Facilities.

Conceptual Frameworks

This framework explores the factors influencing pregnant women's use of antenatal care (ANC) services in maternal health facilities. It highlights the interplay between individual characteristics, socioeconomic factors, service accessibility, and utilization patterns (see Figure 1).

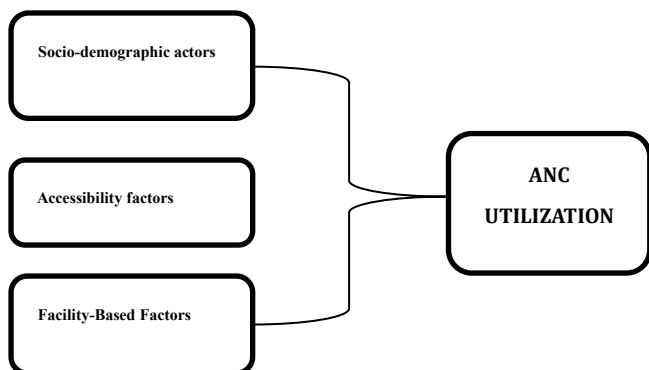


Figure 1: Conceptual framework

This study investigates the factors influencing pregnant women's utilization of antenatal care (ANC) services in maternal health facilities. The framework considers two key categories of independent variables, i.e., Socioeconomic factors, which include a woman's age, education level, occupation, marital status, and income level. These factors can impact women's ability to access and prioritize ANC services. Secondly, access and service delivery factors: This category explores how access to information (through media exposure), the timing of ANC initiation (trimester), waiting times for care, transportation costs, and the type of facility (public vs. private) can influence a woman's use of ANC utilization. By understanding the specific factors influencing ANC use, policymakers and healthcare providers can develop targeted interventions to address them.

Theoretical Model

Theory of Consumer Behavior

This study adopted the theory of consumer behavior, which postulates that a rational consumer allocates his/her income among different wants to maximize his/her utility. Under this study, a pregnant woman is assumed to maximize utility after utilizing antenatal care services, given her health production function and budget constraints. This study adopted a theoretical utility model as used by Machio (2008). The model assumes that women attending antenatal care clinics aim to maximize their overall well-being, which can be influenced by various factors.:

$$U = f(V, H, Y) \dots\dots\dots (1)$$

U is the utility derived by the pregnant woman, V is the consumption goods, H is the health-related good, and Y indicates other factors e.g., Distance, time

In utility maximization, pregnant women have their health production function and budget constraints, which can be expressed as follows:

$$h_i = h(H, N, Z) \dots\dots\dots (2)$$

$$I = P_v \cdot V + P_h \cdot H + P_a \cdot A \dots\dots\dots (3)$$

hi= health production, H is the health-related factors, Z is socio-demographic factors, age, income, education, and occupation, and N is other health inputs. Under the above budget constraints, I is the income of a pregnant woman, A is antenatal care and Pv, Ph and Pa are the prices (costs) for consumption goods (V), health-related goods (H) and Antenatal care utilization (A) including the cost of seeking care respectively.

Using the above equations, we may express the Langrangian equation as follows:

$$L = f(V, H, Y) + \lambda_1 [h - f(H, N, Z)] + \lambda_2 - P_h \cdot H - P_a \cdot A] \dots\dots\dots (4)$$

By solving equation v gives a reduced form of the demand function for antenatal care utilization

$$D_a = f(P_v, P_h, P_a, I, Z) \dots\dots\dots (5)$$

Whereby Da is the demand for antenatal care utilization, which implies that it depends upon several determinants such as prices (costs) for consumption goods (V), health-related goods (H) and Antenatal care utilization, income (I) Pv, Ph, Pa, I and Z.

METHODS

Study design

This research employed a hospital-based cross-sectional design. The study involved two groups of women attending maternal health facilities in Lushoto district, Tanzania, between January and February 2019. Pregnant women aged 15-49, with a gestational age exceeding 32 weeks, attending antenatal clinics at maternal health facilities in Lushoto district was included as group one. Women who had given birth within the past 12 months at the same facilities were regarded as group two. The study was conducted in Lushoto district, located in northeastern Tanzania.

Sample size and sampling techniques

The Lushoto district report 2012-2013 indicated that a total of 38,253 women from five different wards under the study visited different healthcare facilities in the district for the antenatal care services. The distribution of the number of these women who attended antenatal care services is as follows: Lushoto town (14,932), Lukozi ward (6,338), Mlalo ward (4,416), Mtae ward (7237) and Mlola ward (5,330). Thus, the Yamane formula 1967 was used to estimate the sample size of the study from the stated study's sampling frame such that:

$$n = \frac{N}{1 + N(e^2)} = n = \frac{38,253}{1 + 38,253(0.05^2)} = 396$$

Therefore, the total sample size under the study was 396, now since these women are coming from different wards in the district, the Yamane second formula of sub sample population was used whose results have been shown in Table 1.

Table 1. Women's population among the selected wards.

Name of Ward	Ward Status	Sample size
Lushoto	Urban Ward	154
Lukozi	Rural Ward	66
Mlalo	Mixed Ward	46
Mtae	Rural Ward	75
Mlola	Rural Ward	55
Total		396

Data Analysis

Data from the questionnaire were entered into a computer using SPSS version 25 and a p-value of less are presented, followed by data cleaning. A logistic regression model was used to analyze the factors affecting antenatal healthcare utilization in the Lushoto district. Marginal effects with a corresponding 95% confidence interval are presented, and a p-value of less than or equal to 0.05 was considered statistically significant.

Econometric Model and Specification

ANC utilization in Lushoto was explored using a binary logistic regression model since the dependent variable is binary (1 utilized the ANC service, and 0 did not utilize the ANC service). Let Y_{inx1} be a binary outcome variable with

categories 1 utilizing the ANC service and 0 Not utilizing the ANC service. Let $Y_{n \times (p+1)}$ denote the collection of predictor variables of Y and then the conditional probability that pregnant women utilized the services is given as the X_i predictor variables is denoted by $P(Y_i=1/X_i)=Y$ and the model will be expressed in the form of :

The probability of observing the value of one is

$$P_r = \left(y_i = \frac{1}{x_i \beta_i} \right) = 1 -$$

$$F(x_i \beta_i), \dots \dots \dots (2.6)$$

Where F (.) is a cumulative distribution function, it is a continuous, strictly increasing function that takes a real value and returns a value that ranges from 0 to 1. Consequently, the probability of observing zero is

$$P_r = \left(y_i = \frac{0}{x_i \beta_i} \right) =$$

$$F(-x_i \beta_i) \dots \dots \dots (2.7)$$

The maximum likelihood estimation approach can be used from the given specification to estimate the model.

The dependent variable Y_i is an unobserved latent variable that is linearly related to the equation:

$$y_i = \beta_i x_i + \mu_i \dots \dots \dots (2.8)$$

Where μ_i is a random disturbance is a term and x_i is an independent variable that influences the utilization of ANC. The dependent variable y_i can be observed if $y > 0$ which signifies the utilization of ANC and $y=0$ which signifies no utilization of ANC.

$$y = \begin{cases} 1, & \text{If a pregnant woman utilized ANC services} \\ 0, & \text{if a pregnant woman, not utilized ANC services} \end{cases} \dots (2.9)$$

Then, the study adopted the Logit model to analyze the data and the empirical model is specified as

$$y = \frac{e^{\beta_0 + \beta_1 X_1 + \dots + \beta_p X_{ip}}}{1 + e^{\beta_0 + \beta_1 X_1 + \dots + \beta_p X_{ip}}} = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \dots + \beta_p X_{ip})}} \dots \dots \dots (2.10)$$

In the logistic regression model, the logarithmic transformation of the equation gives a linear relationship between independent and dependent variables. Then the logit transformation is given as follows:

$$\text{logit}(y) = \log \frac{P(y)}{1-P(y)} = \beta_0 + \beta_1 X_1 + \dots + \beta_p X_{ip} \dots \dots \dots (2.11)$$

Model Specification

Therefore, the estimated model was specified as;

$$\log \frac{P(y)}{1-P(y)} = \beta_0 + \beta_1 Ag + \beta_2 Mstat + \beta_3 Inc + \beta_4 Occ + \beta_5 Ed TimAc + \beta_6 FacType + \beta_7 Acclnf + \beta_8 Waitm + \beta_9 Transcost + \beta_{10} TimAc + \epsilon_i \dots \dots \dots (2.12)$$

Whereby:

Ag is the age of the women, *Mstat* is the marital status of women, *Inc* is the income level of women, *Occ* is the occupation of women, *FacType* is the facility type, *AcclInfo* is access to information, *Waitm* is the waiting time and

Tranccost is the transport cost to and from the healthcare facility.

Results

The logistic regression model results in Table 2 below indicate regression analysis on the factors affecting ANC utilization in maternal health facilities. The fitness of the data was statistically significant given that the P-value 0.0000 is at (P< 1%). The Pseudo R² was 0.7185, which indeed tells us how well the maximum likelihood estimates were obtained through iteration fitting the model, while the Wald chi2(14) = 276.12, which is the log of the likelihood chi-square test with 14 degrees of freedom. The implication of the log-likelihood -50.668231 is that all the parameters of the independent variables are zero, meaning that the logistic response can be rejected at a given significant level.

Table 2: Logit Regression results indicating factors associated with ANC utilization in maternal health facilities

ANC utilization	Coef.	St. Err.	t-value	p-value	95% Conf	Interval	Sig.
Women's Age	-0.037	0.045	-0.81	0.416	-0.125	0.052	
Married women	2.601	0.543	4.79	0.000	1.537	3.665	***
Secondary education	2.065	0.781	2.64	0.008	0.534	3.595	***
University education	1.821	0.793	2.30	0.022	0.266	3.376	**
Farmer	11.618	1.332	8.72	0.000	9.008	14.228	***
Employed	10.818	1.749	6.19	0.000	7.391	14.245	***
Unemployed	-11.667	1.631	-7.15	0.000	-14.864	-8.47	***
Ln income	2.346	0.633	3.71	0.000	1.106	3.586	***
Time of access to Care	-0.147	0.215	-0.68	0.495	-0.569	0.275	
Ln Transport costs	-0.209	0.078	-2.68	0.007	-0.362	-0.056	***
Information access	1.646	0.568	2.90	0.004	0.532	2.76	***
Public facility	2.463	0.539	4.57	0.000	1.406	3.52	***
Waiting time	-0.114	0.03	-3.74	0.000	-0.173	-0.054	***
Uninsured women	0.394	0.499	0.79	0.430	-0.585	1.373	
Constant	-25.611	7.048	-3.63	0.000	-39.426	-11.797	***
Logistic regression			The number of obs.	=		396	
			Wald chi2(13)	=		276.12	
			Prob > chi2	=		0.0000	
Log pseudo likelihood =	-50.668231						

*** p<.01, ** p<.05, * p<.1

The logistic regression indicates that ANC utilization increases with an increase in the married women's, women's education level (secondary education and university education), women's occupation (farmer, employed and unemployed), the logarithm of income, transport costs, type of facility (public facility), information access and waiting time. The mentioned variables were statistically significant in influencing ANC utilization among selected women in the Lushoto district. Some variables, such as women's age, uninsured women, and time of accessing care, were statistically insignificant in influencing ANC utilization among women in the Lushoto district.

Marginal Effect of Logistics Regression Model

The Marginal effect (Table 3) measures the expected change in independent variables due to the change in explanatory variables, keeping other covariates constant. Since the logistic regression coefficients can only give the direction of the effect but not the magnitude, the Marginal effect is computed to interpret the coefficient given both the magnitude and direction.

Table 3: Marginal Effect Results for factors associated with ANC utilization in maternal health facilities in Lushoto district.

Variable	Marginal effects	Std.Err.	z	P>z	95% C.I.	X	
Age	-0.001	0.001	-0.780	0.438	-0.002	0.001	28.318
Mstatus2*	0.104	0.053	1.970	0.049	0.000	0.208	0.722
Second~c*	0.040	0.018	2.200	0.028	0.004	0.077	0.442
Univer~c*	0.024	0.012	2.050	0.041	0.001	0.048	0.232
Farmer*	0.067	0.000	0.000	0.000	0.000	0.000	0.111
Employed*	0.602	0.220	2.740	0.006	0.171	1.033	0.402
Unempl~d*	-0.856	0.122	-6.990	0.000	-1.096	-0.616	0.510
Lnincome	0.044	0.016	2.790	0.005	0.013	0.075	12.200
Timeof~e	-0.003	0.004	-0.680	0.494	-0.011	0.005	1.467
ln~ocost	-0.004	0.002	-2.250	0.025	-0.007	-0.001	5.838
Infoacc2*	0.035	0.019	1.880	0.061	-0.002	0.071	0.510
Public*	0.091	0.041	2.240	0.025	0.012	0.171	0.707
Wtime	-0.002	0.001	-2.550	0.011	-0.004	-0.000	20.530
Uninsu~d*	0.008	0.010	0.780	0.434	-0.012	0.028	0.631

(*) dy/dx is for discrete change of dummy variable from 0 to 1

The logistic regression indicates that ANC utilization increases with an increase in the married women's, women's education level (secondary education and university education), women's occupation (farmer, employed and unemployed), the logarithm of income, transport costs, type of facility (public facility), information access and waiting time. The mentioned variables were statistically significant in influencing ANC utilization among selected women in the Lushoto district. At the same time, variables such as women's age, uninsured women, and time of accessing care were statistically insignificant in influencing ANC utilization among women in the Lushoto district.

Post Estimation Test to justify the use of the Logit Model

This section indicates all the econometric tests conducted after the logit model's estimation to see whether the estimates will be meaningful given the results. Numerous tests were used to analyze the factors affecting ANC services utilization among women in maternal health facilities and justify the use of the model. The tests involved the fitness of the model. Several statistical measures can also be used; among them are the Hosmer-Lemeshow goodness of fit test, Pseudo R-square, and Specification error (model specification).

Pseudo R-squared

From the regression model above, the Pseudo R² is 0.7185; on some occasions, it can be interpreted as a measure of how well the model fits the data, but it is not obvious. In binary regression, the interpretation of the Pseudo R² and the coefficient is different because we are regressing the 0 and 1 values and not the real values of dependent variables. Therefore, we cannot set a range for Pseudo R² like OLS. DL McFadden stated that a Pseudo R² higher than 0.2 represents an excellent fit.

Hosmer-Lemeshow

Moreover, the model's fitness was examined using the Hosmer-Lemeshow test for logistic regression. For this reason, the significance of the chance of Hosmer-Lemeshow (1.0000) is more than a 5% level of significance, which means that we reject the null hypothesis (H₀) and we accept (H₁). there is, H₀ shows no relationship among the elements influencing ANC utilization of women in maternal health

facilities, and H1 suggests a relationship between the factors influencing ANC utilization among women in maternal health facilities (Table 4).

Table 4: Hosmer-Lemeshow Test

Logistic model for ANC utilization, a goodness-of-fit test			
Number Of Observations	=		396
Number Of Covariate Patterns	=		396
Pearson Chi2(383)	=		187.02
Prob> Chi2	=		1.00000

Model Specification test

Moreover, another test was a specification error test, which was performed by commanding the Link test to check whether the model was correctly specified. The results indicate that **_hatsq**, showing that the model is very well specified that the predicted value from the model is insignificant, with a p-value of 0.563, showing that the model is very well-specified compared to **_haq**.

Table 5: Link test for specification error

ANCutil2	Coefficients	Std. Err.	z	P>z	[95% Conf. Interval]
_hat	0.9694964	0.1346835	7.20	0.000	0.7164925 1.238472
_hatsq	0.0237295	0.0410787	0.58	0.563	-0.0670262 0.100853
cons	-0.0849747	0.3233650	-0.26	0.846	-0.6768667 0.555053
Logistic regression			Number of obs	=	396
			LR chi2(2)	=	259.04
			Prob > chi2	=	0.0000
Log likelihood = -50.504839			Pseudo R2	=	0.7195

DISCUSSION

Table 3 summarizes the factors affecting ANC utilization in maternal health facilities. It can be observed that the contribution of ANC utilization in maternal health facilities was significantly related to marital status (being married), women's education (secondary and university education), facility type (use of the public facility), income, women's occupation (farmer, employed and unemployed women), transport costs, information access, and waiting time for care while women's age, time of accessing ANC and uninsured women was not significantly related to ANC utilization. Variables such as the number of married women, farmers, employed, years of secondary education, university education, public facility use, information access, and income had a positive relationship. In contrast, transport costs, unemployed women, and waiting time negatively correlated with antenatal care utilization.

The results from logistic regression analysis indicate that the number of married women is positively related to ANC utilization and statistically significant at 1% ($p < 0.01$). The findings indicate that the probability of utilization of ANC services among married women is more likely to increase than that of unmarried women by 2.601, *ceteris paribus*. The implication lies in that higher proportions of married women avail ANC. After all, they may receive support from their

husbands and family compared to unmarried women. The number of married women it significantly affects the utilization of ANC compared to unmarried women. This finding of this study is inconsistent with the study conducted by Rurangiriwa et al. (2017), which found that women who were single, divorced, or widowed and who had no support from family, relatives, or friends were at high risk of poor utilization of ANC services. Similarly, the study conducted in public primary healthcare facilities in Edo state by Alenoghena *et al.* (2015) found a positive association between married pregnant women and ANC utilization.

The probability of women utilizing antenatal care is positively related to their income, implying that the probability of women attending ANC services increases with an increase in income of women compared to when their income is low. The finding indicates that women's income was positively and statistically significant at a 1% significant level ($p < 0.01$) in influencing ANC utilization. As the logarithm of income increases, women were more likely to visit for ANC services by 2.346 compared to when income is low. This might be caused by women investing their income to improve their attendance for ANC services. This means that women's income may be used for ANC attendance rather than other expenditures. The results are similar to the study by (Islam and Masudi, 2018; Rutaremwa et al. 2015; Halle- Ekane et al., 2014) showed that women with a higher quantile wealth index are more likely to visit for ANC early as compared to women with lower quantile (poor).

The results from the logistic regression analysis show a positive relation between the use of ANC in maternal health centers and access to information through media. The results indicate that media access is statistically significant at 1% ($P < 0.01$). The results indicate a positive and statistically significant effect between information access through media and the use of ANC services among pregnant women in maternal health facilities. The finding indicates that access to information among pregnant women is more likely to increase ANC services by 1.646 compared to those without information access. The findings of the study by Tekelab et al. (2019) are consistent with research that proves that exposure to mass media (TV and radio) is significantly associated with ANC usage. A similar study conducted by Mathe (2017) shows that women exposed to mass media, especially TV and radio, are significantly using ANC service and proved that watching television programs on health and ANC services every week extensively influences the chances of women looking for antenatal care services, this is because of information on reproductive health motivates pregnant women to seek for ANC services.

The logistic regression results revealed a strong positive relationship between ANC utilization and public facility use. The finding indicates that public facilities were statistically significant at a 1% significant level ($p < 0.01$) and positively related to ANC services among pregnant women. The probability of women using the public facility is more likely to increase attendance to ANC services by 2.463, *ceteris*

paribus. This implies that the use of public facilities indicates the probability of women utilizing ANC services is higher than the private facility, which might be so costly in accessing the ANC services. The results show that the utilization of ANC increases with an increase in the attendance of women in public health facilities compared to private health facilities. Islam and Masud (2018) found similar results as the place of ANC influences the frequency of visits; they found that the place of delivery, such as a public facility is significantly associated with ANC utilization as compared to a private facility. Gupta et al. (2014) reported similar results and proved that about more than 80% of the interviewed women utilized ANC services at public sector health facilities with dispensaries providing ANC to more than 50% of which within the public sector health facilities, ANC +4 rate at the hospital was higher.

A woman tends to be uncomfortable when seated in one position. If the waiting time is too long, they may fail to attend ANC services, unlike when the waiting time is not very long. From the logistic regression analysis, the researcher found that waiting time is negatively related to ANC and statistically significant at 1% ($p < 0.01$). The finding indicates that an increase in waiting time to receive ANC services decreases the utilization of ANC services among pregnant women by 0.114, *ceteris paribus*. This implies that the probability of women not utilizing the ANC services, given the long waiting time to receive the care, is higher as compared to when the waiting time is short. This study supports the results by Deresa et al. (2024), which proved that waiting time for ANC services hinders the utilization of ANC since some women complained that they had been often made to wait for long periods and from time to time they brushed off due to the fact nurses could declare that it was too late for them to receive ANC. The authors proved that women were more worried about spending the entire day at the medical institution once they had to shop for meals while waiting their turn to be served. This study is in line with the study carried out by Banda et al. (2012), where they found that lengthy ready time before being attended to ANC facilities was a barrier to initiating ANC on the advocated term.

The findings from logistic regression indicate that the women with secondary education and university education were positively related to ANC utilization and significant. These outcomes imply that secondary educated and university-educated women are higher in the utilization of ANC compared to non-formal education. Women with secondary education were more likely to utilize ANC compared to women with no formal education and primary education. The level of education of women determines the utilization level of antenatal health care services. Kawungezi et al. (2015) found results which were comparable to the results of this study that women's level of education influenced the use of ANC, whereby women with higher education levels were more likely to attend ANC than women who were unable to read or write. Also, this study supported the study conducted by Greenaway et al. (2012) on the association between maternal education and the use of health services in Ghana,

where the authors demonstrate a strong link between women's formal education and a measure of women's health education in accessing health care services.

This study found that transport cost was negatively related to ANC utilization and was statistically significant at 1% ($p < 0.01$). The negative coefficient of transport costs shows that the probability of utilizing ANC service increases with the decrease in transport costs. The study reveals that since pregnant women were asked to walk at least a distance (maximum of 5km) to the ANC clinic, a researcher found out those transport costs were not the needy factor. The odds of transport costs were 0.209 times less likely to influence the utilization of ANC in maternal health facilities, *ceteris paribus*. Inconsistent with Deresa et al. (2014), the finding indicates that women were more concerned with high transport costs since they were not working. Thus, it was difficult for them to pay for transport costs, while others needed to be accompanied by their families; hence, transport costs hindered regular visits.

The logistic regression results indicate that the dummy of secondary education and university education was positively related to ANC utilization and statistically significant given ($p < 0.01$ for secondary education, and $p < 0.05$ for university education) with 1% and 5% significant levels, respectively. The findings indicate that the probability of pregnant women with secondary and university education are more likely to utilize ANC by 2.065 and 1.821, respectively. These outcomes imply that pregnant women with secondary and university education are higher in the utilization of ANC compared to non-formal education. The level of education of pregnant women determines the utilization level of antenatal health care services. (Fumbwe et al., 2021; Tekelab et al. 2019; Kawungezi et al. 2015) found the results, which were comparable to the results of this study, that mothers' level of education influenced the use of ANC, whereby mothers with secondary education levels were more likely to attend ANC than women unable to read or write. Also, this study supported the study conducted by Greenaway et al. (2012) on the association between maternal education and the use of health services in Ghana, where the authors demonstrate a strong link between mothers' formal education and a measure of women's health education in accessing health care services.

The occupation of women is categorized as farmer, employed, and unemployed. From the logistic regression, the dummy of farmer and employed pregnant women is statistically significant at 1% ($p < 0.01$) and positively related to the ANC utilization but negatively related to the unemployed woman at 1% significance. It establishes that employed and farmer woman influences their use of ANC services. The coefficient of the dummy of an employed and pregnant farmer is positive, indicating that the women are more likely to utilize ANC in maternal health facilities by 10.818 and 11.618, respectively. The probability of unemployed women is 11.667 times less likely to utilize ANC, *ceteris paribus*. This study supports the results given by Kimani et al. (2016) Akowuah et al. (2016), and Akowuah et al. (2018), revealing that the involvement of

women in different employable ventures influences their ANC utilization. This empowers pregnant women to control the things most affecting their lives, especially healthcare needs.

CONCLUSION AND RECOMMENDATIONS

The study identified several factors that statistically influenced women's use of ANC services in Lushoto district, Tanzania. These factors mirrored findings in other regions globally. Transportation costs, a woman's income level, and occupation played a significant role. This suggests that financial limitations and work demands can create barriers to accessing ANC services. The availability of public health facilities and women's access to information about ANC services were also important factors. This highlights the need for improved outreach and education programs to ensure women know the benefits of ANC and where to access them. Women with secondary or university education were more likely to utilize ANC services. This suggests a potential link between education level and health awareness/prioritization. Married women were more likely to utilize ANC services compared to unmarried women. This could be due to various factors, such as greater support from a spouse or cultural norms.

The study recommends addressing the waiting time issues for antenatal care services to improve their utilization. That is, there is a need to increase the number of nurses and midwives and equip dispensaries to distribute a high workload among them. Also, the study recommends the promotion and provision of education based on the ANC services package and aware of the number of visits recommended by WHO, which provides the need to educate pregnant women, especially of younger ages, on the need to utilize maternal health services including ANC to achieve WHO minimum requirement of several visits on ANC and reducing maternal mortality under SDG 3 and 5. Also, the study recommends training health workers on interpersonal relationships to improve their health workers' relationships, which should be done during basic professional training.

In addition, the study recommends different efforts in the utilization of ANC, which should be targeted in rural areas through strengthening maternal health programs and ensuring that they are more efficient, friendly, focused, and accessible to all pregnant women. Furthermore, exposure to mass media is a key determinant in utilizing ANC services. The positive relationship between exposure to mass media and pregnant women's utilization of ANC. This places great emphasis on the government and other NGOs providing basic information on maternal health through television, radio, and indifferent government and NGO health institutions, specifically on ANC, to reduce maternal mortality and enhance the utilization of maternal health services in Lushoto. Moreover, the facility type categorized as public facility use was significant in determining the level of ANC utilization of pregnant women in Lushoto districts. Women were considered to utilize the service in public health facilities more than in private ones. This then calls for sensitization to the government to increase public facilities, especially in rural areas, that will provide

more health services to the public where most women attend.

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Conflicts of interest:

The authors declare that they have no competing interests.

Authors' contributions

J.S.: Data management, data analysis, and writing of the first draft. L.C: Project Supervision, Data analysis, writing and reviewing of the drafts, E.M: Project supervision, writing and reviewing of the draft, submission

REFERENCES

- Acharya, S. K. (2016). Demographic and Socio-economic Factors Affecting antenatal care services utilization in Nepal. *Journal of Development and Administrative Studies*, 24(1-2), 71-87.
- Akowuah, A.J, Agye-Baffour P&Awunyo-Vito D (2018) Determinants of Antenatal Healthcare Utilization by Pregnant women in 3rd Trimester in Peri-Urban Ghana
- Alenoghena, I. O., Isah, E. C., & Isara, A. R. (2015). Maternal health services uptake and its determinants in public primary health care facilities in edo state, Nigeria. *Nigerian Postgraduate Medical Journal*, 22(1), 25-31.
- Ali, S. A., Dero, A. A., Ali, S. A., & Ali, G. B. (2018). Factors affecting the utilization of antenatal care among pregnant women: a literature review. *Journal of Pregnancy and Neonatal Medicine*, 2(2).
- Banda, I., Michelo, C., & Hazemba, A. (2012). Factors associated with late antenatal care attendance in selected rural and urban communities of the copperbelt province of Zambia. *Medical Journal of Zambia*, 39(3), 29-36.
- Deresu Dinagde, D., Tesema, K. F., Wolde, F., Heyi, G. W., Feyisa, G. T., & Walle, A. D. (2024). Intimate partner violence is independently associated with poor utilization of antenatal care in Arba Minch town, southern Ethiopia: A cross-sectional study. *PLOS Global Public Health*, 4(1), e0002246.
- Fumbwe, F., Lihawa, R., Andrew, F., George, K., & Mkuna, E. (2021). Examination on level of scale efficiency in public hospitals in Tanzania. *Cost Effectiveness Resources Allocation* 19, 49 (2021). <https://doi.org/10.1186/s12962-021-00305-4>

- Greenaway, E. S., Leon, J., & Baker, D. P. (2012). Understanding the association between maternal education and use of health services in Ghana: exploring the role of health knowledge. *Journal of biosocial science*, 44(6), 733-747.
- Gupta, S., Yamada, G., Mpembeni, R., Frumence, G., Callaghan-Koru, J. A., Stevenson, R., ... & Baqui, A. H. (2014). Factors associated with four or more antenatal care visits and its decline among pregnant women in Tanzania between 1999 and 2010. *PloS one*, 9(7), e101893.
- Halle-Ekane, G. E., Obinchemti, T. E., Nzang, J. L. N. O., Mokube, N. M., Njie, M. M., Njamen, T. N., & Nasah, B. T. (2014). Assessment of the content and utilization of antenatal Care Services in a Rural Community in Cameroon: a cross-sectional study. *Open Journal of Obstetrics and Gynecology*, 4(14), 846-856.
- Islam, M. M., & Masud, M. S. (2018). Determinants of frequency and contents of antenatal care visits in Bangladesh: Assessing the extent of compliance with the WHO recommendations. *PloS one*, 13(9), e0204752.
- Kawungezi, P.C., AkiiBua, D., Aleni, C., Chitayi, M., Niwaha, A., Kazibwe, A., Sunya, E., Mumbere, E.W., Mutesi, C., Tukei, C. and Kasangaki, A. (2015). Attendance and utilization of antenatal care (ANC) services: multi-center study in upcountry areas of Uganda. *Open Journal of Preventive Medicine*, 5(3), 132.
- Kibusi, S. M., Sunguya, B. F., Kimunai, E., & Hines, C. S. (2018). Health insurance is important in improving maternal health service utilization in Tanzania—analysis of the 2011/2012 Tanzania HIV/AIDS and malaria indicator survey. *BMC Health Services Research*, 18, 1-10.
- Kimani, D. N., Mugo, M. G., & Kioko, U. M. (2016). An econometric analysis of health care utilization in Kenya. *European Scientific Journal*, 12(16), 443-461.
- Kitole, F. A., Lihawa, R. M., & Mkuna, E. (2022). Comparative analysis on communicable and non-communicable diseases on catastrophic spending and impoverishment in Tanzania. *Global Social Welfare*, 1-12.
- Kitole, F. A., Lihawa, R. M., & Mkuna, E. (2023). Equity in the public social healthcare protection in Tanzania: does it matter on household healthcare financing? *International Journal for Equity in Health*, 22(1), 50.
- Kitole, F.A., Lihawa, R.M., & Mkuna, E. (2022b). Analysis on the equity differential on household healthcare financing in developing countries: empirical evidence from Tanzania, East Africa. *Health Economic Review* 12, 55 (2022). <https://doi.org/10.1186/s13561-022-00404-9>
- Kitole, F.A., Sesabo, J.K., & Lihawa, R.M. (2023b). Instrumental variable approach on analyzing risk factors associated with noncommunicable disease prevalence in Tanzania: a nonexperimental design. *Health Science Report*. 2023; 6:e1585. doi:10.1002/hsr2.1585
- Lincetto, O, Mothebesoane-Anoh, S, Gomez P, Munjanja, S (2015) Antenatal Care. *Opportunities for Africa's Newborns*. WHO Reproductive Health Indicator countdown to 2015 Child Survival Process.
- Machio, M. P. (2008). Demand for maternal Health care services in Kenya. Unpublished Master of Arts Research Paper). University of Nairobi.
- Mathe, M. (2017). Socio-demographic factors affecting utilization of Antenatal Care Services in Botswana. *International Journal of Academic Research in Business and Social Sciences*, 7(9), 477-520.
- Mourtada, R., Bashour, H., & Houben, F. (2021). A qualitative study exploring barriers to adequate uptake of antenatal care in pre-conflict Syria: low cost interventions are needed to address disparities in antenatal care. *Contraception and Reproductive Medicine*, 6(1), 1-12.
- Njiku, F., Wella, H., Sariah, A., & Protas, J. (2017). Prevalence and factors associated with late antenatal care visit among pregnant women in Lushoto, Tanzania. *Tanzania Journal of Health Research*, 19(3).
- One Plan II (2016-2020) The National Road Map Strategic Plan to Improve Reproductive, Maternal NewBorns, Child & Adolescent Health in Tanzania. Ministry of Health, Community Development, Gender, Elderly and Children, URT.
- Ota, E., da Silva Lopes K., Middleton, P., Flenady, V, Wariki W.M., Rahman, M.O., Tobe-Gai R, Mori R. Antenatal interventions for preventing stillbirth, fetal loss and perinatal death: an overview of Cochrane systematic

- reviews. *Cochrane Database Syst Rev.* 18;12(12): doi: 10.1002/14651858.CD009599.
- Rurangirwa, A. A., Mogren, I., Nyirazinyoye, L., Ntaganira, J., & Krantz, G. (2017). Determinants of poor utilization of antenatal care services among recently delivered women in Rwanda; a population-based study. *BMC Pregnancy and Childbirth*, 17, 1-10.
- Rutaremw, G., Wandera, S. O., Jhamba, T., Akiror, E., & Kiconco, A. (2015). Determinants of maternal health services utilization in Uganda. *BMC Health Services Research*, 15, 1-8.
- Singh, J. K., Evans-Lacko, S., Acharya, D., Kadel, R., & Gautam, S. (2018). Intimate partner violence during pregnancy and use of antenatal care among rural women in southern Terai of Nepal. *Women and birth*, 31(2), 96-102.
- TDH-MIS (2016) Tanzania Demographic Health Survey and Malaria Indicator Survey. Ministry of Health, Community Development, Gender, Elderly and Children, National Bureau of Statistics, Office of the Chief Government Statistician and ICF. Dar es Salaam, Tanzania, and Rockville, Maryland, USA.
- Tekelab, T., Chojenta, C., Smith, R., & Loxton, D. (2019). Factors affecting utilization of antenatal care in Ethiopia: a systematic review and meta-analysis. *PloS One*, 14(4), e0214848.
- UNICEF (2015) Progress for Children beyond Averages: Learning from the MDGs. New York, 2015
- URT (United Republic of Tanzania). (2013). Population and housing census 2012: population distribution by administrative areas. National Bureau of Statistics.
- Vyawahare, A. P., Gaidhane, A., & Wandile, B. (2023). Asthma in Pregnancy: A Critical Review of Impact, Management, and Outcomes. *Cureus*, 15(12).
- Wake, S. K., Botor, A., Mohammed, A., Gemed, K., Bariso, M., & Gerema, U. (2023). Disparities in Antenatal Care Visits between Urban and Rural Ethiopian Women. *Journal of Pregnancy*, 2023.
- WHO (2016) WHO recommendations on antenatal care for a Positive Pregnancy Experience. WHO, Geneva, 2015