ANTENATAL CARE SERVICE UTILIZATION AMONG WOMEN IN UGANDA: A MULTILEVEL ANALYSIS

[1]Alex Mugarura, [1]Will Kaberuka, [2]Leonard K Atuhaire, [1]Ruth Atuhaire, [1]Arnest Abaho

[1]Makerere University Business School

[2]Makerere University

1. INTRODUCTION

Antenatal care plays an important role in ensuring a healthy mother and baby during pregnancy and after delivery, maximizing good health outcomes like; low maternal and neonatal mortality, low postpartum anaemia, and appropriate birth weight (Awusi et al, 2009; WHO, 2005; and Adekanle et al, 2008). It should be noted that going for antenatal care service, mothers are given important information on danger signs during pregnancy, preventive and curative treatment, appropriate nutrition, breastfeeding, and contraceptive use. This is normally the time when the identification of pregnancy complications are made so as the appropriate referral or specialist case management is recommended (WHO, 2005).

Over 99% of mothers who die of complications related to pregnancy and childbirth each year are found in developing countries. The global maternal mortality rate (MMR) is 216 while the MMR in developing regions is 239, which is roughly 20 times higher than that of developed regions, where it is just 12. Sub-Saharan Africa has a very high MMR which is estimated at be 546 maternal deaths per 100 000 live births. In 2015, Developing regions account for approximately 302 000 of the estimated global maternal deaths, with sub-Saharan Africa alone accounting for roughly 201 000 deaths, followed by Southern Asia (66 000) (WHO et al, 2015). It has been noted that the number of women dying due to complications during pregnancy and childbirth has decreased by 43% from an estimated 532 000 in 1990 to 303 000 in 2015. Although this progress is notable, however, the annual rate of decline was less than half of what was needed to achieve the target according to the Millennium Development Goal (MDG) target of reducing the maternal mortality ratio by 75% between 1990 and 2015, which would require an annual decline of 5.5% (WHO et al, 2015).

In Uganda, Maternal morbidity and mortality remains high; largely due to inadequate antenatal care (ANC), low skilled deliveries and poor quality of other maternal health services (Ediau1 et al, 2013). Uganda maternal mortality is estimated at 343 deaths per 100,000 live births, putting Uganda in the second position among the East African countries (Tanzania (398); Kenya (510); and Rwanda (290)) (WHO et al, 2015). This meant that Uganda could not achieve the MDGs by 2015 and continues to remain a challenge. Most women in Uganda have continued to register late ANC attendance, averaging at 5.5 months of pregnancy and do not complete the required four visits. Therefore this inadequate utilization of ANC is greatly contributing to persisting high rates of maternal and neonatal mortality in Uganda (Kawungezi et al, 2015).

Understanding the factors influencing the utilization of antenatal care services should be a matter of great policy concern to the government and other stakeholders, especially donors. Whereas studies have been done to understand the factors influencing the utilization of antenatal care services in Uganda (Kyomuhendo, 2003; Tann et al, 2007; Kiwuwa et al, 2008; Parkhurst et al, 2005; Bbaale, 2011; Ediau1 et al, 2013; and Kawungezi, 2015), no study has been carried about the utilization of antenatal care using the Uganda Demographic Health Survey (UDHS) 2011.

Demographic and health survey data as used for child mortality analysis have a hierarchical structure, therefore a multilevel analysis, known as a hierarchical model that accounts for the lack of independence across levels of nested data is the suitable model for such analysis. The conventional regression assumes that all experimental units are independent in the sense that any variable affecting maternal mortality has the same effect in all families. A multilevel modeling relaxes this assumption and allows these variables' effects to vary across the families. Therefore this study explores the hierarchical structure at individual and household (family) levels of analysis and examines the effect of household characteristics/level factors on Utilization of antenatal health services in Uganda.

2. LITERATURE REVIEW

This paper will extend the existing literature by analyzing the factors influencing the utilization of antenatal care at individual and household levels using a hierarchical model, providing more informative insights to policy makers about the potential public health strategies that can increase the uptake and access to utilization of antenatal care services in Uganda.

2.1 Individual level factors with the utilization of antenatal care services

Age of woman: Age of a mother has a significant influence on use of antenatal services. Studies by Dairo et al 2010 and Nguyen et al 2012 indicate that Women who were 25 years and above utilize ANC services more than women who were below 25 years of age. Age of a woman was found to be a major predictor for three antenatal care visits (Manas et al, 2013). This is also

supported in studies by Abosse et al (2010) and Nketiah et al (2013) which indicated that ANC service utilization was significantly influenced by maternal age. Mothers who are in the age group of 25–29 years were less likely to utilize ANC service than women who are 35 years and above. However, studies by Kwast et al (1988) and UNFPA (2004) reached a contrary view on age of the woman and utilization of antenatal care services.

Occupation: Magadi et al (2000); Bbaale (2011); Simkhada et al (2008) found a significant association between occupation of respondents and their utilization of ANC services. However, Olayinka et al (2012) found no significant association between occupation of respondents under study and their utilization of ANC services in Nigeri.

Religion: Religious differences that capture traditions and beliefs of mothers are found to be significant in influencing both the timing and frequency of utilizing the antenatal care services. Studies by Adekanle et al (2008) and Olayinka et al (2012) found a significant association between religion and utilization of antenatal care services. This was also supported by Nketiah et al (2013). Dairo et al (2010) revealed that Women who were Muslims or other religions were more than 2 times likely to attend ANC clinic than women who were Christians.

Education level of a mother: A number of studies have shown that education level of a mother has a significant association with the use of antenatal health care services. According to Becker et al (1993); Abosse et al (2010) and Bergsjo (1997) mother's education was the most consistent and important determinant of the use of maternal health services. This could be because educated women are more aware of health problems, know more about the availability of health care services, and utilize the information more effectively than non-educated women (Costello et al, 1996). Studies by Bbaale (2011); Titaley et al (2010); Adekanle et al (2008); Navaneetham et al (2002); Nketiah et al (2013) also indicated that mother's education was statistically significant in influencing the attainment of the four antenatal visits. The utilization of antenatal care services was also significantly associated with education of both the mother and her partner (Bbaale, 2011 and Simkhada et al, 2008). Education level of a woman and the husband's acceptance of services had a significant influence on utilization of antenatal care services (Olayinka et al (2012). However, Adekanle et al (2008) found that mothers with primary and lower education were more likely to book late for antenatal care compared to those with at least secondary education. Education, on the other hand, by imparting awareness and autonomy to the women, encourages utilization of maternal services and leads to demand for maternal health care services (Manas et al, 2013).

2.2 Family level factors

Residence: The utilization of the antenatal care services was significantly associated with location disparities (Bbaale, 2011). According to Nketiah et al (2013), there is a significant relationship between residence and antenatal care utilization. It is demonstrated that women in urban areas are more likely to use antenatal services more than women in rural areas (Paredes et al. 2005). However, a study by Navaneetham et al (2002) found that women in urban areas were less likely to receive Antenatal Care services than those living in rural areas.

Region: The timing and frequency of antenatal visits were significantly associated with regional disparities (Bbaale 2011). Studies in developing countries have found regional inequalities in access to antenatal care services (Magadi et al, 2000; Addai, 2000).

Distance: Location and long distances are often seen to negatively affect ANC service utilization. A study by (Ensor T, 1996) found that distance is a principle determinant of how long patients delay before seeking care. In Zimbabwe, it is said that up to 50% of maternal deaths could be attributed to the absence of emergency transport to the health centers. At the same time, distance has been cited as the main reason Uganda's rural women choose to deliver at home rather than at a health facility (Amooti-Kaguna et al, 2000). Therefore it can be said that distance to facilities imposes a considerable cost on individuals and thus reducing the demand for the services from the health facilities.

Therefore there is a significant relationship between distance and utilization of antenatal care services (Olayinka et al, 2012). Distance to the health facility is inversely associated with ANC utilization (Glei et al. 2003). Magadi et al. (2000) in Kenya demonstrated that an increase in distance to the nearest healthcare facilities was associated with fewer antenatal visits. Uncomfortable transport, poor road conditions and difficulties in crossing big rivers are some of the barriers to utilization of health facility services (Mathole et al. 2004; Mumtaz et al, 2005). However, Nketiah et al (2013) in a study in Ghana found no significant relationship between physical access to health services and utilization of antenatal care services.

Household Wealth status (index): In the study by Bbaale (2011) on the utilization of antenatal care services, it was shown that utilization of antenatal care services was significantly associated with wealth status. The Wealth status of the household influences the frequency and timing of antenatal care. This is supported by a study by Magadi et al (2000) done in Kenya. It was noted that the frequency is more related with the ability to pay for transport and care than the timing of care. A study done by Simkhada et al (2008) in developing countries also indicated that wealth status had a significant influence on utilization of antenatal care services, and it is argued that the utilization rate increases among women from household with high wealth status (Nketiah et al, 2013; Fan and Habibov 2009; Sagna et al, 2012). Antenatal care is provided for free in some

African countries like Zambia, thus, wealthier households are expected to be better equipped to cope with any other direct and indirect costs of seeking antenatal care (De Allegri et al. 2011).

Family size/household size: Family size significantly influences the use of antenatal care services. A study by Abosse et al (2010) indicated that family size was major predictor of antenatal care service utilization. It was also observed that availability of women's time is important. Women spend more time on their responsibilities like; care of children, collecting water or fuel, cooking, cleaning, than on their own health (World bank, 1994). Mothers who live within a household size less than three people were eight times more likely to utilize ANC than those living in a household size greater than five (Abosse et al, 2010). Hence, family size was a strong determinant of antenatal care service utilization.

3. DATA AND METHODS OF ANALYSIS

3.1 Data

Secondary data from the Uganda Demographic and Health Survey (UDHS) 2011 was used. This survey was a follow up on the previous surveys, which covered the whole of Uganda. A sample of 10,086 households was selected from 404 Enumeration Areas (EAs). A two-stage sampling was employed. In the first stage, 404 Enumeration Areas were sampled from a list of clusters prepared by Uganda National Household Survey (UNHS) of 2010. The second stage involved updating the UNHS-2010 list in the 404 Enumeration Areas and then the sample of households selected purposively. All women aged 15-49 years who were either usual residents or visitors present in the sampled household on the night before the survey were interviewed. The cleaning and coding of the data collected was done so as to remain with variables of interest. The coded data was analyzed using STATA version 12.0.

3.2 Study Variables

Dependent variable: the study analyzed whether the mother completed a four minimum number of antenatal visits as recommended by the WHO.

Explanatory variables: These were put into two categories; Individual level factors and Household/family level factors. The individual level factors included; Mother's age, Occupation, Religion, Education level, Marital status and Number of living children. Household level factors included; Residence, Household wealth index, Family size, and Region.

3.3 Methods

Descriptive statistics were presented using frequency tables; testing for associations, between two variables was done using the chi-square, while a hierarchical model (random effects model)

modal was fitted to examine the effect of family level factors on the utilization of antenatal care services.

As mentioned above, the outcome variable is binary; therefore a hierarchical or multilevel logistic regression model was used in the analysis. For the i th response in the j th household, we observe a dichotomous response:

Yij = 1, for a mother who did attend a minimum four times of antenatal care services during pregnancy, or 0, otherwise.

We assume that Y ij /P ij = Bernoulli (P ij)

Where P ij =Pr (Y ij =1) is the probability that i th observation (Mother) will have attended up to minimum four times of antenatal care services. Therefore, for the j th household, the usual logistic regression will be:

$$\text{Logit (Pij)} = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = b_0 + b_{ij}x_{ij} + \dots + b_{kn}x_{kn} \qquad \textbf{(1)}$$

Where; $\quad x_i$'s are independent variables

$\qquad b_0$ is a constant.

$\qquad b_i$ are unknown coefficients of each x_i.

Considering the nested structure in the data set, A random-effects regression model, which is the simplest mixed model, will have the following form.

$$\text{Logit (Pij)} = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = x_{ij}\beta + V_j + e_{ij} \qquad \textbf{(2)}$$

Where; $\quad x_{ij}$ = the covariate matrix

$\qquad \beta$ = the vector of unknown regression parameters,

$\qquad V_j$ = the random cluster effect (one for each level-2 cluster i.e. family/household)

$\qquad$ e ij = the error term

V_j the random effect (one for each family/household). These random effects represent the influence of j-th community on woman utilization of ANC that is not captured by the observed

covariates. These are treated as random effects because the sampled subjects (mothers) are thought to represent a different population of subjects (families).

4. RESULTS

Descriptive Analysis

Distribution of respondents by Individual level characteristics

Table 1 Distribution by individual characteristics

Age group	Frequency	Percent (%)
15-19	473	6
20-29	4,304	54.6
30-39	2,517	32
40-49	584	7
Total	**7,878**	**99.6**
Education level of woman		
No education	1,427	4
Primary	4,687	18
Secondary	1,445	60
Higher	319	18
Total	**7,878**	**100**
Religion		
Catholic	3,447	44
Muslim	1,086	14
Pentecostal	911	11
Protestant	2,209	28
SDA	135	2
Other	90	1
Total	**7,878**	**100**
Number of children living		
0 - 2	2,547	32
3-_6	4,172	53
> 6	1,159	15
Total	**7,878**	**100**
Marital Status		
Single	240	3
Married	6,827	87

Divorced/Widowed/Separated	811	10
Total	**7,878**	**100**
Occupation		
Not working	1,628	54
Agricultural	4,244	21
Clerical	18	0.2
Professional/technical/managerial	307	3.8
Sales and services	1,681	21
Total	**7,878**	**100**

From the Table 1 above, about 93% of the total respondents were of reproductive age (15-40) and about 96% had some level of education. About 85% of the respondents were Christians (Catholics, Protestants, Pentecostals and SDA). The majority (85%) had less than 6 children and married (87%) while professionals were just 4%.

Distribution of respondents by Family/household level characteristics

Table 2 Distribution by Family/household level characteristics

Region	Frequency	Percent
Central	2002	25
Eastern	1874	24
Northern	2317	29
Western	1685	22
Total	**7878**	**100**
Household/Family size		
1--4	2019	26
5--10	5315	67
>10	544	7
Total	**7878**	**100**
Household wealth index		
Poor	3580	45
Middle	1405	18
Rich	2893	37
Total	**7878**	**100**
Residence		
Rural	6196	79

Urban	1682	21
Total	**7878**	**100**

From the Table 2, it was shown that the respondents seem to have been equally spreed among regions of origin. According to the family size, 67% had between 5-10 family members; about 45% coming from poor families and 79% from rural areas.

Frequency of Antenatal Care visits during pregnancy

Table 3 Utilization of ANC services

Ever gone for Antenatal care service during pregnancy	Frequency	Percent
Yes	4639	94.5
No	179	3.7
Don't know	89	1.8
Total	**4907**	**100**
Number of antenatal visits during pregnancy		
No antenatal visit	179	3.65
1-3 times	2173	44.28
4 & above	2466	50.25
Don't know	89	1.81
Total	**4907**	**100**

From the Table 3, the study revealed that more than three-quarters (94%) of the respondents had ever gone for Antenatal care service during pregnancy while only 3.7% had not got any antenatal care service during pregnancy. More than half (50.2%) of the respondents had completed at least four recommended antenatal visits during pregnancy while at least 3.6% had never had any Antenatal care visits during pregnancy. These results show that ANC attendance is quite appreciated by most women as a way of monitoring both the growth of the baby and their own health status.

Frequency of Antenatal care visits for some selected study variables

Table 4 Distribution by Number of Visits during pregnancy

Number of Antenatal visits during last pregnancy	No visit	%	Three or fewer visits	%	Four or more than four visits	%	Don't know	%	Total	Total %
Age group										
15--19	18	4.8	176	46.9	177	47.2	4	1.1	375	100
20-29	75	2.9	1116	43.9	1300	51.1	52	2	2543	100
30-39	55	3.5	707	45.4	769	49.4	25	1.6	1556	100
40-49	31	7.2	174	40.1	220	50.8	8	1.8	433	100
Education level										0
No education	42	4.9	389	45.3	414	48.3	13	1.5	858	100
Primary	107	3.8	1351	47.4	1349	47.3	42	1.4	2849	100
Secondary	28	2.9	371	38.4	545	56.4	23	2.3	967	100
Higher	2	0.8	62	26.6	158	67.8	11	4.7	233	100
Religion										0
Catholics	76	3.6	939	44	1083	50.7	37	1.7	2135	100
Protestants	51	3.7	636	46.2	668	48.5	23	1.7	1378	100
Muslims	25	3.6	267	38.8	379	55.2	16	2.3	687	100
Pentecostal	26	4.6	257	45.4	271	47.8	12	2.1	566	100
SDA	1	1.1	42	47.7	44	50	1	1.1	88	100
Others	0	0	32	60.4	21	39.6	0	0	53	100
Marital status										0
Never married	11	5	98	45.4	103	47.7	4	1.8	216	100
Married	141	3.4	1815	44	2097	50.8	73	1.8	4126	100
Divorced/widowed/separated	25	1	2097	87.4	265	11	12	0.5	2399	100
Residence										0
Urban	27	2.2	436	36.8	689	58.1	33	2.7	1185	100
Rural	152	4	1737	46.7	1777	47.7	56	1.5	3722	100
Wealth Index										0
Poor	86	4	1017	47.9	997	46.9	24	1.1	2124	100
Middle	37	4.4	416	49.5	379	45.1	8	0.9	840	100
Rich	56	2.8	740	38.1	1090	56.1	57	2.9	1943	100

From the study, it is indicated that completing the recommended number of visits (4 times) may depend on age, education level, religion, marital status, residence, and wealth index. From Table 4, it was shown that completion of the recommended antenatal care visits (4 times) during pregnancy is high among women from the rich households compared to women from poor families/households. 56% of the women from the rich households had completed the recommended visits while 40.9% of them did not complete the visits. About 51.9% of the women from poor families had not completed the recommended visits compared to 46.9% who completed the recommended visits from the rural areas. It is also indicated that completion of recommended antenatal visits is high among age group 20-29 and 40-49 years (51.1% and 50.8% respectively). It was also observed that the completion rate of the recommended visits was high among women of secondary and higher levels of education. This shows that the more educated the mother is educated the more she will seek for the services knowing the importance of visiting health centres during pregnancy. Muslims, Catholics and SDAs have high level of antenatal care visits (recommended visits). Of the total married women considered, 50.8% of them had completed the recommended number of visits while 3.4% did not go for any antenatal care visit. The completion rate among the widowed/separated was very low. From the table 4, out of the widowed/separated women considered, only 11% completed the recommended number of antenatal visits (4 times) during the last pregnancy. Of the total women residing in the urban areas, at least 58% of them completed the recommended visits while 39% did not finish the visits. Among the rural women, only 47% completed the recommended visits.

Multilevel regression results

Table 5 Random effects variances

	Model 0	Model 1	Model 2
	Zero model	**Individual**	**Local**
Variance at local level	1.651	0.769	0.256
Variance partition coefficient (VPC) [%]	54.8	21.7	9.8
Likelihood ratio test	Reference	1240.12	303.14

Table 5 shows the variances for each of the random effects models. The zero model shows that 54.8% of the variance in the probability of completing the recommended four antenatal care visits is due to differences between communities and thus may be explained by family or local level variables context. When the individual and household characteristics were included (Model 1), the variance decreased to 21.7%. In model 2, all the variables in both levels were included; the study shows that the variance further decreased to 9.8%. These results clearly indicated

inequalities in utilization of antenatal care services and deficiencies in ensuring the completion of a minimum of four antenatal care visits amongst households.

**Table 6 Multilevel logistic regression models for completing four
or more antenatal care visits.**

	Model 1		Model 2	
Individual level factors	**Odds ratio**	**P-Value**	**Odds ratio**	**P-Value**
Age				
15--19				
20-29	1.245	0.023	1.224	0.02
30-39	2.686	0.018	2.602	0.004
40-49	2.234	0.002	2.208	0.001
Education level				
No education	1			
Primary	1.812	0.048	1.544	0.04
Secondary	2.468	0.024	2.104	0.02
Higher	2.864	0.018	2.42	0.008
Religion				
Catholics	1			
Protestants	1.443	0.046	1.544	0.041
Muslims	0.804	0.042	0.688	0.038
Pentecostal	0.684	0.024	0.602	0.024
SDA	0.86	0.034	0.64	0.031
Others	0.624	0.05	0.754	0.048
Number of Living children				
0-2	1			
3--6	0.9845	0.002	0.854	0.002
>6	0.601	0	0.424	0
Marital status				
Never married	1			
Married	2.484	0.038	2.244	0.038
Divorced/widowed/separated	1.84	0.042	1.824	0.024
Occupation				
Working	4.328	0	4.02	0
Not working	1			

Family/household level factors				
Region				
Central			1	
Eastern			0.865	0.044
Northern			0.876	0.034
Western			0.964	0.048
Residence				
Urban			3.48	0.001
Rural			1	
Wealth Index				
Poor			1	
Middle			2.045	0.002
Rich			3.824	0
Family size				
<5			1	
5--10			1.864	0.024
>10			1.204	0.048

Table 6 shows the results of the multilevel logistic models for a minimum of four antenatal care visits. Model 1 shows the effect of individual factors on the willingness to complete four or more antenatal care visits. The results show that a woman of age group 20-29 is 1.2 times more likely to complete the recommended antenatal visits compared to a woman aged below 20 years (OR=1.245. while a mother aged 40 years and above are 2.2 more likely to complete the recommended antenatal visits compared to a mother aged below 20 years. The study also shows that mothers who are educated, working and married have high chances of completing the recommended antenatal care visits. In contrast, the likelihood of completing the minimum number of antenatal care visits decreases with an increasing number of living children in the household. Also, mothers of Islamic (Muslim) religion, Pentecostals, SDA's, are less likely to complete the recommended antenatal care visits compared to a Catholic mother. On the orther hand, Protestant women were 1.4 times likely to complete the recommended antenatal care visits compared to Catholics. The findings related to individual variables are similar to those by Kesterton et al (2010), Stephenson et al (2002), where characteristics such as being an older mother, having fewer children, higher level of education, were associated with a greater likelihood of completing the minimum number of visits.

The Family/household level variables are included in Model 2. The findings indicate that the likelihood of completing the minimum number of visits increases with increasing level of a family/household wealth index. This means that women from poor households/families or socially and economically disadvantaged are less likely to complete the minimum recommended number of antenatal care visits. The findings are in line with studies by Bbaale (2011); Magadi et al (2000); Nketiah et al, 2013; and Sagna et al, 2012. This could be because the women from high economic status will manage to meet all the costs involved in the antenatal care visits required which may be a problem to women from economically disadvantaged families

Women living in communities in urban areas were 3.48 times more likely to complete the recommended antenatal care visits compared to those women living in the rural areas. This could be because rural women are likely to be far away from th services which services may also be costly.

Family size was also a significant factor on the willingness to complete the recommended antenatal care visits. It was shown that women from the big sized household/families have slightly reduced chances of completing the recommended antenatal care visits compared to women from the small sized families or households. This is in line with the results by Abosse et al (2010) who pointed out that availability of women's time is important in attending the antenatal care services. Mothers spend more time on other responsibilities e.g. care of children, cooking and cleaning, than on their own health (World bank, 1994).

After including the family level variables, controlling the effect of the individual and household variables, the odds ratio for Occupation, Marital status, Number of living children, Education level and Age of respondent slightly decreased.

5. CONCLUSION AND POLICY IMPLICATIONS

Conclusions

While both individual-and household-level factors are instrumental in determining the utilization of ANC and adequate use in Uganda, the findings revealed inequalities in the utilization of antenatal care services and deficiencies in ensuring the completion of a minimum of four antenatal care visits amongst families or households. The results showed that all the individual variables; age, education level, occupation, marital status, number of living children, religion were significant factors affecting the utilization of antenatal care services. The family level factors; region, family size, wealth index and residence were also significant factors in the utilization of antenatal care services in Uganda.

Policy implications

With inequalities in utilization of antenatal care services and deficiencies in ensuring the completion of a minimum of four antenatal care visits amongst households, it is very important that the government considers to seriously promote the use of ANC among pregnant women. The access to maternal health services by rural women and those from poor families/households should be emphasized and a national sensitization campaign among women should be carried to increase the knowledge about the importance of Antenatal care services during pregnancy so as to make women appreciate the fact that ANC attendance is not only good for growth of the baby but also for the health status of the mother.

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