Regional differentials in early antenatal care, health facility delivery and early postnatal care among women in Uganda

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Abstract

Background

Maternal health equality is an ultimate goal for a better world. Early maternal healthcare service utilization is hindered by numerous social and economical barriers, along with widespread inequalities in utilization of existing services. To better understand variations existing in Uganda, we assessed differences in early antenatal care, health facility delivery and early postnatal care among women in selected sub regions. The differences were decomposed into components attributed to variation in women's characteristics and the effects of coefficients.

Methods

We used a sample of 1,521 women of reproductive ages (15-49), who delivered a child five years prior to the 2016 Uganda Demographic and Health Survey. Non-linear Oaxaca' Blinder Multivariate Decomposition method and STATA 13.0 software were used.

Results

Significant differences in early ANC, health facility delivery and EPNC among women in Eastern and Western sub regions were attributed to both variation in women's characteristics and effects of coefficients. Overall gap in early ANC (57.39%), health facility delivery (63.88%) and EPNC (59.06%) was attributed to differences in women's characteristics, whereas differences in effects of coefficients attributed 42.61% variations in early ANC, 36.12% in health facility delivery, and 40.94% in EPNC.

Specifically, overall gap in early ANC would reduce if differences in availability of community health workers (31.6%) and media exposure (34.7%) were to disappear. Furthermore, the gap would increase by 68.8% and 12.6% in absence of the variation in effects of maternal education, and wealth

differences respectively. Overall gap in health facility delivery would reduce if differences in community health worker availability (24.6%) and media exposure (37.2%) were to disappear, and increase by 54.9% in the absence of variations in effects of maternal education. The overall gap in EPNC would reduce if differences in maternal education (18.5%) and community health worker availability (17.17%) were to disappear and increase by 52.8% and 8.4% in the absence of the variation in effects of maternal education and wealth quintile respectively.

Conclusion

Progress towards equitable maternal health should focus more on strategies that guarantee even distribution of community health workers, broad dissemination of maternal healthcare information and girl child education completion in Uganda.

Key words: Regional decomposition, Oaxaca' Blinder, Early ANC, health facility delivery, EPNC

Background

According to World Health Organization (WHO), maternal health is one of the ultimate rights of every woman to be enjoyed, without distinction of demographic, social or economic conditions. The findings by the WHO, UNICEF and UNFPA, show that a woman living in sub-Saharan Africa has 1 out of 6 chances of dying in pregnancy, childbirth and/or after delivery (1), moreover, maternal health inequalities are still high in most areas (2). Equal and early care make it possible for health workers to evenly offer maternal care among women, and discover avoidable and or preventable complications on time (3-6). According to the Andersen's model, usage of health services is determined by three dynamics: predisposing factors (demographic and social factors, and health beliefs), enabling factors, and need (7-11).

The Uganda National Population Policy and National Safe Motherhood program (SMP) sought to increase maternal health by promoting informed choice, equitable and improved quality of Maternal and Infant health care. Equity in the health sector has long been regarded as an important objective of the health system (12, 13). However, low use of maternal health services coupled with enormous spatial disparities with social-economic and cultural changes, require a significant shift to increase better service coverage and better policy formulation (14-16). Even distribution and continuum of care are important in prevention and or reducing pregnancy and birth complications and risks that may lead to death or serious illness of the mother and her baby (17, 18).

Although Uganda has registered slight progress in utilization of Maternal Health Care Services (MHCS), according to the Uganda Demographic Health Survey (UDHS) 2016 (18), regional disparities were evident in utilization of early ANC, health facility delivery and EPNC. Moreover, the country still ranks among the top 40 countries in the world with high maternal mortality at 440 deaths per 100,000 live births (3, 4) in comparison to the global target of 70 deaths per 100,000 live

births (19). Progress towards United Nations (UN) proposed Sustainable Development Goals 10 and 3.1 aimed at equality and reducing maternal mortality by 2030 respectively, can be achieved by better interventions targeting even distribution and early MHCS utilization (1, 13).

Various studies have shown that enactment of fair and sustainable health maternal reforms, strategies and action plans should be based on the principles of early access, equitable allocation, non-discrimination and stakeholder participation (12, 20, 21). Therefore, the main purpose of this study is to establish regional differentials in utilization of early antenatal care, health facility delivery and early postnatal care in Uganda. This study contributes towards better understanding of balanced interventions regarding equity, early maternal healthcare utilization, and quality of care that will enable policy makers make better informed decisions and focus their interventions.

Methods

Data source

The analysis of this study is based on the recent round of the Uganda Demographic and Health Survey (UDHS) which was conducted during the period 2015/16. The UDHS series is a nationally representative cross-sectional survey, conducted under the leadership of the Uganda Bureau of Statistics (UBOS). The UDHS provides information on demographic and household characteristics, maternal and child health indicators for each region in Uganda. This data is from a nationally representative sample of households obtained at two- stage cluster sampling. Authorization and approval to use the data was obtained from MEASURE DHS Program and ICF Macro International U.S.A, respectively. Particular set of questions were asked using women's questionnaires with the written consent of the respondents.

Based on our previous study (22), we selected a sample of 939 women of reproductive age (15-49) from Eastern_Busoga and 582 women from Western_Bunyoro sub regions, who had delivered a child five years prior to the 2016 Uganda Demographic and Health Survey. The selection was based on the two sub regions having almost similar economic indicators (23) but with different maternal healthcare utilization factors (18).

Outcome variables

Using available information, we constructed the three outcome variables defined as; early antenatal care (women who utilized first antenatal visit within first trimester), health facility delivery (women who had a supervised delivery at the health facility) and early postnatal care (women who attained first postnatal care within 48 hours after birth).

Predictor variables

The predictor variables include maternal age (15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49years), highest maternal education level (some primary, completed primary seven, some secondary, and completed secondary six), wealth (poor, middle and rich), marital status (unmarried and married), pregnancy wanted (yes and no), media exposure (exposure and non-exposure), complications (yes and no), available community workers (yes and no), distance to a health facility (big problem and not), costs (big problem and not) (22).

Data analysis

We analyzed the data using STATA 13.0 (24). Firstly, descriptive summary statistics showing differentials in women's characteristics and a bar graph of the differences in the outcome variables. Secondly, percentage differences in early ANC, health facility delivery and EPNC distributed according to their demographic, social and economic characteristics. Lastly, the Blinder-Oaxaca decomposition technique using a logistic model to partition differences between Eastern (A) and Western (B) sub regions into components attributable to variation in women's characteristics and variation in effect of coefficients. The decomposition was based on equations (1), (2) and (3) as shown below:

$$\bar{Y}_A - \bar{Y}_B = \overline{F(X_A\beta_A)} - \overline{F(X_B\beta_B)} \tag{1}$$

The mean difference in between women in different regions was further decomposed as below;

$$\bar{Y}_A - \bar{Y}_B = \left\{\overline{F(X_A\beta_A)} - \overline{F(X_B\beta_A)}\right\} + \left\{\overline{F(X_B\beta_A)} - \overline{F(X_B\beta_B)}\right\} \tag{2}$$

The above equation can be summarized as;

$$\bar{Y}_A - \bar{Y}_B = E - C \tag{3}$$

Where $\bar{Y}_A - \bar{Y}_B$ implies inequalities/differences in mean level outcomes between Eastern and Western sub regions. The component E refers to the part of the differential attributable to differential in characteristics. The component C refers to the part of the differential attributable to differential in coefficients and $X\beta$ refers to coefficients of characteristics of women. F follows a logistic function mapping $X(X\beta)$ to Y. Associations between the variables and differentials attributed to compositional variations and predictor variations were established at 5% level of significance.

RESULTS

This section presents the descriptive characteristics of Eastern and Western women, the differentials in early ANC, health facility delivery and EPNC between the women, decomposition of change in early ANC, health facility delivery and EPNC and discussion of findings.

Descriptive characteristics of women

Table 1 presents the weighted differences between Eastern and Western women by their characteristics, who are summarized as follows: Early ANC was higher for women who completed senior six (Eastern 36.8% and western 32%) with a percentage difference of 4.8%, the unmarried (21.8% and 17.8% (=4.5%)) and among the rich (26% and 22.2% (=3.8%)). However, main difference was observed among women with some primary (21.5% and 15.9% (=5.6%)). Percentage difference in health facility delivery between Eastern and Western women was high in a community with readily available health workers (80.4% and 58.7% (=21.7%)). However, there was a slight difference in health facility delivery between Eastern and Western women who completed senior six (78.2% and 75.8% (=2.4%)), and those with cost of service problems (72.8% and 70.3% (=2.5%)). Percentage differences in EPNC between Eastern and Western women was higher among those who completed senior six (53.8% and 38% (=15.8%)) and among women without distance to the health facility problems (41.3% and 3.3% (=11.0%)). EPNC was higher among the rich quintile for Eastern and Western women (60.2% and 54.7%) respectively.

Table 1: Weighted differences between Eastern and Western women by their characteristics.

Characteristics	Early ANC		Health facility delivery		EPNC	
	Eastern	**Western**	**Eastern**	**Western**	**East**	**West**
Age						
15-19	29.9	27.2	72.0	54.0	39.9	34.2
20-24	23.2	21.5	67.9	53.8	43.1	36.5
25-29	20.8	19.8	73.0	53.0	41.8	37.8
30-34	21.2	20.0	71.5	54.5	42.2	36.9
35-39	23.0	23.3	76.1	58.1	43.0	37.3
40-44	25.4	26.5	77.2	62.2	43.4	36.5
45-49	27.9	26.0	79.9	67.9	45.2	37.0
Maternal education						
Some primary	21.5	15.9	74.8	58.1	36.5	30.1
Completed primary 7	21.9	21.9	76.7	60.9	39.7	36.9
Some secondary	33.8	31.8	78.0	69.8	40.2	36.8
Completed secondary six	36.8	32.0	78.2	75.8	53.8	38.0
Marital status						
Unmarried	21.8	17.3	76.8	56.3	39.8	36.3
Married	24.0	21.4	78.0	58.4	43.0	38.9
Wealth						
Poor	20.2	20.8	77.2	57.8	38.2	37.9
Middle	27.7	25.4	80.7	58.4	43.7	38.4
Rich	22.2	26.0	79.2	60.2	60.2	54.7
Distance to facility						
Not big problem	29.7	27.4	79.7	60.4	40.7	37.4
Big problem	21.3	23.5	75.3	57.0	41.3	30.3
Costs of service						
Not big problem	23.8	22.3	72.8	70.3	43.8	39.1
Big problem	21.2	21.5	69.2	56.5	36.2	36.5
Availability of a health worker in community						
Not readily available	22.8	21.2	79.8	50.2	28.8	29.2
Readily available	30.4	28.5	80.4	58.7	42.4	39.4
Exposure to media						
Not exposed to media	21.7	21.2	77.7	56.9	30.5	30.0
Exposed to media	27.9	25.6	79.3	58.0	42.6	35.2
Pregnancy wanted						
No	17.4	18.5	77.8	57.3	40.3	35.3

Characteristics	Early ANC		Health facility delivery		EPNC	
	Eastern	Western	Eastern	Western	East	West
Yes	22.0	21.1	78.2	58.5	43.7	39.0
Complications						
No	23.5	22.9	77.1	57.2	20.2	19.5
Yes	29.3	27.9	82.4	68.5	45.4	40.2
TOTAL	**28.1**	**25.1**	**77**	**57**	**43.3**	**38.9**

Results in Figure 1 reveal that there are disparities in utilization of early ANC, health facility delivery, EPNC. The results show a bigger difference in health facility delivery (20%) between Eastern and Western women. Western sub region lags behind in all maternal health care services.

Figure 1: Multiple bar chart showing percentage distribution of women by early ANC, health facility delivery and EPNC services
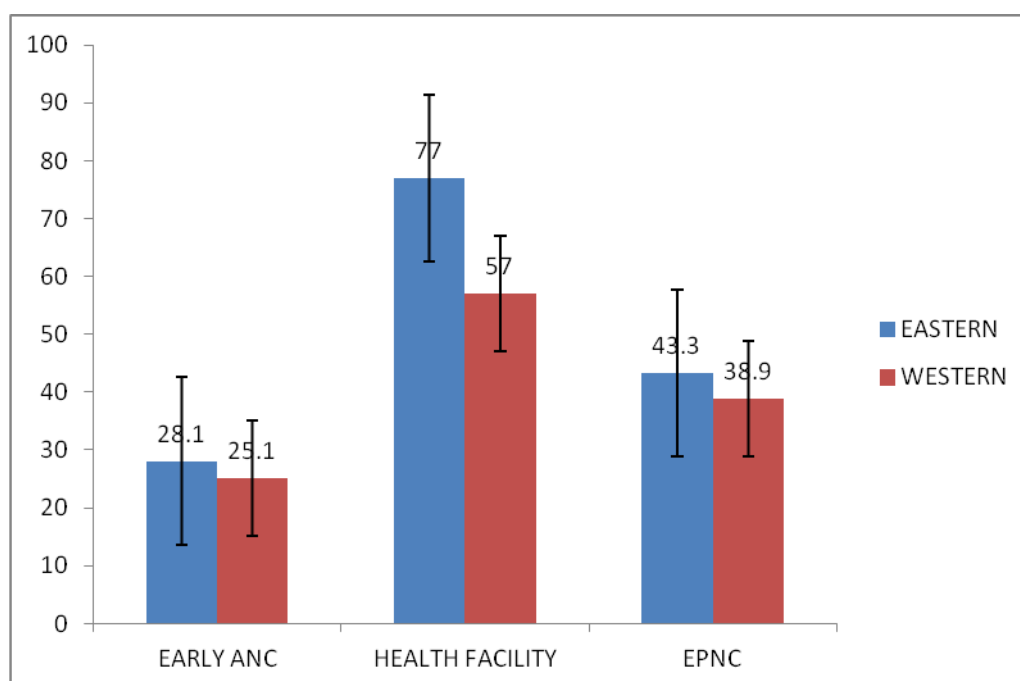
Decomposition of differences in early ANC, health facility delivery and EPNC services

A multivariate decomposition logistic regression model was used to decompose differences in early ANC, health facility delivery and EPNC between women in selected sub regions, attributed to variation in their characteristics/ endowments (E) and variation in the effects of the

predictors/coefficients (C). Tables 2, 3, 4 and 5, present decomposition results of differences in utilization of early ANC, health facility delivery and EPNC by background characteristics.

Results in Table 2 reveal that differences in early ANC, health facility delivery and EPNC between the selected sub regions were significantly attributed to both differences in the characteristics and variations in effects of predictors ($p<0.05$). Overall, about 57.39%, 63.88% and 59.06% of the gap in early ANC, health facility delivery and EPNC respectively is attributed to differences in characteristics of women. On the other hand, 42.61%, 36.12% and 40.94% of the gap is attributed to differences in effects of predictors or coefficients.

Table 2: Summary of decomposition of early ANC, health facility delivery and EPNC services

	Early ANC			Health facility delivery			EPNC		
Components	**Coef**	**p-value**	**%**	**Coef**	**p-value**	**%**	**Coef.**	**p-value**	**%**
E	0.194	0.000	57.39	0.260	0.001	63.88	0.225	0.000	59.06
C	0.145	0.000	42.61	0.147	0.000	36.12	0.156	0.003	40.94
R	0.339	0.000	100	0.407	0.001	100	0.381	0.003	100

Note: overall decomposition results of early ANC, health facility delivery and EPNC; n=1521: variations to differences in endowments (E) and effects of coefficients(C); R is the total variation

Decomposition of early ANC due to differences in characteristics and effects of coefficients

Variations due to differences in characteristics of women

Overall, variation in the characteristics of women contributed about 57.39% to the overall gap in early ANC between the two sub regions. Specifically, the differences were significantly attributed to highest maternal education, marital status, availability of a health worker in community, exposure to media and desire for pregnancy ($p<0.05$). The variation in these characteristics of women contribute about -6.5%, 0.2%, 34.72%, 31.6% and 0.75% to the overall gap in early ANC gap respectively. The positive percentages in the results show the proportion in which the overall gap would reduce if the differences in the characteristics of women in the two sub regions were to disappear. On the other

hand, the negative percentage shows the proportion to which the gap in early ANC would increase if the differences in the characteristics of women in the two sub regions were to disappear.

The overall gap in early ANC between Eastern and Western sub regions would reduce mainly by 31.6% and 34.7% if differences in availability of a health worker in a community and exposure to media were to disappear and increase by 6.5% if the differences in maternal education were to disappear.

Variations due to differences in effects of predictors (coefficients)

Variations in the effects of predictors on early ANC between Eastern and Western sub regions contribute about 42.61% to the overall change, with difference in intercepts accounting for this most. Specifically, the differences were significantly attributed to variation in the effects of characteristics namely; highest maternal education, wealth and availability of health worker in the community ($p<0.05$). The variations in the effects of predictors (coefficients) of women contribute about -68.8%, -12.6% and -2.4% of the overall gap in early ANC among women in the Eastern and western regions respectively. In particular, the overall gap in early ANC between the two sub regions would increase on average by 68.8%, 12.6% and 2.4% in the absence of the variation in the effects of maternal education, wealth and community health worker respectively.

Table 3: Decomposition of early ANC due to differences in characteristics and effects of coefficients

Variables	Differences in characteristics(E)			Differences in effects of coefficients(C)		
	Coefficient	p-value	percent	Coefficient	p-value	percent
Age						
15-19	1.000			1.000		
20-24	-0.182	0.104	-0.26	-0.759	0.939	-0.22
25-29	0.335	0.371	-0.29	-3.096	0.700	-0.91
30-34	-0.089	0.072	0.10	-1.158	0.512	-0.34
35-39	0.050	0.221	0.01	-0.850	0.342	-1.78
40-44	1.024	0.056	0.22	-4.023	0.689	-2.23

Variables	Differences in characteristics(E)			Differences in effects of coefficients(C)		
	Coefficient	p-value	percent	Coefficient	p-value	percent
45-49	1.748	0.614	-0.15	0.874	0.534	-0.06
HighestMaternal education						
Some primary	1.000			1.000		
Completedprimary 7	-8.394	**0.002**	-2.48	-120.341	**0.014**	-23.40
Some secondary	-6.323	**0.000**	-2.29	-23.781	**0.005**	-26.70
Completedsecondary 6	0.089	**0.017**	-1.73	-12.012	**0.036**	-18.70
Marital status						
Unmarried	1.000			.000		
Married	1.568	**0.000**	0.2	-49.461	0.302	-14.6
Wealth						
Poor	1.000			1.000		
Middle	-4.819	0.822	-1.4	-33.948	**0.008**	-10.02
Rich	-5.886	0.821	-1.33	-7.017	**0.017**	-2.58
Distance to health facility						
Not big problem	1.000			1.000		
Big problem	-0.552	0.166	-0.16	0.365	0.689	0.077
Cost of service						
Not big problem	1.000			1.000		
Big problem	-2.098	0.232	-0.07	-0.041	0.527	-1.92
Availability of a health worker in community						
Not readily available	1.000			1.000		
Readily available	116.50	**0.000**	34.72	-8.119	**0.009**	-2.40
Exposure to media						
Not exposed media	1.000			1.000		
Exposed to media	1.369	**0.002**	31.6	12.439	0.319	3.67
Pregnancy wanted						
No	1.000			1.000		
Yes	2.529	**0.001**	0.75	8.153	0.328	-2.41
Complications						
No	1.000			1.000		
Yes	-0.184	0.335	-0.05	9.818	0.401	1.91
Constant				494.080	0.053	145.223
Total	0.194	**0.000**	57.39	0.145	**0.000**	42.61

Decomposition of health facility delivery due to differences in characteristics and effects of coefficients

Variations due to differences in characteristics of women

Overall, variation in the characteristics of women contributed about 63.88% to the overall gap in health facility delivery between the two sub regions. Specifically, the differences were significantly attributed to highest maternal education, availability of a health worker in community, exposure to media, and complicated pregnancy ($p<0.05$). The variation in these characteristics contribute about -8.89%, 24.62%, 34.7% and -0.01% to the overall gap respectively.

The overall gap in health facility delivery between women in Eastern and Western regions would reduce by 24.62% and 37.2% if differences in availability of a health worker in the community and exposure to media were to disappear respectively and would increase mainly by 8.89% if the differences in highest maternal education were to disappear.

Variations due to differences in effects of predictors (coefficients)

Variations in the coefficients or effects of characteristics on health facility delivery among women in Eastern and Western regions contribute about 36.12% to the overall change with difference in intercepts accounting mostly for the changes. Specifically, the differences were significantly attributed to variation in the effects of characteristics namely; highest maternal education and wealth ($p<0.05$). The variations in the effects of characteristics (coefficients) of women contribute about -54.9% and 8.69% to the overall gap in health facility delivery among women in the Eastern and Western regions respectively. In particular, the overall gap in health facility delivery would increase on average by 54.9% in the absence of the variation in the effects of maternal education and reduce on average by 8.69% in the absence of the variation in the effects of wealth.

Table 4: Decomposition of health facility delivery due to differences in characteristics and effects of coefficients

Variables	Differences in characteristics (E)			Differences in effects of coefficients(C)		
	Coefficient	**p-value**	**percent**	**Coefficient**	**p-value**	**percent**
Age						
15-19	1.000			1.000		
20-24	-0.452	0.35	0.00	0.370	0.067	-0.78
25-29	0.631	0.091	2.00	0.096	0.730	-1.3
30-34	-0.043	0.062	3.40	0.158	0.062	-0.7
35-39	0.850	0.514	0.01	0.250	0.312	-1.63
40-44	1.126	0.906	-0.20	4.103	0.621	-5.05
45-49	1.748	0.100	-0.15	3.274	0.074	-0.10
Highest maternal education						
Some primary	1.000			1.000		
Completedprimary 7	5.430	**0.031**	-3.50	-74.481	**0.042**	-17.80
Some secondary	-1.327	**0.001**	-0.50	-24.532	**0.000**	-22.40
Completedsecondary 6	2.084	**0.024**	-4.89	-11.009	**0.001**	-14.70
Marital status						
Unmarried	1.000			1.000		
Married	2.102	0.150	0.04	-6.782	0.302	-11.3
Wealth						
Poor	1.000			1.000		
Middle	-3.512	0.172	5.2	10.236	**0.021**	6.029
Rich	-5.1844	0.351	-1.7	8.100	**0.005**	2.670
Distance to health facility						
Not big problem	1.000			1.000		
Big problem	-0.290	0.091	-0.10	-1.345	0.126	-0.032
Cost of service						
Not big problem	1.000			1.000		
Big problem	0.088	0.511	1.57	-0.111	0.530	-2.64
Availability of a health worker in community						
Notreadily available	1.000			1.000		
Readily available	98.90	**0.003**	24.62	1.091	0.315	-3.41
Exposure to media						
Not exposed media	1.000			1.000		
Exposed to media	1.809	**0.000**	37.2	6.903	0.501	2.62
Pregnancywanted						
No	1.000			1.000		

Variables	Differences in characteristics (E)			Differences in effects of coefficients(C)		
	Coefficient	p-value	percent	Coefficient	p-value	percent
Yes	1.751	0.073	0.89	-0.148	0.710	-3.02
Complications						
No	1.000			1.000		
Yes	2.153	**0.000**	-0.01	12.023	0.081	2.04
Constant				310.12	0.053	107.043
Total	0.260	**0.001**	63.88	0.147	**0.000**	36.12

Decomposition of EPNC due to differences in characteristics and effects of coefficients

Variations due to differences in characteristics of women

Variations in the characteristics of women contributed about 59.06% to the overall gap in EPNC between the two sub regions. Specifically, the differences were significantly attributed to maternal education, marital status and availability of a health worker in community (p<0.05). The variation in these characteristics of women contributed about 18.52%, 0.34% and 17.17% to the overall gap in EPNC between women in Eastern and Western sub regions respectively. The overall gap in EPNC between Eastern and Western sub regions would reduce mainly by 18.52% and 17.17% if differences in maternal education and availability of a health worker in the community respectively were to disappear.

Variations due to differences in effects of predictors (coefficients)

Variations in the coefficients or effects of characteristics on EPNC among women in Eastern and Western regions contribute about 40.94% to the overall change mostly with difference in the intercepts. Specifically, the differences were significantly attributed to variation in the effects of characteristics namely; highest maternal education, wealth and availability of health worker in the community (p<0.05). The variations in the effects of characteristics of women contribute about -52.8%, -8.4% and -4.7% to the overall gap in EPNC among women in the Eastern and western sub

regions respectively. In particular, the overall gap in EPNC would increase on average by 52.8%, 8.4% and 4.7% in the absence of the variation in the effects of maternal education, wealth and health worker availability in community respectively.

Table 5: Decomposition of EPNC due to differences in characteristics and effects of coefficients

Variables	Differences in characteristics (E)			Differences in effects of coefficients (C)		
	Coefficient	p-value	percent	Coefficient	p-value	percent
Age						
15-19	1.000			1.000		
20-24	-0.440	0.231	1.60	-0.191	0.149	-0.62
25-29	-0.323	0.181	2.30	-1.002	0.210	-1.11
30-34	-0.132	0.052	0.12	-1.255	0.090	-0.45
35-39	0.150	0.206	0.21	-0.356	0.331	-1.38
40-44	-1.160	0.123	- 0.34	-2.025	0.690	-1.23
45-49	1.444	0.601	-2.05	1.876	0.094	0.03
Maternal education						
Some primary	1.000			1.000		
Completedprimary 7	12.24	**0.045**	13.5	-34.23	**0.004**	-20.10
Some secondary	10.32	**0.010**	3.00	-2.791	**0.025**	-23.00
Completedsecondary 6	1.089	**0.007**	2.02	0.012	**0.011**	-9.70
Marital status						
Unmarried	1.000			.000		
Married	1.568	**0.006**	0.34	-32.404	0.140	-2.43
Wealth						
Poor	1.000			1.000		
Middle	-3.839	0.236	-3.03	-10.921	**0.019**	-6.43
Rich	-2.832	0.070	-2.79	-3.324	**0.007**	-1.97
Distance to health facility						
Not big problem	1.000			1.000		
Big problem	0.342	0.136	-0.15	-0.315	0.919	0.47
Cost of service						
Not big problem	1.000			1.000		
Big problem	1.018	0.114	-0.37	-0.249	0.316	-1.39
Availability of a health worker in community						
Notreadily vailable	1.000			1.000		

Variables	Differences in characteristics (E)			Differences in effects of coefficients (C)		
	Coefficient	p-value	percent	Coefficient	p-value	percent
Readily available	98.20	**0.03**	17.17	-2.321	**0.025**	-4.70
Exposure to media Not exposed media Exposed to media	 1.000 2.219	 0.283	 31.68	 1.000 8.210	 0.523	 4.07
Pregnancywanted No Yes	 1.000 -0.029	 0.120	 - 3.56	 1.000 3.230	 0.068	 -5.01
Complicated pregnancy No Yes	 1.000 -0.097	 0.92	 -1.13	 1.000 7.085	 0.330	 -2.02
Constant				345.01	0.62	117.91
Total	0.225	**0.000**	59.06	0.156	**0.003**	40.94

Discussion of Results

Our findings show a relatively large regional gap in the use of maternal healthcare services (MHCS) between Eastern and Western sub regions in Uganda. The main factors that contributed to the overall gap in early ANC, health facility delivery and EPNC were highest maternal education and availability of a health worker in community followed by exposure to media and wealth. Significant disparities in early use of maternal health services are common in Malawa due to different geographical locations, education and wealth (25). In Nigeria, pregnant women from poor and uneducated backgrounds were the least likely to receive required maternal services (16), confirmed in China (20), Bangladesh, (26) and India (27).

The higher contribution of maternal education in the overall regional gap in all indicators could be understood through association of education with increasing migrations. Due to the fact that many people move from different regions to Western_Bunyoro sub region looking for work evidenced by the highest percentage of recent female internal migrants (23) and high annual regional population

growth. Among this population of women, this results in less awareness and underuse of maternal healthcare services.

The significant contribution of availability of a health worker in community may be attributed to a higher concentration of health workers (28) and support organizations in Eastern sub regions than Western sub region. Western Bunyoro is considered a geographically disadvantaged sub region because of acculturation due to mixed tribes, the Bafuliki Bakiga, Banyakole and constant migrations from Congo, which limits women's awareness of health services (29-31). Notably, results indicate that wealth reduces the average gap in utilization of early antenatal care, health facility delivery and EPNC among the women in both sub regions. This may be explained by the fact that better economic stand is associated with relatively better education status and affordable cost of service, both of which are favorable for better use of healthcare services (21, 32, 33).

In sum, delayed use of maternal health services coupled with enormous regional disparities in Uganda because of social-economic and community vast differences exist. This requires a significant shift in priorities to increase better service coverage and even distribution of essential services across the country.

Limitation of the study

The major limitation of this study relates to the secondary nature of the data that were used. Invariably many events captured through a retrospective inquiry are often susceptible to recall bias and memory lapse. For example, information asked concerning time for first antenatal care visit might not be remembered exactly, which could impact on precision of the study findings. Furthermore, only reports of women who were alive at the time of the survey were obtained. Moreover, in populations where maternal mortality ratios are very high, women of high mortality risk could have succumbed to the force of mortality.

Conclusion

There were inequalities in utilization of maternal healthcare services among women in Eastern and Western sub regions in Uganda. The critical variations are mainly due to differences in maternal education level, availability of health workers in community, exposure to media and wealth. To address the significant disparities, this study proposes two main strategies: Ensuring even distribution of community health workers without distinction of demographic, social and economic conditions across all regions. Emphasize girl child completion, broad dissemination of maternal health and continuum of care information across all regions through cost friendly means of communication.

In essence: Equity is paramount in improving early maternal health care utilization in Uganda.

Abbreviations

MHCS Maternal Health Care and Services

ADB   African Development Bank

UBOS Uganda Bureau of Statistics

DHS   Demographic Health Survey

ANC   Antenatal Care

PNC   Postnatal Care

SDG   Sustainable Development Goals

MUBS Makerere University Business School

Declarations:

Ethics approval and consent to participate

The study is based on the recent round of the Uganda Demographic and Health Survey (UDHS) which was conducted during the period 2015/16. The UDHS series is a nationally representative cross-sectional survey, conducted under the leadership of the Uganda Bureau of Statistics (UBOS). Authorization to use data was obtained from MEASURE DHS and approval for UDHS usage was obtained from the data originator, ICF Macro International U.S.A. Participants demonstrated their consent prior the commencement of the interview as reported by the data originator.

Consent to publish

Not applicable

Availability of data and materials

The datasets generated and/or analyzed during this study are not publicly available due to a requirement of approval from ICF Macro International U.S.A to use the data. The authors were authorized to use "Survey" data from the Demographic and Health Surveys (DHS) Program accessed on: http://www.dhsprogram.com/data/dataset_admin/login_main.cfm.

The approval letter is therefore, attached for confirmation

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

RA participated in preparation of this MS; conceived the study, selected data, conducted data analyses, reviewed the scientific content, and interpretation of findings, discussion, and conclusions. LAK participated in conceptualization, Methodology, substantively revised the Manuscript. RW participated in preparing this MS, conceptualization, Methodology, scientific content and MS review. All authors read and approved the final manuscript.

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REFERENCES

1.   WHO. WHO recommended interventions for improving maternal and newborn health: integrated management of pregnancy and childbirth. Geneva: World Health Organization, 2015.
2.   Magadi MA, Zulu EM, Brockerhoff M. The inequality of maternal health care in urban sub-Saharan Africa in the 1990s. Population studies. 2003;57(3):347-66.
3.   UNICEF. Maternal, newborn, child and adolescent health. WHO. 2019.
4.   Rice M. Maternal Health & Rights In Uganda. 2019.
5.   Rutaremwa G, Wandera SO, Jhamba T, Akiror E, Kiconco A. Determinants of maternal health services utilization in Uganda. BMC health services research. 2015;15(1):271.
6.   Bbaale E, Guloba A. Maternal education and childbirth care in Uganda. The Australasian medical journal. 2011;4(7):389.
7.   Ricketts TC, Goldsmith LJ. Access in health services research: the battle of the frameworks. Nursing outlook. 2005;53(6):274-80.
8.   Golooba-Mutebi F, editor Maternal health delivery in Rwanda and Uganda: exploring sources of success and failure. Rethinking Development in an Age of Scarcity and Uncertainty conference, DSA/EADI, York; 2011.
9.   Emelumadu O, Ukegbu A, Ezeama N, Kanu O, Ifeadike C, Onyeonoro U. Socio-demographic determinants of maternal health-care service utilization among rural women in anambra state, South East Nigeria. Ann Med Health Sci Res. 2014;4.
10.   Wudineh KG, Nigusie AA, Gesese SS, Tesu AA, Beyene FY. Postnatal care service utilization and associated factors among women who gave birth in Debretabour town, North West Ethiopia: a community-based cross-sectional study. BMC pregnancy and childbirth. 2018;18(1):508.
11.   Babitsch B, Gohl D, von Lengerke T. Re-revisiting Andersen's Behavioral Model of Health Services Use: a systematic review of studies from 1998–2011. GMS Psycho-Social-Medicine. 2012;9.
12.   Houweling TA, Ronsmans C, Campbell OM, Kunst AE. Huge poor-rich inequalities in maternity care: an international comparative study

of maternity and child care in developing countries. Bulletin of the World Health Organization. 2007;85:745-54.

13. WHO. WHO, Health in 2015: from MDGs, Millennium Development Goals to SDGs, Sustainable Development Goals, Geneva, Switzerland, 2015. . SDGs), Transforming our world: the. 2015;2030.

14. Fang P, Dong S, Xiao J, Liu C, Feng X, Wang Y. Regional inequality in health and its determinants: evidence from China. Health Policy. 2010;94(1):14-25.

15. Pallikadavath S, Foss M, Stones RW. Antenatal care: provision and inequality in rural north India. Social science & medicine. 2004;59(6):1147-58.

16. Adeyanju O, Tubeuf S, Ensor T. Socio-economic inequalities in access to maternal and child healthcare in Nigeria: changes over time and decomposition analysis. Health policy and planning. 2017;32(8):1111-8.

17. Kerber KJ, de Graft-Johnson JE, Bhutta ZA, Okong P, Starrs A, Lawn JE. Continuum of care for maternal, newborn, and child health: from slogan to service delivery. The Lancet. 2007;370(9595):1358-69.

18. UBOS I. Uganda demographic and health survey. Uganda Bureau of Statistics, Kampala Uganda. 2017.

19. Norton R. Women's health: a new global agenda. Women's Health. 2016;12(3):271-3.

20. Liu X, Gao W, Yan H. Measuring and decomposing the inequality of maternal health services utilization in western rural China. BMC health services research. 2014;14(1):102.

21. Ssewanyana S, Kasirye I. Causes of health inequalities in Uganda: evidence from the demographic and health surveys. African Development Review. 2012;24(4):327-41.

22. Atuhaire R, Atuhaire LK, Wamala R, Nansubuga E. Interrelationships between early antenatal care, health facility delivery and early postnatal care among women in Uganda: a structural equation analysis. Global Health Action. 2020;13(1):1830463.

23. UPHC. The national population and housing census 2014–main report. UBOS Kampala, Uganda; 2016.

24. Stata S. Release 13. statistical software. StataCorp LP, College Station, TX. 2013.

25.   Yaya S, Bishwajit G, Shah V. Wealth, education and urban–rural inequality and maternal healthcare service usage in Malawi. BMJ global health. 2016;1(2):e000085.

26.   Khan M, Islam M, Rahman M. Inequality in utilization of cesarean delivery in Bangladesh: a decomposition analysis using nationally representative data. Public health. 2018;157:111-20.

27.   Pallikadavath S, Foss M, Stones RW. Antenatal care in rural Madhya Pradesh: provision and inequality. Obstetric Care in Central India. 2004:111-28.

28.   Malarcher S, Meirik O, Lebetkin E, Shah I, Spieler J, Stanback J. Provision of DMPA by community health workers: what the evidence shows. Contraception. 2011;83(6):495-503.

29.   Van der Stuyft P, De Muynck A, Schillemans L, Timmerman C. Migration, acculturation and utilization of primary health care. Social Science & Medicine. 1989;29(1):53-60.

30.   Shaokang Z, Zhenwei S, Blas E. Economic transition and maternal health care for internal migrants in Shanghai, China. Health Policy and Planning. 2002;17(suppl_1):47-55.

31.   Isarabhakdi P. Meeting at the Crossroads: Myanmar Migrants and Their Use of Thai Health Care Services. Asian and Pacific Migration Journal. 2004;13(1):107-26.

32.   Kiwanuka S, Ekirapa E, Peterson S, Okui O, Rahman MH, Peters D, et al. Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. Transactions of the Royal Society of Tropical Medicine and Hygiene. 2008;102(11):1067-74.

33.   Zere E, Tumusiime P, Walker O, Kirigia J, Mwikisa C, Mbeeli T. Inequities in utilization of maternal health interventions in Namibia: implications for progress towards MDG 5 targets. International journal for equity in health. 2010;9(1):16.
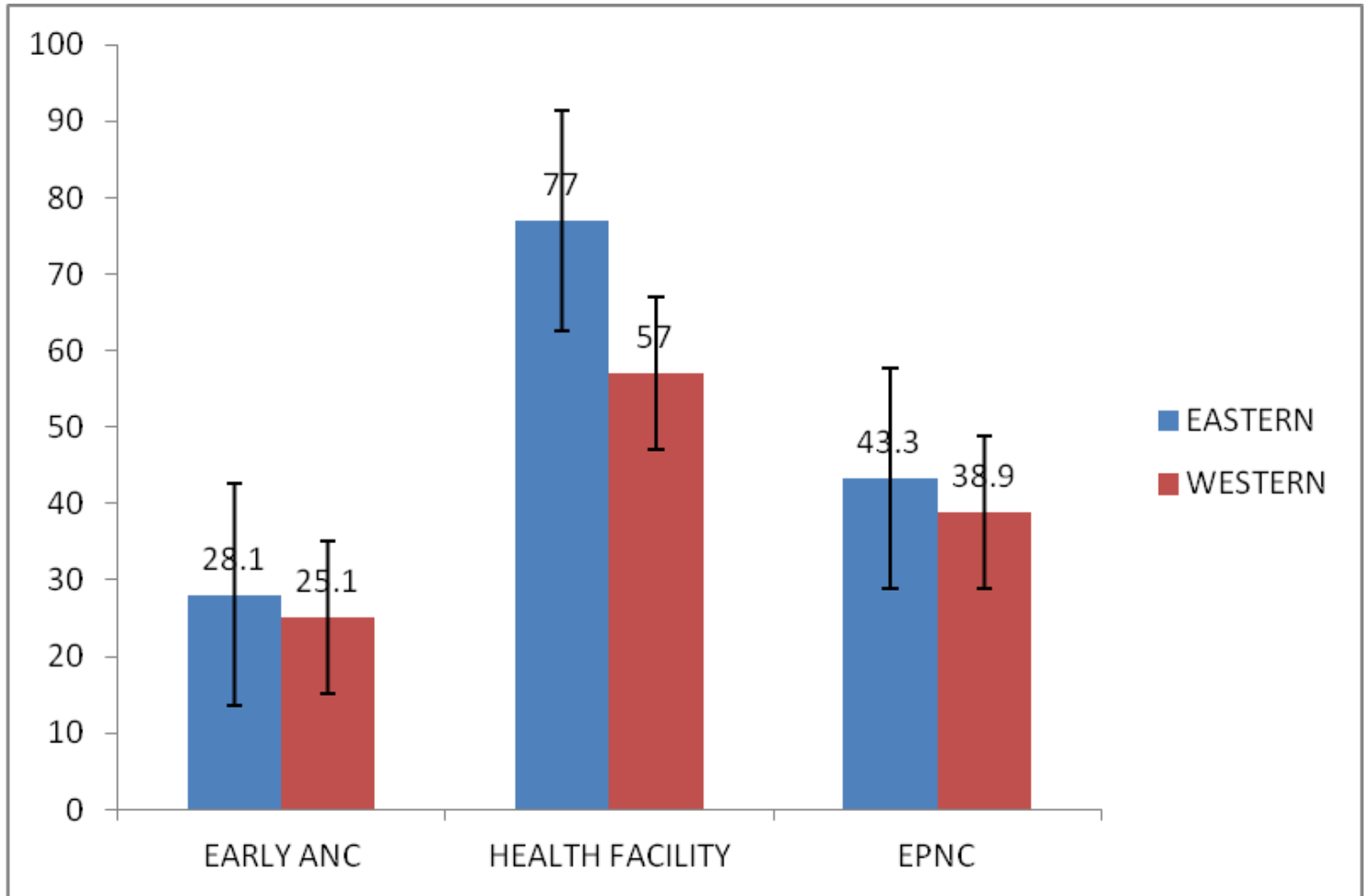
Figures

Figure 1

Multiple bar chart showing percentage distribution of women by early ANC, health facility delivery and EPNC services