

Predictors of the Timing and Number of Antenatal Care Visits among Unmarried Compared To Married Youth in Uganda Between 1995 And 2011

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1 **Predictors of The Timing and Number of Antenatal Care Visits among Unmarried**
2 **Compared To Married Youth in Uganda Between 1995 And 2011**

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8 **Abstract**

9 **Introduction**

10 Inadequate use of maternal health services among the youth remains a serious health challenge
11 in Uganda. The low use of maternal health services among youth partly explains the persistence
12 high maternal mortality rate in the country. Yet, improved use of maternal health services by
13 the youth would help reduce maternal deaths in the country. Therefore, this study examines
14 predisposing and enabling factors associated with the timing and the number of antenatal care
15 visits among unmarried compared to married youth aged 15-24 years between 1995 and 2011
16 in Uganda.

17 **Methodology**

18 Two-level binary logistic and linear regression models with district as a second level of analysis
19 were conducted on pooled data of the 1995, 2000/01, 2006 and 2011 Uganda Demographic
20 and Health Surveys. This analysis was among 581 unmarried, compared to 5,437 married
21 youth, aged 15-24 years.

22 **Results**

23 Only 16% of unmarried youth and 18% of married youth had ANC in the first trimester.
24 Education was the only factor that was significantly associated with early use of antenatal care
25 among unmarried youth. Whereas high education was associated with higher odds of using
26 antenatal care in the first trimester among married youth (OR=1.30, 95%CI=1.08-1.57), it was
27 associated with late start among unmarried youth (OR=0.56, 95%CI=0.31-0.98). Higher parity,
28 protestant membership and residence in eastern region were associated with late start of
29 antenatal care, while access to radio and television, and education level of the husband were
30 associated with higher odds of early use of antenatal care among married youth.

31 Overall, married youth were more likely to have more frequent antenatal care visits than
32 unmarried youth. Among both groups, higher educational attainment and greater access to
33 radio were associated with frequent antenatal care use. Residing in western region was
34 associated with fewer antenatal care visits among both married and unmarried youth. Access
35 to newspaper was associated with more antenatal care visits among married youth only.

36 **Conclusion**

37 This study presents the individual level predisposing and enabling factors that are important
38 predictors of the use of antenatal health care services among youth that will guide policy to
39 reduce maternal deaths among youth in Uganda.

40 **Introduction**

41 Maternal mortality reduction is one of the unfinished agenda of the Millennium Development
42 Goals (1) and one of the goals and priorities of the global sustainable development goals (2, 3).
43 Worldwide, maternal mortality is still high as 303,000 women were reported dead in 2015 due
44 to maternal related causes (4, 5). This is worse in sub-Saharan Africa that accounts for 66
45 percent of these deaths (6). Comparably, the maternal mortality ratio in Uganda is still high at
46 336 per 100,000 live births in 2016 though it reduced from the highs of 540 deaths per 100,000
47 live births in 1995 (7, 8). The life-time risk of women in Uganda is also still high at 1 in 49
48 women at risk of dying from maternal causes compared to the global estimate of 1 in 190 (8,
49 9).

50 Early and frequent antenatal care use has been found to be associated with reduced maternal
51 and child deaths and morbidity (10-16) and better obstetric outcomes through early
52 identification and management of complications (12, 14, 17, 18). On the other hand, late ANC
53 start has been observed to be associated with poor pregnancy outcomes like low birth weight
54 and pre-mature births (19). Timely and frequent ANC benefits include provision of preventive
55 health services such as vaccination, malaria prophylaxis, iron supplementation, nutrition
56 counselling, and HIV counselling and testing (14, 20-22). Antenatal use also influences the use
57 of subsequent maternal health services, such as delivery in the health facilities, or under the
58 supervision of the trained birth attendant (21, 23-31), and postnatal check-ups (26-29, 31-33).

59 The Focused ANC model of World Health organisation (WHO) recommends at least four ANC
60 visits, and the first one should be in the first three months of the pregnancy (34-37). Historical
61 patterns indicate that achievement of SDG 3.1 will require 91 percent coverage of ever use of
62 ANC and 78 percent of at least four antenatal care visits together with 81 percent of in-facility
63 delivery as well as 87 percent of skilled birth attendance (38). Even though use of at least one

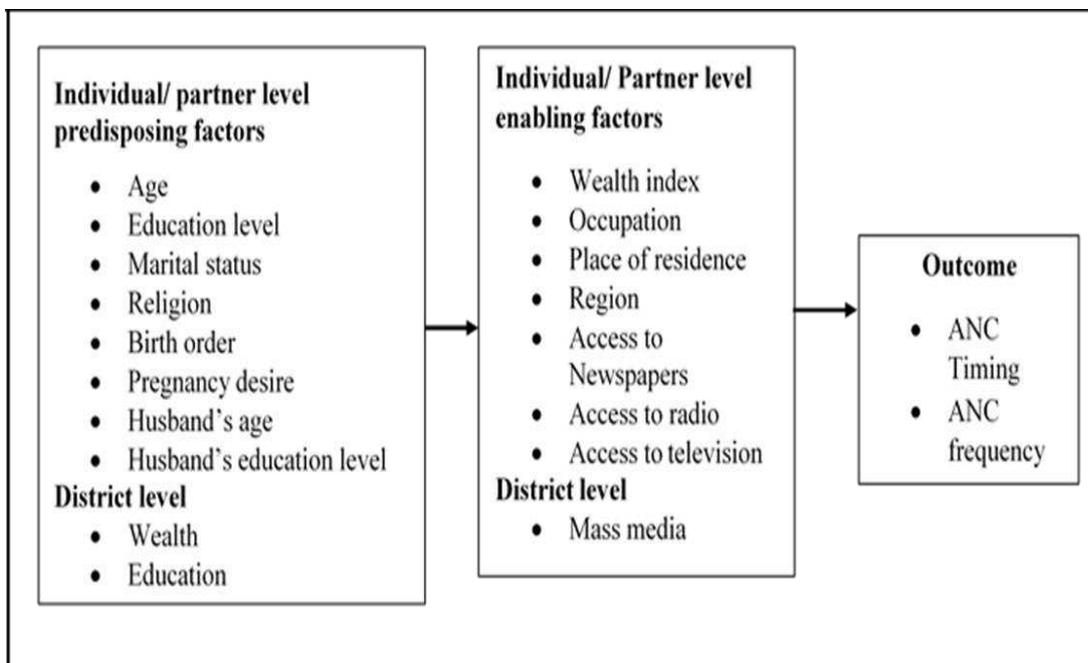
64 ANC visit among women of reproductive age is almost universal (97%) in Uganda, 60 percent
65 and 48 percent had at least four ANC visits in 2016 and 2011 respectively, while only 30
66 percent and 21 percent had ANC in the first trimester in 2016 and 2011 respectively (8, 39).
67 This is lower among adolescents as 93 percent and 97 percent of them ever had ANC in 2011
68 and 2016 respectively, while a much lower proportion (14%) had at least four ANC visits in
69 2011.

70 Previous studies show that the determinants of ANC use among youth has been influenced by
71 predisposing, enabling, environment, need and health provider factors, although the influence
72 is mixed. Antenatal care use has been associated with age of the youth (40), education level
73 (25, 40, 41), pregnancy desire (42, 43), and parity (25, 40, 44). Wealth quintile (26, 30, 45),
74 employment status (46), region of residence (47-49) and urban residence were also associated
75 with early and frequent ANC use (40, 41).

76 Studies have found that some girls especially the unmarried wait to disclose their pregnancy
77 until onset of labour due to fear of family and society reaction to the pregnancy which affects
78 ANC use (42, 50). Partner violence against women also leads to late start or infrequent use of
79 ANC among youth (51, 52). Prior experiences and quality of care at earlier ANC visits, service
80 availability and accessibility also influence use. Lack of privacy for the youth, poor attitudes
81 of health staff, uncomfortable waiting areas, and long waiting hours discourage the youth from
82 attending ANC (43, 53, 54). These studies clearly indicate that beyond predisposing and
83 enabling factors, there are quality, environmental, need, and health provider factors, and
84 individual perceptions that influence the youth to use ANC. However, these are most times not
85 segregated by marital status thus hiding certain vulnerabilities, yet unmarried youth never use
86 or use ANC late compared to the married or formerly married youth (44, 51, 54).

87 This literature analysis further identified that use of ANC among youth can be influenced by
 88 service availability and accessibility, waiting time, service quality, youth' autonomy; domestic
 89 violence prevalence and attitudes of health staff (42, 50, 51, 53-58). However, the
 90 unavailability of these factors in the UDHS data sets do not allow the researcher to examine
 91 these factors in this analysis.

92 The behavioural model of access to healthcare as proposed by Andersen (59) and modified by
 93 Aday & Andersen and Andersen and others (60-63) guided the analysis of factors for the use
 94 of antenatal care. This model suggests that the use of medical care depends on predisposing
 95 factors, need for health care, and enabling factors, environmental, and health provider
 96 characteristics, and health outcomes like consumer satisfaction and quality of life. However,
 97 some factors except predisposing and enabling factors are missing in the Demographic and
 98 Health Surveys data and they are not included in this analysis.



99

100 *Source: Researcher's construct*

101 **Figure 1: A conceptual framework for the analysis of determinants of antenatal care use**
 102 **among youth**

103 Based on the insights from the literature review, several studies have tried to document the
104 factors that influence the use of antenatal care among youth (25, 29-31, 57, 64, 65), but none
105 has presented factors for use among unmarried youth in Uganda. Therefore, this study used
106 pooled data from the 1995, 2000/01, 2006, and 2011 UDHS data to examine the predisposing
107 and enabling predictors of the timing of antenatal care visits among unmarried compared to
108 married youth aged 15-24 years in Uganda.

109 **Methods**

110 **Data source**

111 Secondary analysis of the pooled 1995, 2000/01, 2006, and 2011 Uganda Demographic and
112 Health Survey (UDHS) data was done. This UDHS data was retrieved with permission from
113 MEASURE DHS (dhsprogram.com). These surveys were majorly implemented by Uganda
114 Bureau of Statistics (UBOS) with technical support from Macro International, ICF Macro, ICF
115 incorporation, Ministry of Health, and Makerere University. The four surveys were population-
116 based household surveys that used two stage sampling where clusters (Enumeration Areas) and
117 households from each cluster were randomly selected.

118 The Uganda Demographic and Health Surveys (UDHSs) collect data on socio-economic and
119 demographic characteristics of women, and their use and timing of maternal health services.
120 The pooled sample was among 31,521 women aged 15-49 years of whom 18,456 of them had
121 had a birth within the last five years before each survey. A total of 6,018 (weighted cases)
122 female youth aged 15-24 years, each one of whom had given birth in the preceding five years
123 before each survey were selected. Five hundred eighty-one (581) of them were unmarried and
124 5,437 were married youth. The multivariate analysis was among 485 unmarried and 5,228
125 married youth due to exclusion of missing cases prior to running the multilevel analysis in

126 MLwin. Detailed sampling procedures are published in final reports available on
127 <https://dhsprogram.com/publications/index.cfm>.

128 **Measures of the outcome variable**

129 Antenatal care is measured by two variables; the number of visits and the timing of the first
130 ANC visit. This data was captured from women who sought ANC during the last pregnancy in
131 the last five years before the survey. Women were asked if they had ANC for their last
132 pregnancy. Those who consulted a trained health provider for ANC were asked how many
133 times they did receive antenatal care during that pregnancy. They were also asked how many
134 months pregnant they were, the first time they received ANC for that pregnancy. World Health
135 Organisation (WHO) recommends that pregnant women in resource poor countries attend ANC
136 at least four times, and the first visit should be in the first three months of the pregnancy, to
137 identify pregnancy related problems and mitigate them (WHO, 2006). For this study, a binary
138 outcome was constructed for timing of antenatal care; youth who initiated ANC visits in the
139 first three months of the pregnancy were coded as one '1', while those who never attended or
140 started after the three months were coded as zero '0'. The number of ANC visits was treated
141 as a continuous variable and ranged from zero for those who did not have any ANC visit to 20
142 ANC visits.

143 **Measures of predictor variables**

144 Based on the Anderson behavioural model of access to medical care, previous empirical
145 literature, and their availability in the Uganda Demographic and Health Survey data,
146 predisposing and enabling factors were included in the analysis. These include individual,
147 husband, and district level predisposing and enabling factors relating to demographic and
148 socio-economic factors, and include:

149 Predisposing factors: age of the youth (*15-19 and 20-24 years*), parity (*1. One, 2. Two and*
150 *above*), pregnancy desire (*1. Wanted to get pregnant then, 2. Did not want to get pregnant or*
151 *wanted to get pregnant later*), education level (*1. No education and primary education, 2.*
152 *Secondary and above*) and religion (*1. Catholics, 2. Protestants, 3. Other religions*).

153 Enabling factors: wealth index (*1. Poorest, 2. Poorer, 3. Middle, 4. Richer, 5. Richest*),
154 woman's occupation (*1. Not working, 2. Professionals, 3. Agriculture, 4. Labourers*), region
155 (*1. Central, 2. East, 3. North, 4. West*) and place of residence (*1. Rural, 2. Urban*), frequency
156 of access to radio (*1. No access, 2. Less frequent access, 3. More frequent access*), television
157 (TV) access (*1. No access, 2. Less frequent access, 3. More frequent access*), and reading
158 newspapers (*1. No access, 2. Less frequent access, 3. More frequent access*). Contextual
159 district level factors of education level, wealth level and mass media access were developed
160 from the available related population level variables in the datasets using aggregation method.
161 Contextual variables were categorised into low, middle and high levels.

162 **Statistical analysis**

163 Frequency distributions to show the characteristics of the respondents and the levels of the use
164 of antenatal care were done. For timing of antenatal care, cross tabulations to show the
165 relationship between each predisposing and enabling variable with the timing of the first ANC
166 visit was done. The probability level for statistical significance using p-values was set at p<
167 0.05.

168 Two-level logistic regression models with district as the second level were done to find
169 individual and district level factors for timing of antenatal care among unmarried compared to
170 married youth in Uganda. This is because UDHS data is hierarchical, since UDHS follows a
171 multistage sampling procedure. This approach assumes that youth in the same district may have
172 similar characteristics and access similar resources, therefore, may have equal chances of use

173 of antenatal care services (66, 67). Results are presented in terms of adjusted odds ratios,
 174 reporting 95% confidence interval. The level of statistical significance using p-values was set
 175 at $p < 0.05$. The multilevel logistic regression equation takes the form:

$$176 \text{ Logit } \Pi_{ij} = \text{Log} \left[\frac{\Pi_{ij}}{1 - \Pi_{ij}} \right] = \beta_0 + \beta X'_{ij} + u_{oj}$$

177 Where (Π_{ij}) is the probability of youth i , in the j th district accessing ANC in the first trimester.
 178 β_0 is the regression intercept, X'_{ij} are vectors of individual or district level covariates; β is
 179 the associated vector of estimated parameter estimates and is shared by all districts.

180 For the analysis of number of antenatal care visits, analysis of variance was done to show the
 181 differences in the mean number of antenatal care visits. Since the number of ANC visits is a
 182 continuous variable with ANC numbers ranging from zero to twenty and the predictor variables
 183 are categorical, multilevel linear regression was used to find factors for ANC numbers among
 184 the unmarried and married female youth. Several linearity assumptions were carried out and it
 185 was observed that the number of ANC visits did not violate the most crucial assumptions of
 186 normal distribution of either residuals or linearity between variables and homoscedasticity
 187 (results not presented). Some outliers were identified but these do not affect the outcome
 188 although they may make the model unstable. The multilevel linear regression equation takes
 189 the form below;

$$190 y_{ij} = \beta_0 + \beta_{ij} x_{ij} + u_{oj} + \varepsilon_{ij}$$

191 Where y_{ij} is the multilevel regression model for the number of ANC visits for person i in
 192 district j , β_0 is the regression intercept, x_{ij} are vectors of the individual or district level
 193 characteristics. β_{ij} is the vectors of estimated parameter coefficients, and is shared by all

194 districts, while the random effect u_{oj} is specific to district j and ε_{ij} is the error term at individual
195 and district levels.

196 Quasi-Likelihood estimation methods were relied on for the multilevel estimation procedure
197 for discrete data. Initially, the first-order Marginal Quasi-Likelihood (MQL) estimates were
198 fitted. The second-order Predictive/ Penalised Quasi-Likelihood (PQL) approximate estimation
199 procedure was fitted and only results of the second order are presented. This is because the
200 second order PQL estimates are a considerable improvement, especially for the level 2 standard
201 deviation, and the fixed parameter estimates have been found to be less biased (66, 68).

202 The effects of individual-level and district-level determinants for the use of ANC in the first
203 trimester and the mean number of ANC visits were reported in terms of odds ratios and
204 estimates respectively, whereas the measures of district variation in the use of ANC (random
205 effects) are represented by the intra-district correlation coefficient (IDC) and variance partition
206 coefficients (VPC). The Intra-district correlation shows the proportion of the total unexplained
207 variation in the outcome that is attributable to district level factors (67, 69). It is a measure of
208 the degree of dependency or similarity or homogeneity of individuals in the same district (70).

209 **Research Ethics statement**

210 With DHS, informed consent was sought from all participants before each interview. ICF
211 institutional review board and a Uganda institutional review board approved the UDHS
212 questionnaires. ICF IRB ensured that the survey complies with the U.S. Department of Health
213 and Human Services regulations for the protection of human subjects, while the host country
214 IRB ensured that the survey complies with laws and norms of the nation. Privacy, anonymity,
215 and confidentiality were ensured during the interviews, data storage and analysis. No approval
216 for using UDHS data was required since UDHS is a secondary data source and is available in
217 the public domain. However, to access the data, we sought permission from MEASURE DHS.

218 Details about UDHS data and ethical standards are available at: [https://dhsprogram.com/What-](https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm)
219 [We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm](https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm)

220 **Results**

221 **Descriptive characteristics of the respondents**

222 Table one shows that more than half of the unmarried respondents lived in rural areas (72.2%),
223 were aged 20-24 years (58.8%), had attained primary education (47.4%), and a higher
224 proportion were Catholics (38.2%). Most married youth just like unmarried youth were aged
225 20-24 (76.5%), lived in rural areas (86%), had no or primary education (84%), and were
226 Catholics (42%). The main source of information for both was the radio (48% unmarried
227 compared to 46% among married youth) and most were engaged in agriculture (43% for
228 unmarried Vs 59% married youth). However, most married youth wanted the pregnancy at that
229 time (59.8%), and a bigger proportion had had two or more births (63.8%); compared to the
230 unmarried who mostly wanted the pregnancy later (78%) and most had had one birth (84%).

231 Cross tabulations show that the significant difference in ANC timing was observed only in
232 terms of education level among unmarried youth; no significant difference was observed by
233 other predisposing and enabling factors. While among married youth, significant differences
234 in the timing of antenatal care were observed by parity, region, education level, religion, wealth
235 index, and occupation type, access to the radio, newspapers and television, and the husband's
236 education level and his occupation (Table 1).

237 The mean number of ANC visits significantly varied by pregnancy desire, parity, education
238 level, place of residence, region, occupation, access to newspapers and radio among unmarried
239 youth while it varied by parity, education level, religion, residence, region, wealth index,
240 occupation, access to newspapers, radio and television, age of husband, his education level and
241 his occupation. No differences in mean ANC visits were seen by age for both groups.

Table 1: Distribution of respondents by background characteristics

Variable	Unmarried youth		Married youth	
	Yes, first trimester visit	Total youth	Yes, first trimester visit	Total youth
Age	<i>p=0.410</i>		<i>p=0.737</i>	
15-19	16.1 (40)	249	17.3(221)	1,275
20-24	16.3 (54)	332	18.5(769)	4,161
Pregnancy wanted	<i>p=0.188</i>		<i>p=0.007*</i>	
Then	12.8(19)	149	19.2(668)	3,480
Later or not anymore	17.4(75)	432	16.3(319)	1,957
Birth order/Parity	<i>p=0.728</i>		<i>p=0.001*</i>	
One	16.1(76)	473	20.5(406)	1,980
Two or more	17.4(19)	108	17.4(585)	3,437
Total		581		5,437
Education level	<i>p=0.021*</i>		<i>p=0.000*</i>	
No education or Primary Education	17.8(61)	342	17.2(782)	4,544
Secondary	13.9(33)	239	23.2(207)	893
Religion	<i>p=0.652</i>		<i>p=0.000*</i>	
Catholic	17.6(40)	227	19.8(448)	2,261
Protestant	16.0(37)	231	16.0(283)	1,850
Others	13.8(17)	123	13.8(259)	1,327
Type of Residence	<i>p=0.847</i>		<i>p=0.092</i>	
Urban	15.7(24)	153	20.4(159)	780
Rural	16.4(70)	428	17.9(832)	4,657
Region	<i>p=0.901</i>		<i>p=0.000*</i>	
Central	16.4(39)	238	21.5(326)	1,512
Eastern	14.2(17)	112	11.4(184)	1,617
Northern	16.0(12)	75	21.7(230)	1,061
Western	17.6(26)	148	20.1(251)	1,247
Wealth index	<i>p=0.935</i>		<i>p=0.000*</i>	
Poorest	18.2(12)	66	19.4(166)	857
Poorer	19.4(13)	67	18.0(148)	822
Middle	13.9(12)	79	17.7(122)	690
Richer	15.5(14)	89	23.2(149)	642
Richest	18.4(30)	163	19.8(177)	896
Woman's Occupation	<i>p=0.084</i>		<i>p=0.002*</i>	
Not working	15.3(27)	177	18.6(267)	1,435
Professionals	18.4(23)	125	23.6(147)	625
Agriculture	15.6(39)	249	17.0(545)	3,202
Labourers	16.2(5)	30	18.2(32)	176
Frequency¹ of reading newspapers	<i>P= 0.420</i>		<i>P=0.016*</i>	
Not at all	16.0(46)	287	18.7(616)	3,292
Less frequent	20.9(32)	153	23.1(128)	553

¹ Not at all- No access to any, Less frequent- once or less than once; More frequent- Almost daily access

Variable	Unmarried youth		Married youth	
	Yes, first trimester visit	Total youth	Yes, first trimester visit	Total youth
More frequent	15.4(4)	25	27.0(17)	63
Frequency of listening to the radio	<i>P=0.853</i>		<i>P=0.000*</i>	
Not at all	14.8(23)	155	14.1(271)	1,920
Less frequent	17.1(25)	146	17.6(183)	1,038
More frequent	16.4(46)	280	21.7(537)	2,479
Frequency of watching TV	<i>P=0.208</i>		<i>P=0.000*</i>	
Not at all	15.7(68)	433	17.3(831)	4,802
Less frequent	22.2(18)	81	23.1(84)	364
More frequent	11.9(8)	67	27.7(75)	271
Husband's age				<i>p=0.081</i>
			15-24	19.0(205)
			25-29	19.5(325)
			30+	19.9(230)
Husband's Education level-				<i>p=0.000*</i>
			No education	16.4(88)
			Primary Education	16.7(538)
			Secondary	21.8(365)
Husband's Occupation				<i>p=0.000*</i>
			Not working	23.2(318)
			Professionals	18.9(176)
			Agriculture	16.0(369)
			Labourers	15.4(127)
Total		581		5,437

243

244 **Levels and trends in the timing of antenatal care among unmarried youth in Uganda,**
245 **1995-2011**

246 Almost all youth who had birth in the last five years before each survey had some antenatal
247 care (93% among unmarried and 95% among married) though very low proportions had
248 antenatal care within the first three months (16% for unmarried & 18% for married). Almost
249 half of both unmarried and married youth had at least four ANC visits (47%) (Table 2).

250

251

252 **Table 2: Distribution of ANC use among unmarried youth between 1995 and 2011**

Parameter	Unmarried Youth	Percentage	Married youth	Percentage
ANC use				
No ANC	41	7.0	259	4.8
Some ANC	540	93.0	5,578	95.2
Timing of first ANC (Dichotomous)*				
First Trimester	94	16.2	991	18.3
Never had or Second or third Trimester	487	83.8	4,446	81.7
Number of ANC visits				
No ANC visit	41	7.0	259	4.8
1-3	269	46.4	2,644	48.6
4+	271	46.6	2,534	46.6
Total	581		5,437	

253 **Trends in the use of antenatal care among unmarried compared to married youth aged**
 254 **15-24 years in Uganda between 1995-2011**

255 The levels of the use of ANC in the first trimester were low but increased over the years (Table
 256 3). It increased from 13 percent to 21 percent between 1995 and 2011; a total percentage
 257 increase of 7.8% among unmarried youth. It increased by 9% from 16% to 25% among married
 258 youth. This increment was not significant among unmarried youth (p=0.454) but was
 259 significant among married youth (P= 0.007). Almost half of the youth had at least four ANC
 260 visits across the survey years and this was significantly different at p= 0.012 and p= 0.000 for
 261 unmarried and married youth respectively.

262

263

264

265 **Table 3: Trends in the use of antenatal care among unmarried compared to married**
 266 **youth aged 15-24 years in Uganda between 1995-2011**

	Unmarried Youth	Had ANC in the first trimester	Married youth	Had ANC in the first trimester
ANC timing per survey year		<i>p=0.454</i>		<i>p=0.007*</i>
1995	117	13.1(15)	1,530	16.1(246)
2000/01	124	16.8(24)	1,367	16.7(228)
2006	171	17.2(29)	1,313	19.4(255)
2011	169	20.9(35)	1,227	25.2(309)
Percent having at least four ANC visits		<i>p=0.012*</i>		<i>p=0.000*</i>
1995	117	45.2(53)	1,530	49.0(750)
2000/01	124	51.9(64)	1,367	46.8(640)
2006	171	50.6(87)	1,313	47.8(628)
2011	169	46.7(79)	1,227	51.2(628)
Total	581		5,437	

267 **Significant at 95% confidence interval*

268 **Predictors of antenatal care use among unmarried compared to married youth in Uganda**

269 With multivariate analysis, the variables were introduced successively into the model to show
 270 potential pathways of the factors influencing timing of antenatal care. The first model (model
 271 0) has no covariates, the second model (model 1) controlled for predisposing variables and
 272 model three controlled for predisposing and enabling variables. For married youth, we ran a
 273 fourth model controlling for husband factors. A model controlling for district level factors was
 274 not ran because the variance partition component (VPC) among unmarried youth was zero,
 275 thus for uniformity, this was not run among married youth too.

276 **Predictors of the timing of antenatal care among unmarried youth in Uganda**

277 Model 1 controlled for predisposing factors and it is observed that no predisposing variable
 278 had a significant relationship with the use of ANC in the first trimester. However, controlling
 279 for predisposing factors increased the impact of year of survey. There were increased odds of

280 having an ANC visit in the first trimester in the year 2011 compared to 1995 (OR=2.00, 95%
281 CI=1.01-3.97).

282 When enabling factors are controlled for (Model 2), no enabling factor showed any significant
283 influence on timing of antenatal care among unmarried youth. However, education level
284 (predisposing factor) becomes significant and is negatively associated with the use of ANC in
285 the first trimester. It is observed that the odds of using ANC in the first trimester were reduced
286 with having a secondary education level. Unmarried youth who had at least a secondary level
287 of education were 44 percent less likely to attend ANC in the first trimester compared to those
288 with no education or primary level education only (OR=0.56, 95%CI= 0.31-0.98). There is no
289 evidence that other predisposing factors or enabling factors play a significant role in
290 influencing the timing of antenatal care, except for education level (Table 4). Controlling for
291 enabling factors reduced the impact of year of survey. The significance of use in the year 2011
292 was reduced and there was no longer a significant difference in unmarried youth having an
293 ANC visit between 2011 compared to unmarried youth in 1995.

294 As observed from the variance components model (that is, the empty model) in table 4,
295 variation in timing of antenatal care among unmarried youth was only at the individual level.
296 There were no district-level variations as indicated by zero random variance in timing of ANC
297 in the first trimester across districts. In addition, the variance partition coefficient (VPC) and
298 the intra-district correlation (IDC) is zero in all the models. Thus, the total unexplained
299 variation in having an ANC visit in the first three months among unmarried youth could be
300 attributed to unobservable individual-level factors. The zero IDC indicates that unmarried
301 youth in each district have no similarity.

302 **Table 4: Adjusted odds of first trimester antenatal timing among unmarried youth from**
303 **Multilevel Logistic Regression Model (confidence intervals in brackets)**

Variable	Estimate	Odds Ratio (95% CI)	Odds Ratio (95% CI)
Year of survey (1995)	Model 0	Model 1	Model 2
2000/01	1.59 (0.77-3.26)	1.65(0.80-3.42)	0.77 (0.40-1.49)
2006	1.80 (0.91-3.53)	1.93(0.97-3.84)	0.91(0.52-1.59)
2011	1.87(0.96-3.64)	2.00(1.01-3.97)*	1.00 (1.00-1.00)
Predisposing factors			
Age (15-19)			
20-24		1.24(0.78-1.99)	1.32(0.77-2.24)
Education (No education or primary education)			
Secondary+		0.78(0.49-1.23)	0.56(0.31-0.98)*
Random Variance (SE)	0.000(0.000)	0.000(0.000)	0.000(0.000)
IDC	0	0	0
VPC=IDC*100	0	0	0
VPC=Variance Partition Coefficient, IDC=intra-district correlation, *Level of significance at 5% level $p < 0.05$, Reference categories are in brackets after the names of the characteristic being considered, Sample size at level 1 (Individual)=485, level 2 (District)=54			
Model 0- No covariates controlled for except year of survey			
Model 1- Controlling for predisposing factors			
Model 2- Controlling predisposing and enabling factors			

304 **Predictors of the timing of antenatal care among married youth in Uganda**

305 Model 1 (Table 5) controlled for predisposing factors and it is observed that the use of ANC in
306 the first trimester was associated with higher parity, higher education level and protestant
307 religion membership among married youth. With parity, married youth who were pregnant at
308 least twice were 21 percent less likely to have their first ANC visit in the first trimester
309 compared to married youth who were pregnant for the first time. Married youth with at least
310 secondary education were 30 percent more likely to attend ANC in the first trimester than those
311 who had no education or had primary education (OR=1.30, 95%CI=1.08-1.57). This is
312 different from what was found among unmarried youth where higher levels of education were
313 related with lower odds of having an ANC visit in the first trimester (OR=0.56, 95%CI=0.31-
314 0.98). Use of ANC in the first trimester was also significantly associated with religion among
315 married youth. Protestants had 20 percent reduced odds (OR=0.80, 95%CI=0.72-0.95) of

316 having an ANC in the first trimester compared to their catholic counterparts. Parity and religion
317 were not observed as an influence on timing of ANC among unmarried youth. Age and desire
318 to have a child had no influence on ANC timing among both groups.

319 Model 2 (Table 5) controlled for enabling factors and among married youth, region and media
320 exposure were observed to be associated with ANC visits in the first trimester. Among
321 unmarried youth, no enabling variable was significantly related to ANC use in the first
322 trimester. Married youth in the eastern region were 40 percent (OR=0.60, 95%CI=0.40-0.89)
323 less likely to have their first ANC visit in the first trimester compared to those in central region.
324 More frequent access to radio was associated with 40 percent (OR=1.40, 95%CI=1.11-1.76)
325 higher chances of ANC visit in the first trimester compared to married youth who had no access
326 to radio. Married youth with more frequent access (almost daily) to television were 57%
327 (OR=1.57, 95%CI=1.11-2.22) more likely to have their first ANC visit within the first trimester
328 than those who did not have access to the television.

329 Controlling for enabling factors reduced the impact of year of survey. There were reduced odds
330 of having an ANC visit in the first trimester in the year 2000/01 (OR=0.72, 95%CI=0.57-0.90)
331 and 2006 (OR=0.79, CI=0.64-0.97) compared to 1995. The significance of early use in the year
332 2011 was reduced and there was no longer a significant difference in married youths having an
333 ANC visit between 2011 compared to married youths in 1995.

334 Among married youth, the final model (model 4) controlled for husband factors of age,
335 education and occupation. Education was the only husband variable that significantly
336 influenced the use of ANC in the first trimester and the pattern is as expected. The odds of
337 married youth having an ANC visit in the first trimester were 68 percent higher (OR=1.68,
338 95%CI=1.20-2.35) for youth with husbands with secondary education compared to married
339 youth with husbands with no education. Controlling for partner factors considerably reduced

340 the estimate for year of survey such that year of survey was no longer significant among
341 married youths in having an ANC visit in the first trimester.

342 For married youth, the results in Table 4 indicate that most of the variations in ANC visit in
343 the first trimester occurred at the individual level. However, some variations at the district level
344 were observed as indicated by the significant random variance in reporting of having ANC in
345 the first three months across districts. As shown by the variance partition coefficient (VPC),
346 the ICC was estimated at about 3.3-7.5%, even after controlling for predisposing and enabling
347 factors. Thus, about 3% of the total unexplained variation in the use of ANC in the first
348 trimester could be attributed to unobserved district-level effects with the remaining
349 unexplained variation attributable to individual-level factors.

350 **Determinants of numbers of antenatal care among unmarried youth in Uganda**

351 Table 5 presents the factors for the mean number of antenatal care visits among unmarried
352 youth. Model one controlled for individual predisposing factors. Results show higher mean
353 ANC numbers with higher education levels. Unmarried youth with at least secondary level
354 education had 0.7 more ANC visits (Estimate= 0.720, SE=0.214) compared to those with no
355 education or primary level education. Unmarried youth of other religions had 0.5 fewer ANC
356 visits (Estimate= -0.509, SE= 0.261) compared to their catholic counterparts. There is no
357 evidence of other predisposing factors having an influence on the mean number of ANC visits.

358 The final model among unmarried youth (model 2) controlled for predisposing and enabling
359 factors and it can be seen from Table 5 that the mean number of ANC visits was significantly
360 related to region, wealth index and access to radio. Unmarried youth who lived in western
361 Uganda had 0.7 fewer ANC visits (Estimate= -0.662, SE=0.333) than the unmarried youth in
362 central Uganda. Unmarried youth in middle income households had almost one (0.9) more
363 mean ANC visits (Estimate= 0.889, SE=0.424) compared to those in the poorest households.

364 In addition, those who listened to the radio almost daily had 0.6 more ANC visits compared to
 365 youth who did not have any access to the radio at all. Controlling for predisposing factors in
 366 model two reduced the significant impact of religion and education of unmarried youth on ANC
 367 frequency. Unmarried youth of other religions are no longer significantly different from
 368 Catholics. The estimates for education also reduced considerably that at least secondary level
 369 education was no longer significantly associated with the number of ANC visits for unmarried
 370 youth.

371 The results for the intercept model and model one in table 5 show that most of the variation in
 372 the mean number of ANC visits was at an individual-level and the variation at district level
 373 was not significant, as indicated by the non-significant district level variance. Model three
 374 shows that the variation in the number of ANC visits was at an individual level. The variance
 375 partition component for the final model was estimated at zero, thus the unexplained variation
 376 in the number of ANC visits among unmarried youth is explained by individual-level factors.

377 **Table 5: Multilevel Linear Regression parameter estimates of the number of ANC visits**
 378 **among unmarried youth (standard errors given in brackets)**

Variable	Model 0	Model 1	Model 2
Year of survey (1995)			
2000/01	0.617(0.308)*	0.5843(0.306)*	1.018(0.294)*
2006	0.478(0.293)	0.3917(0.294)	0.505(0.255)*
2011	0.027(0.291)	-0.057(0.293)	0.000(0.000)
Predisposing factors			
Age (15-19)			
20-24		0.2756(0.215)	0.284(0.239)
Parity (One)			
Two+		-0.1526(0.273)	-0.290(0.317)
Education (No education or primary education)			
Secondary & above		0.720(0.214)*	0.211(0.260)
Religion (Catholic)			
Protestant		-0.177(0.227)	-0.068(0.254)

Variable			
Others		-0.509(0.261)*	-0.390(0.285)
Enabling factors			
Region (Central)			
East			-0.166(0.326)
North			0.103(0.388)
West			-0.662(0.333)*
Wealth Index (Poorest)			
Poorer			-0.316(0.437)
Middle			0.889(0.424)*
Richer			0.567(0.427)
Richest			0.194(0.428)
Radio (No access)			
Less frequent access			0.394(0.332)
More frequent access			0.635(0.319)*
Random variance (SE)	0.173(0.235)	0.177(0.130)	0(0)
IDC	0.028	0.030	0
VPC=IDC*100	2.8	3	0
VPC=Variance Partition Coefficient, IDC=intra-district correlation, *Level of significance at 5% level $p<0.05$, Reference categories are in brackets after the names of the characteristic being considered, Sample size at level 1 (Individual)=485, level 2 (District)=54 Model 0- No covariates controlled for Model 1- Controlling for predisposing factors Model 2- Controlling for predisposing and enabling variables			

379 **Predictors of frequency of antenatal care among married youth in Uganda between 1995**
380 **and 2011**

381 Table 6 presents the results for factors impacting on ANC visits among married youth and these
382 results differ somewhat from those of unmarried youth.

383 Model 1 controlled for predisposing factors and some results differ for married youth compared
384 to unmarried youth. Married youth with higher parity had 0.2 lower mean ANC visits
385 (Estimate= -0.241, SE=0.070) than married youth who were pregnant for the first time.
386 However, parity was not significant among unmarried youth. Education was similarly
387 significantly related with mean ANC visits among married youth as among unmarried youth
388 and the mean increase was almost the same (Estimate=0.720, SE=0.214 among unmarried
389 compared to Estimate=0.705, SE=0.085 among married youth). Religion was not significant

390 among married youth while among unmarried youth, being a follower of other religions was
391 associated with lower mean ANC visits (Estimate=-0.510, SE=0.261).

392 Model two controlled for enabling factors and significant differences were seen among
393 unmarried and married youth. Among married youth, more variables are significantly related
394 with the mean number of ANC visits. Eastern and western regions had fewer mean ANC visits
395 compared to married youth in the central region, whereas among the unmarried, it was only
396 those in the western region that had lower mean ANC visits compared to unmarried youth in
397 the central region. As expected, married youth in professional positions had higher mean ANC
398 visits compared to non-working youth (estimate=0.282, SE=0.116). Labourers also had higher
399 mean ANC visits (estimate=0.529, SE=0.188) compared to their non-working counterparts.
400 Occupation of unmarried youth was found to have no significant influence on the number of
401 ANC visits. Contrary to what I had expected, married youth in the richest households have
402 lower mean ANC visits (estimate=-0.292, SE=0.131) compared to married youth in poorest
403 households, while among the unmarried as observed in literature, youth in middle income
404 households had higher mean ANC visits (estimate=0.889, SE=0.424) compared to unmarried
405 youth in the poorest households.

406 Some access to newspapers also significantly influenced the number of ANC visits among
407 married youth while this was not significant among unmarried youth. Married youth with
408 access to newspapers at least once a week had 0.3 more mean ANC visits (estimate=0.262,
409 SE=0.109) and those who had almost daily access to the newspaper had 0.6 more mean ANC
410 visits (estimate=0.572, SE=0.265) compared to married youth who had no access to the
411 newspapers at all. Almost daily access to the radio was also associated with higher mean ANC
412 visits among married youth compared to those with no access to the radio (estimate=0.404,
413 SE=0.093). The trend was comparable to what was observed among unmarried youth
414 (estimate=0.635, SE=0.319). More frequent access to the television was also associated with

415 higher mean ANC visits among married youth but this was not observed to be associated with
 416 ANC numbers among unmarried youth. Married youth with daily access to television had 0.4
 417 more mean ANC visits (estimate=0.412, SE=0.160) than married youth with no access to
 418 television.

419 Model three controlled for husband factors and it is seen from Table 6 that mean number of
 420 ANC visits was associated with age and education level of the husband. Married youth with
 421 husbands aged 30 years and above were able to attend on average 0.2 (estimate=0.194,
 422 SE=0.098) more ANC visits compared to those with husbands aged 15-24 years. More so,
 423 youth with husbands who had at least secondary level education had 0.5 more ANC visits
 424 (estimate=0.480, SE=0.133) while those with primary level education had 0.3 more ANC visits
 425 (estimate= 0.293, SE=0.123) compared to youth with husbands who had no formal education.
 426 The results provided no evidence of association between the number of ANC visits and
 427 husbands' occupation.

428 The results observed in Table 6 suggest that most of the variation in mean number of ANC
 429 visits was at the individual level. However, there was also some variation at the district level
 430 as indicated by the significant random variance in the reporting of number of ANC visits across
 431 districts. As shown by the variance partition coefficient (VPC), the IDC was estimated at about
 432 2.2-5.5%, even after controlling for individual predisposing and enabling factors. Thus, a large
 433 percentage of the total unexplained variation in number of ANC visits among married youth is
 434 attributable to individual-level factors.

435 **Table 6: Multilevel Linear Regression parameter estimates of the number of ANC visits**
 436 **among married youth (standard errors given in brackets)**

Parameter	Model 0	Model 1	Model 2	Model 3
Year of survey (1995)				

Parameter	Model 0	Model 1	Model 2	Model 3
2000/01	0.040(0.087)	0.030(0.086)	0.653(0.095)*	0.694(0.339)*
2006	-0.210(0.089)*	-0.245(0.089)*	0.318(0.090)*	0.371(0.339)
2011	-0.363(0.092)*	-0.472(0.093)*	0.000(0.000)	0.000(0.000)
Predisposing factors				
Age (15-19)				
20-24		0.140(0.082)	0.051(0.093)	0.025(0.096)
Parity (One)				
Two+		-0.241(0.072)*	-0.278(0.081)*	-0.290(0.081)*
Education (No education or primary education)				
Secondary+		0.705(0.085)*	0.396(0.101)*	0.314(0.103)*
Region (Central)				
East			-0.357(0.160)*	-0.407(0.159)*
North			0.025(0.173)	0.025(0.172)
West			-0.563(0.164)*	-0.580(0.163)*
Enabling factors				
Occupation (Not working)				
Professionals			0.282(0.116)*	0.245(0.116)*
Agriculture			-0.073(0.098)	-0.057(0.099)
Labourers			0.529(0.188)*	0.505(0.187)*
Wealth Index (Poorest)				
Poorer			0.187(0.113)	0.161(0.113)
Middle			0.014(0.121)	-0.023(0.121)
Richer			-0.124(0.131)	-0.170(0.131)
Richest			-0.291(0.131)*	-0.334(0.131)*
Newspapers (No access)				
Less frequent access			0.262(0.109)*	0.219(0.109)*
More frequent access			0.572(0.262)*	0.538(0.264)*
Radio (No access)				
Less frequent access			0.186(0.101)	0.160(0.101)
More frequent access			0.404(0.093)*	0.356(0.094)*
Television (No access)				
Less frequent access			0.116(0.123)	0.131(0.123)

Parameter	Model 0	Model 1	Model 2	Model 3
More frequent access			0.412(0.160)*	0.402(0.160)*
Husband factors				
Age of husband (15-24)				
25-29				0.017(0.089)
30+				0.194(0.098)*
Education level of husband (No Education)				
Primary Education				0.293(0.123)*
Secondary+				0.480(0.133)*
Random variance(SE)	0.242(0.063)*	0.191(0.052)*	0.0755(0.0290)*	0.073(0.028)*
IDC	0.046	0.055	0.022	0.022
VPC=IDC*100	4.6	5.5	2.2	2.2
VPC=Variance Partition Coefficient, IDC=intra-district correlation, *Level of significance at 5% level $p < 0.05$, Reference categories are in brackets after the names of the characteristic being considered, Sample size at level 1 (Individual)=3,788, level 2 (District)=56 Model 0- No covariates controlled for Model 1- Controlling for predisposing factors Model 2- Controlling for predisposing and enabling factors Model 3- Controlling for predisposing, enabling and husband factors				

437 **Discussion of key findings for the use of antenatal care among unmarried compared to**
438 **married youth in Uganda**

439 The study aimed at understanding the predisposing and enabling factors associated with the
440 timing and number of antenatal care visits among unmarried compared to unmarried youth
441 aged 15-24 years in Uganda. Pooled data from the 1995, 2000/01, 2006 and 2011 Uganda
442 Demographic and Health Surveys was analysed. This was among 581 unmarried and 5,437
443 married youth. Multilevel logistic regression models with district as the second level were done
444 to show the predictors of timing of antenatal care among unmarried youth.

445 It was observed that there was an increase in early initiation of prenatal care from 13% to 20%
446 and 16% to 25% among unmarried and married youth respectively. However, this is still low

447 but is consistent with the national level of 21 percent in 2011 and 29 percent in 2016 (8, 39).
448 Low levels of early start of ANC are also observed among sub-Saharan Africa countries such
449 as Tanzania (24%) (71), Kenya (20%) (72), and Malawi (24%) (73). Low levels have also been
450 reported in prior studies in Uganda (74, 75) and in Ethiopia (76). This could be because youth
451 are accessing ANC from informal sources like Traditional Birth Attendants in Uganda (77) or
452 because mothers had no pregnancy complications and take pregnancy as a normal life event
453 (75, 78-80).

454 Compared to married youth, it was also observed that unmarried youth had lower proportions
455 of initiating ANC in the first trimester across the years compared to married youth. Hueston
456 (25) revealed that married youth were associated with early use of ANC than unmarried youth.
457 Married youth might have an advantage of husband support and health systems which favour
458 married women over the unmarried ones (81). Also, since most pregnancies among unmarried
459 women are unwanted, they tend to hide the pregnancies due to fear of negative family and
460 society reaction to their pregnancies until late stages (33, 42, 50, 51, 54). Some unmarried youth
461 might also be planning an abortion in the early stages of the pregnancy before it is realised by
462 others, therefore, they will not access ANC early (80). Therefore, societal and familial attitudes
463 change to support unmarried youth will help them to disclose their pregnancies early and thus
464 receive the support to seek ANC early.

465 Previous studies among youth have shown that higher woman's education level was associated
466 with greater odds of the use of antenatal care (25, 26, 29, 30, 40, 41, 47, 64). The current study
467 also found that higher education levels were associated with greater odds of seeking ANC in
468 the first trimester among married youth compared to those with no education or primary
469 education and increased odds of frequent ANC use among unmarried and married youth.
470 Women empowerment (64, 82-84), increased likelihood of communication with partners and
471 family members regarding their health (85, 86), and higher levels of knowledge on the benefits

472 of seeking maternal healthcare have been found to be the mediating factors for increased use
473 of ANC (82, 87-89). Contrarily, limited knowledge of the benefit of ANC use was associated
474 with delayed or non-use of ANC among adolescents in Bulawayo, Zimbabwe (50). In this
475 analysis, the impact of education on the number of ANC visits ceased to be significant among
476 unmarried youth after controlling for predisposing factors, thus the impact of education could
477 be explained by wealth index and access to health information through the mass media among
478 unmarried youth.

479 However, education level although being the only significant predictor of early ANC among
480 unmarried youth, this was contradictory to what has been found in the literature. At least
481 secondary level education was associated with reduced odds of the use of ANC in the first
482 trimester compared to unmarried youth with no education or primary education. Previous
483 studies found that higher education levels were associated with greater odds of seeking ANC
484 in the first trimester among youth compared to those with no or primary education (25, 26, 29,
485 30, 40, 41, 47, 64). Stigmatisation of unmarried pregnancies in Uganda might make unmarried
486 youth to hide the pregnancies until the later stages (90). Also, since most of the youth in this
487 age range are still in school, they could have continued with school as much as possible, a
488 situation that competes for time for antenatal care (Ehlers et al., 2000).

489 Prior studies have found higher parity to be associated with fewer ANC visits and late start of
490 ANC (25, 31, 40, 41, 44). In this study, married youth of higher parity were less likely to start
491 ANC in the first trimester and more likely to have fewer ANC visits compared to married youth
492 of parity one but not among unmarried youth. High parity was found to be associated with
493 reduced excitement (91, 92), increased child care responsibilities for older children (15, 93),
494 limited resources in a family due to large family size (15) which reduce the chances to use
495 ANC. Youth with higher parity should hence be supported to solve the barriers that hinder them

496 from accessing ANC. Community outreach programmes may help bring the ANC services
497 closer to the youth.

498 Research has shown that the level of education attained by the husband has an influence on
499 married youth use of ANC services (26, 30, 47-49). Attainment of a secondary or even higher
500 level of education by the husband was associated with increased chances of having both the
501 first ANC visit in the first trimester and frequent ANC visits thereafter in this study. Studies
502 have shown that higher education level is generally related with a greater amount of knowledge
503 on the benefit of using ANC (82, 87) which could be the case for husbands with a higher
504 education level, who then support their wives in seeking ANC both early and frequently.

505 Another husband factor that was significantly related to the number of antenatal care visits was
506 the age of the husband. Youth who had husbands who were at least thirty years old were more
507 likely to have higher ANC visits than those who had husbands aged 15-24 years. This points
508 to the level of support older husbands offer to their wives as men are, in most cases, the
509 financial controllers in the homes (94-96). Thus, with the financial support from husbands,
510 married youth can afford to frequently go to the health facilities for antenatal care.

511 Similar to findings elsewhere (26, 27, 30), among unmarried youth, middle wealth index was
512 associated with more ANC visits compared to those classified as the poorest unmarried youth.
513 This might be because youth in middle wealth households could afford both direct and indirect
514 costs to access antenatal care frequently (76). Unmarried youth in richer and richest households
515 were not significantly different from unmarried youth in poorest households. However, married
516 youth in the richest wealth index were associated with infrequent ANC visits compared to the
517 poorest married women. This could be explained by the availability of alternative care during
518 pregnancy, especially from traditional birth attendants and older women in the extended family

519 in Uganda (77). The joint decision from husbands and mothers-in-law has also been
520 unfavourable to use of ANC by married women elsewhere (15, 82, 97).

521 Prior studies have found regional differences in the use of antenatal care elsewhere (26, 27, 47,
522 48). The current study found that youth in the central region were more likely to use ANC than
523 those in other regions. The advantage that the central region has over other regions is its
524 proximity to Kampala city, which is well served by social and health amenities including over
525 90 percent of all private health facilities, as well as the national referral hospital (MOH, 2013,
526 2016b). The short distances to health centres in Central region ease the use of ANC (42, 51,
527 54, 98-100).

528 Exposure to health information has been found to have a positive impact on ANC use among
529 youth (26, 29, 32, 45, 47, 48, 64, 101). Our findings are in agreement with other studies as daily
530 access to the radio and television and daily access to radio and newspapers were associated
531 with early start and frequent use of antenatal care among married youth. Daily access to the
532 radio was also associated with frequent ANC use among unmarried youth. Access to media is
533 associated with increased knowledge about the benefit of using maternal health services which
534 compels youth to better use antenatal care (15, 43, 50, 102). This study also helped identify the
535 radio is a main source of information for the youth in Uganda since a large proportion of the
536 population in Uganda has greater access to the radio as the main source of information (55.2%)
537 compared to the television (7.2%) and newspapers (2.1%) (103).

538 Other predisposing and enabling factors that were controlled for in this analysis included age
539 of the youth, pregnancy desire, region, religion but these had no significant influence on the
540 use of antenatal care.

541 **Limitations of the study**

542 Uganda Demographic and Health surveys (UDHS) collect data from women for births in the
543 last five years before the date of the study which may lead to inaccuracies due to memory lapse.
544 The inattention given to some important variables that influence the use of maternal health
545 services is a limitation common in secondary data analysis. The cross-sectional nature of data
546 from UDHS is that, we are not able to establish the time sequencing of events of interest that
547 is antenatal care use and socio-economic factors that is antenatal care use is asked for a birth
548 in the last five years while socio-economic factors are as of the time of the interview. However,
549 the UDHS remains one of the most robust data sets in understanding ANC use. Thus, this study
550 increases knowledge about the predictors of ANC among unmarried and married youth in
551 Uganda.

552 **Conclusion**

553 The results indicate that youth in Uganda have few ANC visits and very small proportions of
554 less than 25 percent start ANC visits in the first trimester in Uganda. Lower proportions also
555 had the minimum of four ANC visits. This is far below the WHO recommendation for universal
556 use within the first three months of the pregnancy. The poor ANC use has an impact on the
557 pregnancy outcomes, and the health and mortality of both the youth and their infants. Efforts
558 should be geared towards improvements in the knowledge of the benefit of using ANC to
559 encourage them to seek ANC early and more frequently. Policies aimed at removing barriers
560 that delay or stop youth from seeking ANC frequently should also be formulated and
561 implemented.

562 Education predicted the use of ANC in the first trimester among unmarried and married youth.
563 Education was the only factor significantly associated with the use of ANC in the first trimester
564 among unmarried youth. While high levels of education were associated with higher chances
565 of using ANC in the first trimester among married youth, it was associated with late start of

566 ANC among unmarried youth. High parity, protestant membership and residence in the eastern
567 Uganda were associated with late start of ANC while access to radio and television, and higher
568 partner education were associated with early use of ANC in the first trimester among married
569 youth.

570 Among unmarried and married youth, higher educational attainment and greater access to radio
571 were associated with frequent ANC use. Although having a middle wealth index was associated
572 with more ANC visits among unmarried youth, married youth in highest wealth quintile
573 households were associated with infrequent ANC visits. Unmarried and married youth living
574 in western Uganda had fewer ANC visits compared to those living in the central region.
575 Additionally, married youth residing in the eastern region were associated with lower ANC
576 visits among married youth, but this did not apply to unmarried youth. Membership of other
577 religions was associated with lower ANC visits among unmarried youth compared to Catholics
578 but not among married youth. More access to newspapers and higher levels of the husband's
579 education level were associated with more ANC visits among married youth only.

580 Overall, the multilevel results show no variation in ANC use among unmarried youth at district
581 level. Therefore, individual predisposing and enabling factors explain the timing and frequency
582 of ANC visits among unmarried youth. Thus, policy makers need to focus on factors at the
583 individual level to improve ANC use among unmarried youth. More so, few variations were
584 observed in terms of the individual factors, especially with the use of ANC in the first trimester
585 among unmarried youth where only secondary education was associated with reduced odds of
586 using ANC in the first trimester. Therefore, unmarried youth should be targeted as a whole to
587 improve their ANC use in Uganda. Radio was also identified as the main source of ANC
588 information among youth since it is widely available.

589 **Declarations**

590 **Consent to publish**

591 All authors (PA & CM) agreed that the article be published

592 **Conflict of interest**

593 The authors declare no conflict of interest

594 **Availability of Data and materials**

595 The datasets used and/or analysed during the current study are available from the
596 corresponding author on reasonable request.

597 **Authors' contributions**

598 PA conceived of the study, acquired the data, determined the design and performed the
599 statistical analysis. All authors interpreted the data and drafted the manuscript. All authors read
600 and approved the final manuscript.

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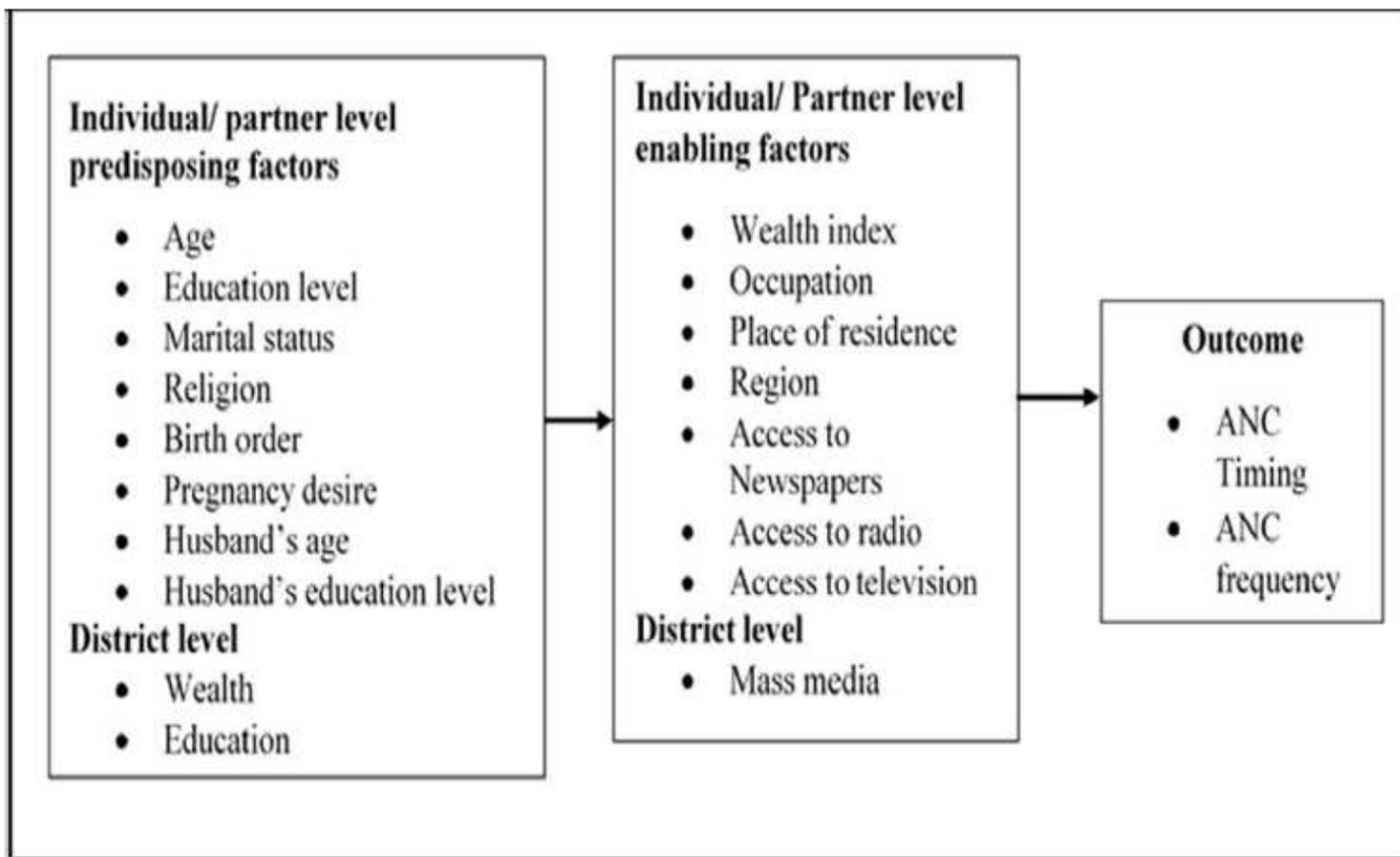
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Figures



Source: Researcher's construct

Figure 1

A conceptual framework for the analysis of determinants of antenatal care use 101 among youth