Trends And Predictors of Maternal Health Services Utilization Among Adolescent Mothers in Uganda; A Secondary Analysis Of 2000 – 2016 Uganda Demographic Health Surveys (Udhs)

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ABSTRACT

Background: Uganda has a high teenage pregnancy rate. The risk of morbidity and mortality is high if pregnant adolescent mothers do not utilize maternal health services. This study analyzed the trends and predictors of maternal services utilization by adolescent mothers aged 15-19 years in Uganda.

Methods: Secondary data were extracted from 2000/2001, 2006, 2011, and 2016 Uganda demographic and health survey datasets. The participants were selected based on a national stratified-cluster sample design. Data were analyzed using Stata/SE 14.2 software to investigate the trends and predictors of antenatal care, delivery care, and postnatal care utilization by adolescent mothers. DHS survey protocols were approved by the IRBs at Inner City Fund (ICF) and Uganda, and access to the datasets was authorized by DHS.

Results: The number of pregnant adolescent women aged 15-19 in each respective survey from 2000/01 to 2016 were 376, 348, 352, and 789. Utilization of maternal health services by adolescent women increased from 2000/01 to 2016. The average percentage point (pp) increase in utilization was 23.58 with the highest in PNC (pp=32.08, p<0.0001) and the least in early ANC timing (pp=11.07, p<0.001). Not living together with a partner was negatively associated with ANC visits (aOR=0.43, 95%CI: 0.23-0.80, p=0.009); while northern region (aOR=1.87, 95% CI: 1.02-3.40; p=0.042) and those living together with their partners (aOR=2.19, 95% CI: 1.15-4.16; p=0.016) were positively associated with ANC timing. Being an urban adolescent woman positively predicted institutional delivery (aOR=3.34, 95% CI: 1.45-7.49; p=0.005). Being married (aOR=0.38, 95% CI: 0.38-0.91; p=0.019), not living together with a partner (AOR=0.46, 95% CI: 0.24-0.90; p=0.024), and primary education level (AOR=0.10, 95% CI: 0.013-0.819; p-0.032) negatively predicted PNC check before discharge.

Conclusions: Maternal health services utilization by adolescent women in Uganda increased over the years, but with variations predicted by regional and rural-urban differences, education level, and living with partner. These findings show the significant roles of gender, social, cultural and economic factors in maternal health, and calls for policy and implementers to address them in order to achieve to the intended improvements in reduction of maternal and maternal and perinatal mortality among teenage mothers.

Abbreviations

ANC : Ante-Natal Care

DHS : Demographic and Health Survey

EAs   :   Enumeration Areas
MoH   :   Ministry of Health
PNC   :   Post-Natal Care
SDGs   :   Sustainable Development Goals
UBOS   :   Uganda Bureau of Statistics
UDHS   :   Uganda Demographic Health Survey
WHO   :   World Health Organization
GoU   :   Government of Uganda
MHS   :   Maternal Health Services

Introduction

In many parts of the world, including Uganda, teenage pregnancy remains a serious public health concern. Adolescent pregnancy rates in Uganda are among the highest in Africa, where they are prevalent at 24%. [1]. It is well recognized that having children at a young age carries a higher risk to the health of the adolescent mother and her offspring. These dangers are greatest for the youngest youths. A girl's life might change dramatically when she gets pregnant; her health often deteriorates, she may not be able to finish her education, her career options are diminished, and she is more vulnerable to poverty and marginalization[2]. Pregnancy and childbirth complications rank as the second most common cause of death worldwide for teenage girls between the ages of 15 and 19[3]. One of the primary causes of death for girls aged 15 to 19 in poor nations like Uganda is problems connected to pregnancy. It appears from recent research that teenage mothers are more likely to die during pregnancy or childbirth than women in their early 20s [4].

According to Uganda's four most recent Demographic Health Surveys, almost 25% of girls between the ages of 15 and 19 have started having children. This percentage is comparable to that of 2011, 2006, and 2000/01[1, 5-7]. Information regarding the percentage of teenage moms who use maternal health services from ANC to PNC is unknown. The estimates that are currently available on the use of maternal health services include all women who are of reproductive age without regard to their age. Numerous initiatives are underway to decrease maternal mortality during childbirth including teenage girls aged 15 to 19 years, but, with varied levels of achievement [8-10]. Uganda is dedicated to achieving the United Nation's third sustainable development goal (SDG), target 3.1 which aims at reducing global maternal mortality to less than 70 maternal deaths per 100,000 live births by 2030 [11]. Achieving this target requires that all pregnant women access and utilize essential maternal and new born health services. This study therefore intended to analyze the utilization of maternal health services over the years using the UDHS data in order to contribute evidence for improving interventions. Understanding the patterns and factors associated with maternal health services utilization by pregnant adolescent girls will focus interventions for saving teenage mothers but also achieve the broad goals and targets for maternal health.

Methods

Study Design, Population & Sampling: The study was conducted using data drawn from the Uganda Demographic and Health Surveys (UDHS) for the years 2000/01, 2006, 2011, and 2016

[1,5-7]. The DHS uses a two-stage cluster sampling design to generate a nationally representative sample of women aged 15-49 years in sampled households. The first stage involves selecting the clusters while the second stage involves the selection of the households for interview. Stratification of urban and rural areas was taken into account. The 2000/2001, 2006, 20011, and 2016 UDHS used the sampling frame provided by the list of census enumeration areas (EAs) with population and household information from the population censuses in that period. The sampling frame contains information about the EA location, type of residence (urban or rural), and the estimated number of residential households. The allocation of the sample EAs features a power allocation with a small adjustment because a proportional allocation would not meet the minimum number of clusters per survey domain required for a DHS survey. The sample EAs were selected independently from each stratum using probability proportional to size. The women's questionnaires were used to obtain information on women who had live births in the 5 years preceding the survey. Records for adolescent women aged 15 to 19 years were extracted as shown in figure 1.
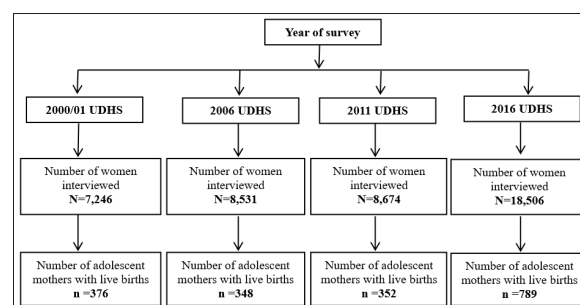
Figure 1: Sample Selection Criteria For Adolescent Women 2000/01-2016 Udhs

Measurement Of the Outcome Variables: In the DHS women's questionnaire, all women who had a birth in 5 years preceding the survey were asked about the ANC timing, ANC visits, and whether they were checked before discharge from the health facility. ANC timing was categorized as early timing (1, 2, and 3 months of pregnancy) and late timing (4 through 9 months of pregnancy). ANC visits were categorized as <4 ANC visits and 4+ ANC visits. Delivery care utilization was measured as institutional delivery and assisted delivery. Institutional delivery was categorized as delivery at a health facility (government hospital, government health facility, private hospital/clinic) and elsewhere (home and others). Assisted delivery was measured as delivery by skilled assistance (a midwife/nurse, doctor) and unskilled assistance (nursing assistant/aide, relative, TBA, and friend). PNC was measured as whether the mother's health was checked after delivery and before discharge from the health facility.

Measurement of Predictor Variables: The predictor variables included in this study were; place of residence, region, religion, occupation, education, marital status, and wealth status. The place of residence was classified as rural or urban. The variable region was collapsed and regrouped into four traditional regions of Uganda; central (comprising of Kampala, central1, and central2), eastern (comprising of Busoga, Bukedi, Bugisu, and

Teso), northern (comprising of Karamoja, Lango, Acholi, and West Nile) and western (comprising of Bunyoro, Tooro, Ankole, and Kigezi). Religion was regrouped as Anglican, Catholic, Muslim, and others; where others comprised SDA, Orthodox, Pentecostal, and Jehovah's Witness, among others including those with no religion.

The education variable was defined as the highest level of education attained by the respondent and was divided into no education, primary, secondary, or higher education. Higher education did not have enough observations to warrant separating, so we had to collapse and merge it with secondary hence forming a third category called secondary and higher education. Wealth status was categorized in household quintiles as poorest, middle, richer, and richest as per the DHS convention. The occupation was defined as the current occupation of the respondent and regrouped into three categories; not working, non-professional (a merger of all agricultural, household, and domestic works, sales, services, skilled and unskilled manual works) and professional (a merger of all technical, managerial and clerical works). Marital status was collapsed into three categories never married, married or living together, and not living together.

Data Extraction and Analysis: UDHS Datasets for 2000-01, 2006, 2011, and 2016 surveys were obtained through an online application via www.dhs.org. The required data for the study were extracted from the datasets for the women's questionnaire in each survey. The extracted data were reorganized into the study datasets containing variables for the outcome variables and predictors variables. The study data were analyzed using Stata version 14.2, Stata Corp, Texas. All analyses were weighted to take into consideration complex survey design using the svyset and svy commands. Three types of analyses were performed. Descriptive statistics were calculated using proportions. The absolute percentage point (pp) differences were also calculated between survey points, and a two-sample test of proportions was conducted to estimate the p-value of the differences. Secondly, bivariate analysis was performed for adolescent mothers' predictors and their categorical outcomes using only the 2016 UDHS dataset as it provided the most current information on these predictors. Cross-tabulations between predictor variables and outcome variables were performed to assess associations. These predictors were used to compare the odds of; late (0) and early (1) timing of the first ANC visit; <4 ANC visits (0) and 4+ ANC visits (1), health facility delivery (1) and elsewhere (0); skilled assistance (1) and unskilled assistance (0) during delivery, no (0) and yes (1) PNC check for mother before discharge. The results were then expressed using crude odds ratios (cORs) for each predictor variable. Thirdly, Predictor variables that were found to be significantly associated with the outcome variables were considered for multivariable analysis using binary logistic regression analysis to control for any potential confounders. The reference categories were selected on the basis that they have the least likelihood of influencing the outcome variables. The level of statistical significance for the adjusted odds ratios (aORs) was determined using the $p<0.05$. Hosmer – Lemeshow goodness of fit test was performed to test for the model's goodness of fit for the data.

Ethical Consideration: Our study utilized the UDHS dataset, which was collected with informed consent from participants at the time of each survey. The DHS protocols for each survey were approved by the instutional review boards (IRBs) at Inner City Fund (ICF) and in Uganda. Permission to use the data was obtained from DHS (www.dhs.org) and Uganda Bureau of Statistics (www.ubos.org). Confidentiality of data was observed. The anonymity of the information was maintained, and there was no contact with the participants since the study involved using secondary data.

Results
Study Participants: The total number of adolescent mothers aged 15 to 19 years with live births who were included in the study for the 2000-01, 2006, 2011, and 2016 surveys were were 376, 348, 352, and 789 respectively. The mean age and standard deviation for the participant in the respective surveys was 18.07 ± 0.98 years, 18.15 ± 0.93 years, 18.17 ± 0.97 years and 18.11 ± 1.00 years respectively. There was no major differences in the distribution of participant characteristics across the difference surveys (table 1):

Table 1: Characteristics of Study Participants by Year of Survey

Variable and category	Participants by year of survey			
	2000/01 N=376, n(%)	2006 N=348, n(%)	2011 N=352, n(%)	2016 N=789, n(%)
Age				
15	05(01.33)	04(01.15)	05(01.42)	15(01.90)
16	29(07.71)	16(04.60)	20(05.68)	52(06.59)
17	50(13.30)	51(16.38)	49(13.92)	111(14.07)
18	144(38.30)	119(34.20)	114(32.39)	268(33.97)
19	148(39.36)	152(43.68)	164(46.59)	343(43.47)
Mean age ±SD	18.07 ± 0.98	18.15 ± 0.93	18.17 ± 0.97	18.11 ± 1.00
Residence				
Urban	55(14.57)	56(15.97)	61(17.21)	147(18.62)
Rural	321(85.43)	292(84.03)	291(82.79)	642(81.38)
Region				
Central	137(36.42)	96(27.72)	99(28.18)	196(24.86)

Eastern	110(29.42)	83(23.83)	118(33.69)	259(32.88)
Northern	70(18.50)	85(24.45)	60(16.92)	170(21.55)
Western	59(15.66)	84(24.00)	75(21.21)	164(20.71)
Religion				
Anglican	127(33.69)	108(31.07)	95(26.90)	232(29.46)
Catholic	159(42.24)	162(46.41)	144(41.04)	327(41.47)
Muslim	72(19.15)	39(11.18)	59(16.76)	115(14.53)
Other	18(04.92)	39(11.34)	54(15.31)	114(14.5)
Woman's education				
No education	67(17.86)	25(07.22)	18(05.02)	22(02.74)
Primary	260(69.16)	263(75.57)	266(75.54)	592(74.98)
Secondary& higher	49(12.98)	60(17.21)	68(19.44)	176(22.28)
Woman's occupation				
Not working	96(25.41)	63(18.15)	107(30.53)	211(26.74)
Non-professional	270(74.18)	285(81.85)	241(68.59)	570(72.23)
Professional	02(00.41)	00(00.00)	03(00.88)	08(01.03)
Household wealth status				
Poorest	78(20.80)	79(22.57)	72(20.40)	195(24.66)
Poorer	54(14.39)	80(23.06)	84(23.73)	202(25.58)
Middle	63(16.73)	52(14.91)	68(19.21)	135(17.12)
Richer	42(11.27)	64(18.52)	65(18.44)	135(17.31)
Richest	138(36.80)	73(20.95)	64(18.23)	119(15.13)
Marital status at survey				
Never in union	55(14.53)	70(20.23)	66(18.78)	187(23.66)
Married/living together	288(76.52)	233(66.95)	240(68.31)	508(64.36)
Not living together	34(08.95)	08(02.26)	45(12.90)	94(11.98)

Trends in Maternal Health Services (Mhs) Utilization by Adolescents

The proportion of adolescents who utilised maternal health services in Uganda increased from 2000/01 to 2016. The average percentage point increase in utlization was 23.58 with the highest in PNC (pp=32.08, p<0.0001) and the least increasement was for Early ANC timing (pp=11.07, p<0.0001). The highest utilization attained by 2016 was for health facility delivery (81.25%; 95%CI: 77.18 - 84.74), followed by skilled assisted delivery (80.28%; 95%CI: 76.22 - 83.79), and PNC (66.63% 95%CI: 62.37 - 70.63). The least utilization was for early ANC timing (26.29%; 95%CI: 23.29 - 29.86). The trends for each MHS utilization by survey year is shown in table 2.

Table 2: Mhs Utilization Among Adolescent Mothers With Live Births Aged 15-19 Years From 2000/01 – 2016.

Maternal Health Service	Year of Survey				Percent Point (pp)
	2000/01	2006	2011	2016	
	N=376 %(95%CI)	N=348 %(95%CI)	N=352 %(95%CI)	N=789 %(95%CI)	(2000/01- 2016)
ANC Timing					
Early	15.22 (11.48 – 19.89)	19.21 (15.19 – 24.00)	32.72 (27.34 – 38.60)	26.29 (23.29 – 29.86)	+11.07***
Late	84.78 (80.11 – 88.52)	80.79 (76.00 – 84.81)	67.28 (61.40 – 72.66)	73.71 (70.14 – 77.00)	
ANC Visits					
<4 visits	53.94 (48.38 – 59.40)	53.23 (47.10 – 59.26)	49.08 (43.07 – 55.12)	40.88 (37.07 – 44.80)	
4+ visits	46.06 (40.60 – 51.62)	46.77 (40.74 – 52.90)	50.92 (44.88 – 56.93)	59.12 (55.70 – 62.93)	+13.06***
Institutional Delivery					

Health facility	50.34 (42.99 – 57.67)	53.95 (47.47 – 60.29)	65.92 (59.44 – 71.88)	81.25 (77.18 - 84.74)	+30.90***
Elsewhere/home	49.66 (42.33 – 57.01)	46.05 (39.71 – 52.53)	34.08 (23.14 – 40.56)	18.75 (15.26 - 22.82)	
Assisted Delivery					
Skilled assistance	50.10 (42.80 – 57.39)	55.49 (49.28 – 61.52)	66.69 (60.16 – 72.63)	80.28 (76.22 – 83.79)	+30.18***
Unskilled assistance	49.90 (42.61 – 57.20)	44.52 (38.48 – 50.72)	33.31 (27.37 – 39.84)	19.72 (16.21 – 23.78)	
PNC					
No	-	65.45 (57.30 – 72.78)	61.45 (55.52 – 67.05)	33.37 (29.37 – 37.63)	(2006-2016)
Yes	-	34.55 (27.22 – 42.70)	38.55 (32.95 – 44.48)	66.63 (62.37 – 70.63)	+32.08***
AVERAGE					23.58
Note: *pp-percentage point, ***p<0.001, CI-Confidence Interval*					

Mhs Utilization by Socio-Demographic Characteristics Using In 2016
Analysis of adolescent utilization of maternal health services by the socio-demographic characteristics (table 3) showed that ANC timing was highest among adolescents who were in professional employment (48%) and those in the richer wealth class (31.57%), but lower among adolescent who had never married (21.41%), those in richest class (21.92%), and those in the urban residence (21.94%). Attendance of four or more ANC visits was highest among adolescents who were in professional employment (87.3%) and lowest among those who have never been married (54.5%). Institutional health facility delivery was generally high with the least in Western Uganda at 72.21%. Assisted delivery by skilled attendants was also generally high with the least proportion among adolescent mothers in the poorest class (74.51%). Post natal care was highest among adolescent mothers in Eastern Uganda, and lowest among adolescents in Western Uganda (57.2%).

Table 3: Proportion of Adolescent Women Utlizing Mhs by Socio-Demographic Characteristics İn 2016

Participant Characteristic	ANC Timing	ANC Visits	Institution Delivery	Assisted Delivery	PNC
	Early (%)	4+ (%)	Health facility (%)	Skilled assistance (%)	Yes (%)
Residence					
Urban	21.94	58.42	95.03	94.57	69.19
Rural	27.94	59.28	78.11	77.02	65.92
Region					
Central	23.03	60.04	86.12	84.57	64.29
Eastern	23.48	57.69	79.61	77.35	73.27
Northern	33.29	64.82	86.86	84.80	67.59
Western	29.97	54.34	72.21	75.06	57.20
Religion					
Anglican	28.45	64.33	83.05	83.64	67.83
Catholic	25.38	55.61	76.37	75.28	65.54
Muslim	25.46	61.22	88.57	85.35	68.05
Other	28.88	56.49	84.23	82.61	65.57
Woman's education					
No education	36.55	56.11	81.00	83.25	93.98
Primary	25.94	57.20	78.32	77.29	64.80
Secondary& higher	28.56	65.99	91.18	90.03	68.92

Woman's occupation					
Not working	23.73	60.50	85.89	84.11	64.92
Non-professional	27.67	58.20	79.53	78.68	67.34
Professional	48.00	87.30	80.64	92.08	64.92
Household wealth index					
Poorest	26.86	60.84	78.54	74.51	70.69
Poorer	26.30	55.59	78.66	77.54	64.30
Middle	27.08	57.60	80.51	82.80	63.84
Richer	31.57	62.44	78.52	79.94	67.79
Richest	21.92	60.24	94.38	92.22	66.01
Marital status at survey					
Never in union	21.41	54.50	85.80	80.65	74.60
Married/living together	26.96	60.68	79.87	77.87	64.96
Not living together	36.30	59.84	79.72	80.71	58.74

Factors Associated with Adolescent Utilization of Mhs In 2016
Bivariate and multivariable analysis was conducted using the 2016 UDHS data. Six predictor variables were analyzed to assess their independent associations with utilization of four of the maternal health services. After adjusting for confounders, there was a significant association between early timing of the first ANC visit and not living together with a partner (aOR=2.19; 95%CI = 1.15 – 4.16; p=0.016), and adolescent women living in Northern Uganda (aOR=1.87; 95%CI = 1.02 – 3.40, p=0.042). Not living together with partner was associated with reduction in attendance of four or more ANC visits (aOR=0.43; 95%CI = 0.23 – 0.81; p=0.009) (Table 4a).

Table 4a: Bivariate and Multivariable Analyis Between Sociodemographic Characteristics and Utilization of Anc Services

Socio-demographic Factors	Early ANC timing				4+ ANC Visits			
	(%)	cOR (95% CI)	aOR (95% CI)	P-value	(%)	cOR (95% CI)	aOR (95% CI)	P-value
Residence								
Urban	21.94	0.73 (0.43-1.22)	0.74 (0.43-1.27)	0.267	58.42	0.97 (0.59-1.58)	1.32 (0.77-2.27)	0.306
Rural	27.94	1.00	1.00		59.28	1.00	1.00	
Region								
Central	23.03	1.00	1.00		60.04	1.00	1.00	
Eastern	23.48	1.03 (0.58-1.80)	1.08 (0.53-1.25)	0.796	57.69	0.91 (0.58-1.43)	0.93 (0.52-1.66)	0.794
Northern	33.29	1.67 (0.96-2.89)	1.87 (1.02-3.40)	0.042*	64.82	1.23 (0.73-2.05)	0.55 (0.30-1.00)	0.050
Western	29.97	1.43 (0.81-2.53)	1.48 (0.82-2.67)	0.192	54.34	0.79 (0.48-1.30)	0.68 (0.38-1.23)	0.200
Religion								
Anglican	28.45	1.00	1.00		64.33	1.00	1.00	
Catholic	25.38	0.86 (0.56-1.30)	0.82 (0.53-1.25)	0.348	55.61	0.69 (0.48-1.00)	1.24 (0.81-1.89)	0.324
Muslim	25.46	0.86 (0.46-1.59)	0.84 (0.45-1.58)	0.584	61.22	0.88 (0.50-1.52)	1.23 (0.65-2.32)	0.521
Other	28.88	1.02 (0.59-1.77)	1.07 (0.62-1.86)	0.798	56.49	0.72 (0.44-1.17)	0.91 (0.53-1.58)	0.747

	(%)	cOR	aOR	P-value	(%)	cOR	aOR	P-value
Woman's education								
No education	36.55	1.000	1.000		56.11	1.00	1.00	
Primary	25.94	0.61 (0.25-1.49)	0.69 (0.28-1.68)	0.412	57.20	1.05 (0.44-2.48)	1.42 (0.58-3.46)	0.770
Secondary & higher	28.56	0.69 (0.27-1.82)	0.92 (0.35-2.44)	0.872	65.99	1.52 (0.61-3.80)	1.02 (0.39-2.68)	0.050
Household wealth index								
Poorest	26.86	1.000	1.000		60.84	1.00	1.00	
Poorer	26.30	0.97 (0.60-1.58)	1.05 (0.63-1.73)	0.858	55.59	0.81 (0.50-1.29)	0.98 (0.59-1.62)	0.931
Middle	27.08	1.01 (0.61-1.69)	1.10 (0.63-1.93)	0.744	57.60	0.87 (0.53-1.45)	0.93 (0.53-1.63)	0.795
Richer	31.57	1.26 (0.74-2.13)	1.61 (0.92-2.81)	0.095	62.44	1.07 (0.63-1.82)	0.66 (0.38-1.16)	0.147
Richest	21.92	0.76 (0.40-1.47)	1.12 (0.52-2.41)	0.764	60.24	0.97 (0.54-1.75)	0.96 (0.45-2.05)	0.921
Marital status at survey								
Never in union	21.41	1.000	1.000		54.50	1.00	1.00	
Married/living together	26.96	1.35 (0.90-2.05)	1.41 (0.91-2.17)	0.124	60.68	1.29 (0.86-1.94)	0.68 (0.44-1.06)	0.088
Not living together	36.30	2.09 (1.12-3.92)	2.19 (1.15-4.16)	0.016*	59.84	1.24 (0.69-2.26)	0.43 (0.23-0.81)	0.009*
*=p<0.05; cOR = Crude Odds Ratio; aOR = Adjusted Odds Ratio; CI = Confidence Interval								

There was a significant association between urban residence and health facility (aOR = 3.34; 95%CI = 1.45 – 7.69; p=0.005). The primary adolescent women were 90% less likely to be checked before discharge (aOR = 0.10; 95%CI = 0.013 – 0.819; p=0.032). Being married had 41% reduced odds of a PNC check (aOR = 0.59; 95%CI = 0.38 – 0.91; p=0.019), and not living together had 54% reduced adjusted odds of a PNC check before discharge from the health facility (aOR = 0.59; 95%CI = 0.38 – 0.91; p=0.019) (table 4b).

Table 4b: Bivariate and Multivariable Analyis Between Sociodemographic Factors and Utilization Of Delivery and Postnatal Care Services

Socio-demographic Factors	Health facility delivery				Skilled Assisted Delivery			
	(%)	cOR (95% CI)	aOR (95% CI)	P-value	(%)	cOR (95% CI)	aOR (95% CI)	P-value
Residence								
Urban	95.03	5.25 (2.29-12.51)	3.34 (1.45-7.69)	0.005	69.19	1.16 (0.73-1.85)	1.22 (0.68-2.20)	0.501
Rural	78.11	1.00	1.00		65.92	1.00	1.00	
Region								
Central	86.12	1.00	1.00		64.29	1.00	1.00	
Eastern	79.61	0.63 (0.32-1.24)	0.95 (0.47-1.93)	0.885	73.27	1.52 (0.88-2.63)	1.57 (0.84-2.95)	0.157
Northern	86.86	1.07 (0.53-2.16)	2.01 (0.93-4.36)	0.077	67.59	1.16 (0.66-2.02)	1.13 (0.59-2.17)	0.711
Western	72.21	0.42 (0.21-0.84)	0.62 (0.30-1.29)	0.196	57.20	0.74 (0.44-1.26)	0.73 (0.40-1.32)	0.298
Religion								
Anglican	83.05	1.00	1.00		67.83	1.00	1.00	

Catholic	76.37	0.66 (0.41-1.06)	0.65 (0.41-1.05)	0.065	65.54	0.90 (0.57-1.42)	0.92 (0.58-1.47)	0.725
Muslim	88.57	1.58 (0.75-3.35)	1.22 (0.57-2.62)	0.610	68.05	1.01 (0.55-1.84)	1.05 (0.56-1.97)	0.889
Other	84.23	1.09 (0.58-2.06)	1.12 (0.58-2.16)	0.735	65.57	0.90 (0.51-1.61)	0.86 (0.47-1.60)	0.641
Woman's education								
No education	81.00	1.00	1.00		93.98	1.00	1.00	
Primary	78.32	0.83 (0.32-2.19)	0.79 (0.26-2.46)	0.687	64.80	0.12 (0.01-0.90)	0.10 (0.01-0.82)	0.032*
Secondary & higher	91.18	2.39 (0.81-7.04)	1.66 (0.47-5.85)	0.431	68.92	0.14 (0.02-1.14)	0.12 (0.01-1.06)	0.057
Household wealth index								
Poorest	78.54	1.00	1.00		70.69	1.00	1.00	
Poorer	78.66	1.01 (0.61-1.67)	1.24 (0.71-2.16)	0.454	64.30	0.75 (0.46-1.21)	0.84 (0.51-1.38)	0.488
Middle	80.51	1.13 (0.62-2.01)	1.28 (0.67-2.45)	0.461	63.84	0.73 (0.41-1.30)	0.84 (0.45-1.56)	0.585
Richer	78.52	1.00 (0.52-1.93)	0.82 (0.41-1.64)	0.575	67.79	0.87 (0.48-1.58)	0.88 (0.46-1.71)	0.711
Richest	94.38	4.59 (1.78-11.86)	2.05 (0.69-6.04)	0.194	66.01	0.81 (0.45-1.45)	0.81 (0.37-1.77)	0.598
Marital status at survey								
Never in union	85.80	1.00	1.00		74.60	1.00	1.00	
Married/living together	79.87	0.66 (0.39-1.11)	0.77 (0.45-1.31)	0.327	64.96	0.63 (0.41-0.97)	0.59 (0.38-0.91)	0.019
Not living together	79.72	0.65 (0.81-7.04)	0.67 (0.32-1.14)	0.288	58.74	0.48 (0.25-0.92)	0.46 (0.24-0.90)	0.024

Discussion

This study focused on the trends in and predictors of maternal health services utilization by adolescent women aged 15-19 years in Uganda using UDHS 2000/01 to 2016 datasets. The uptake of maternal health services by adolescent women aged 15-years in Uganda increased over the period from 2000/01 to 2016. The average percentage point increase in utilization of maternal health services by adolescent mothers in Uganda between 20001/01 and 2016 was 23.58 with the highest increase in PNC service utilization (pp=32.08, p<0.0001) and the least increment in early ANC timing (pp=11.07, p<0.0001). The highest utilization attained by 2016 was for health facility delivery (81.25%; 95%CI: 77.18 - 84.74), followed by skilled assisted delivery (80.28%; 95%CI: 76.22 - 83.79), and PNC (66.63% 95%CI: 62.37 - 70.63). The least utilization was for early ANC timing (26.29%; 95%CI: 23.29 - 29.86).

The proportion of women who had an ANC visit in the first trimester of pregnancy increased from 14% in 2000/01, 17% in 2006, 21% in 2011 to 29% in 2016. Similarly, the proportion of women who received at least 4+ recommended ANC visits increased from 42% in 2000/01, 47% in 2006, and 48% in 2011 to 60% in 2016, while the proportion of women whose births occurred in a health facility increased more dramatically from 37% in 2000/01 to 73% in 2016. In the same period, the proportion of births attended by skilled providers rose from 37% in 2000/01 to 74% in 2016. Also note the proportion of women who received a postnatal check during the first 2 days after delivery increased from 17% in 2006, 33% in 2011 to 54% in 2016 (UBOS & ICF, 2017).

Adolescent women who had their births at the health facility increased significantly from 50% in 2000-01, to 54% in 2006, 66% in 2011 to 81% in 2016. This was far above the general proportions of all women of reproductive age 15-49 years (UBOS & ICF, 2017). The proportion of births by adolescent mothers attended to by skilled providers also rose from 50% in 2000-01, 55% in 2006, and 67% in 2011 to 80% in 2016. The proportion of adolescent women who received a postnatal check within 2 days after delivery increased significantly from 35% in 2006, 39% in 2011 to 67% in 2016. Therefore in 2016 alone, adolescent women aged 15-19 years had a better uptake of PNC checks (67%) since this was far above the general uptake (by 15-49 years, 54%) in 2016.

The study also found that there was a significant variation in facility delivery by both regions and places of residence. Urban adolescent women had 95% facility delivery as compared to rural

(78%). Similarly, central and northern regions had about 87% versus 80% and 72% for eastern and western respectively. This may also be a context-specific issue that needs to be considered when designing interventions tailored to improving adolescent maternal health services utilization.

The study found that some sociodemographic factors are predictor variables that are significantly associated with the utilization of different maternal health services by adolescent women in Uganda. These are residence, religion, region, education, marital and wealth status. For ANC utilization, only one predictor emerged to be significantly associated with ANC visits and two for ANC timing. Adolescent women who were not living together with a partner were more likely to have their first ANC visit in the first trimester of pregnancy. At the same time, they were less likely to have the recommended ANC visits. This finding was inconsistent with those of a similar study conducted in Kenya[13] where they found out that married women were more likely to go for ANC and make their first visit during the first trimester compared to theirs. This could be due to the support married women receive from husbands and the health delivery system that tends to favor married women over unmarried young women[14]. It is, therefore, important to note that the adolescent women who are not living together with their partners could be living with an elderly person most likely their mothers who may have advised on the importance of early ANC visits than if they were living with partners.

Adolescent women from the northern Uganda were more likely to go for the first ANC visit in the first trimester of pregnancy as compared to other regions. Contradictory to this finding, a similar study conducted in Uganda found that women in the northern region were less likely to make 1-3 ANC visits and not the 4 visits compared to those in the western region[15].

Facility delivery was significantly associated with residence, region, and wealth. Urban adolescent women were more likely to have their births at the health facility and be assisted by a skilled provider. This could be because there is more health facilities concentrated in urban settings with better quality health care with easy of accessibility and affordability of healthcare services.

This study found that adolescent mothers from poor backgrounds were less likely to deliver from the health facility. This finding was consistent with those in Bangladesh [16]. This may be attributed to the fact that adolescent mothers from low socio-economic status are usually less uneducated, unemployed, and detached from social networks, making them more difficult to reach through maternity care programs, and they tend to underestimate the importance of maternal healthcare services. Therefore, prioritize spending their limited resources on daily basic needs over maternal health care [17, 18].

PNC checks for the mother had 2 predictor variables i.e. education and marital status. Adolescent women with a primary level of education were 90% less likely to be checked as compared to their counterparts in secondary or higher education. These current findings confirm results from a similar study in Nepal [19]. The study in Nepal found that educated women are more likely to understand the benefits of using maternal health services, and that education may enhance female autonomy, thereby enabling them to make decisions about their health [20]. The findings were also consistent with results from other studies conducted in Bangladesh, Ethiopia, and Uganda. It was reported that female education was one of the major predictors of PNC utilization [21-24]. This study found that marital status negatively associated with postnatal check-ups. Adolescent mothers who were married and those not living together with their partners were less likely to utilize a PNC check. Contradictory to this finding, a similar study conducted in Rwanda found that women who were not involved in their healthcare decision-making were more likely to use PNC services than women involved in their healthcare decision-making [25]. A perspective theory in public health is that women who are empowered to make healthcare decisions will use the power to make healthier choices than their husbands [26, 27].

Strengths And Limitations of The Study

An important strength of this study is the use of a nationally representative sample, which makes the results generalizable to the entire country of Uganda. Furthermore, the findings provide fifteen-year trends and predictors of maternal health service utilization among adolescent mothers in Uganda. Nonetheless, this study has some limitations that must be acknowledged. A major limitation is the cross-sectional nature of the DHS, which means that the causality could not be established between the variables, but only association. The study is further limited by the fact that it is based on retrospective information provided by the respondents at the time of each survey which may be subject to recall bias.

Conclusions

The secondary analysis of UDHS data showed that utilization of maternal health services by adolescent mothers aged 15-19 years increased from 2000/01 to 2016. There was increased utilization in all the five maternal health services. By 2016 the highest utilization was observed in health facility delivery and skilled assisted delivery, whereas the least utilization was noted with early ANC timing. There were significant variations in utilization of the maternal health services by the adolescent mothers. The early timing of the first ANC visit was significantly associated with adolescent women not living together with their partners, and adolescents staying in the northern region. Urban areas predicted a significant association for delivering in a health facility. Primary education by adolescent mothers was significantly less likely to receive PNC checks before discharge from the health facility. Adolescent women who married and those not living together with partners were significantly less likely to be checked for PNC before discharge from the health facility.

Recommendations

Efforts should be made to sustain the increased utilization of maternal health services. However, this should be coupled with efforts and interventions to address regional disparities with a focus on northern Uganda and rural communities. They should use the most reliable and robust information that enables policy and program planners to target the most in-need areas. This will bridge the equity gap and promote the universal coverage of maternal

health services. This study shows that utilization early timing of the first ANC visit is still too low. There is an urgent need to design enabling interventions that will enable more adolescent women to have their first ANC visit within the first trimester of pregnancy. This will help in screening for any maternal complications at an early stage. The uptake of postnatal check-ups before discharge remains too far below national and global targets. There should be continuous health education right away from ANC on the benefits of these check-ups. Strengthen the need to emphasize broadening and improving girl-child education strategies.

Declarations
Consent for publication: Not applicable.

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