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Determinants of change in the inequality and associated predictors of teenage pregnancy in Uganda for the period 2006–2016: analysis of the Uganda Demographic and Health Surveys

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ABSTRACT

Objective Teenage pregnancy has become a public health concern in Uganda because of its negative consequences to both the mother and child. The objective of this study was to examine the determinants of change in the inequality and associated predictors of teenage pregnancy in Uganda for the period 2006–2016.

Study design A retrospective national cross-sectional study.

Setting Uganda.

Participants Uganda Demographic and Health Survey secondary data of only female teenagers aged 15–19 years. The samples selected for analyses were 1936 in 2006; 2048 in 2011 and 4264 in 2016.

Outcome measure The primary outcome was teenage pregnancy. Analysis was performed using the logistic regression, equiplots, concentration curve, normalised concentration index, decomposition of the concentration index and Oaxaca-type decomposition.

Results The prevalence of teenage pregnancy has seemingly remained high and almost constant from 2006 to 2016 with the risk worsening to the disadvantage of the poor. Household wealth-index, teenagers' years of education, early sexual debut and child marriage were the main key predictors and contributors of the large inequality in teenage pregnancy from 2006 to 2016.

Conclusion Teenage pregnancy is disproportionately prevalent among different subpopulations of adolescent girls in Uganda. We therefore recommend policy actions to sensitise communities and enforcement of child rights and child protection laws to stop child marriages. There is also need to promote girl child education, improving household incomes, and intensifying mass media awareness on the risks of early pregnancies. Further, ensuring that villages have operational adolescent and youth friendly services as well as incorporating sex education and other different adolescent reproductive health programmes in school curriculum will be key measures in reducing the large inequality in teenage pregnancy.

Strengths and limitations of this study

- The strength of this study is that it included all self-reported pregnancies among teenagers.
- The study applied multiple analysis techniques to examine the changes and levels of inequalities over time.
- On the other hand, the cross-sectional nature of the data could not permit the establishment of causality.
- Also, the small sample size of adolescents used creates stratification difficulties and leads to larger SEs or wide CI.
- The Demographic and Health Survey data on sexuality, fertility and reproduction is based on self-reporting, which may be affected by the desirability reporting bias.

INTRODUCTION

An estimate of 7.3 million girls become pregnant before the age of 18 every year with the number approximated to reach 86 million by 2030.[1] The greatest increase in teenage pregnancy is projected to be highest in sub-Saharan Africa.[1] Despite the global call to fight early pregnancies, several adolescents continue to engage in early sex without using any contraceptive method which exposes them to a risk of being pregnant. In Uganda, teenage pregnancy is at its peak across East and Southern Africa with an estimate of one in five female adolescents giving birth every year.[2]

Further, according to the 2016 Uganda Demographic and Health Survey (UDHS), 6% of girls aged 12–17 years are currently married with 9% of them having at least a child.[3] The report also showed that 1 in 10 women aged 15–19 have sex by the age of 15 and the trend at which these teenagers also give birth or become pregnant has remained

stable in the past years.[3] It can also be shown that 43% of women aged 25–49 years married before age 18 and age at marriage in Uganda is much higher than age at first sex.[3]

Teenage pregnancy has therefore become a public health issue because of its adverse consequences on the women's physical, mental and emotional development.[4 5] Findings have linked early pregnancies to negative health and low economic outcomes to the teens, their families and communities.[5] The main contributor to these pregnancies could partly be attributed to child marriages. Some parents have a perception that allowing their young children to marry is a way of reducing their household expenses, protecting them from premarital pregnancy and other hazards of sexual activity.[5] However, early marriages expose adolescents to early sexual debut which in turn increases the risk of HIV infection and other sexually transmitted diseases. Findings have revealed that the majority of sexually active teenagers do not use condoms or other contraceptive measures. According to 2016 UDHS, 22% of married women in Uganda aged 15–19 years are not using any form of contraception which is the lowest compared with other older women.[3]

There is also increased maternal and morbidity among teenage mothers with an estimate of 70 000 adolescents in low-income and middle-income countries dieing annually due to pregnancy and childbirth-related problems including unsafe abortions.[1] Similarly, their newborn babies are more likely to die earlier with only 19% of Ugandan women aged 20–24 having had a live birth by their 18th birthday.[1] A study carried out on factors associated with teenage pregnancy and its effects in Kibuku district of Uganda also indicated miscarriages, abortions due to fear from parents and other external pressure as well as death of neonates as some of the health-related effects of teenage pregnancy.[6]

In addition, teenage births have been associated with newborn babies having extremely low birth weights, vaginal tears during births among mothers as well as preterm and caesarean deliveries.[7 8] Teenage mothers may not be skilled nor knowledgeable on the better prenatal and postnatal care practices which directly impacts on their newborn babies. Still, their weak bodies may also prohibit proper vaginal delivery thus increasing the risk of caesarean section. Other consequences of teenage pregnancies include: barrier to education and school dropout, unemployment, and failure to exercise autonomy and freedom.[9 10] It has been shown by previous findings that almost half of Ugandan teenagers drop out of school due to teenage pregnancy.[3 6] This in a long run contributes to inter-generational poverty since such teenagers may not be in a position to have decent jobs to support themselves and their children.[6]

With relatively a very young population in Uganda where half of it is highly dominated by adolescent females, the choices that these teenagers and their parents make will always influence and affect the country's future for decades to come.[3] Some information on factors associated with teenage pregnancy among low and middle income countries are currently known.[6 11 12] It has also been revealed that teenage pregnancy is driven by socioeconomic and demographic inequalities.[13 14] Studies that explore these inequalities have been done in some few low and middle income countries with limited information on Uganda. The main objective of this study was to examine the determinants of change in the inequality and associated predictors of teenage pregnancy in Uganda for the period from 2006 to 2016. More specifically, the study was intended to: (i) examine the trend in the prevalence of teenage pregnancy from 2006 to 2016; (ii) determine the factors associated with teenage pregnancy; (iii) measure and decompose the inequality in teenage pregnancy; (iv) examine the determinants of change in the inequality in teenage pregnancy over 2006–2011 and 2011–2016. This paper has important policy implications for the inequalities that exist to reduce teenage pregnancy as well as contributing to the existing literature.

METHODS

Data source and population

This study was based on data from three consecutive UDHS conducted in 2006, 2011 and 2016. All the data used in this study is available in a public, open access repository. These datasets are publicly available from the DHS website (https://www.dhsprogram.com/data/available-datasets.cfm) on request.[15] The UDHS are nationally representative surveys and follow a two-stage cluster sampling design. The first stage involved a selection of clusters (321 in 2006, 404 in 2011 and 697 in 2016) while the second stage involved a systematic sampling of households within each cluster from which all women of childbearing age (15–49 years), who were either permanent residents of the households or visitors who slept in the households the night before the surveys were interviewed.[3 16 17] A total of 9864 households in 2006, 10 086 in 2011 and 20 880 in 2016 were selected with a total number of 8531; 8674 and 18 506 women aged 15–49 years fully interviewed in the 2006, 2011 and 2016 UDHS, respectively. Further information about the sampling techniques that were used can be accessed from the UDHS final reports.[3 16 17] However, this study was restricted to only female teenagers aged 15–19 years with weighted totals of 1936 in 2006, 2048 in 2011 and 4264 in 2016 giving a total of 8248 respondents.

Study variables

Outcome variable

Teenage pregnancy was the outcome variable for the study. The UDHS collects information on various reproductive health issues including pregnancy and child birth. This provides an opportunity to understand whether the adolescent was pregnant at the time of the survey, had any terminated pregnancy or miscarriage and the number of births she had in the past 5 years before the surveys.[3 16 17] The outcome variable was binary in nature with a code

of 1 if the teenager has ever been pregnant and 0 if otherwise.

Independent variables

These include: household wealth index (poorest, poorer, middle, richer, richest); years of education (count), place of residence (rural or urban); region (Kampala, Central, East-central, Eastern, Western, West-Nile, Northern and South-west); religion (Catholic, Protestant, Muslims, others; where other religions include Seventh Day Adventists, Orthodox, Born again/Pentecostal/Evangelical, Baha'i, Baptist, Presbyterian, Jehovah's witness, Salvation army, Traditionalists and other unknown religions). Other variables include: age of the respondent treated as categorical with binary dummy variables for each of the ages 15, 16, 17, 18 and 19; early sexual debut (treated as a binary variable taking on 1 if a teenager had her first sex before 18 years and 0 otherwise); access to media (measured using three questions that required whether a teenager has access to information through radio, television and newspapers). All the responses to these questions were merged and coded 0 for no exposure to all the forms of media, 1 for exposure to only one form of media, 2 for exposure to only two sources and 3 for exposure to all the three sources of media. The selection and identification of all these variables was based on their significance in prior studies.[12 18]

Statistical analysis

The data were first weighted to ensure the representativeness of the sampled data as required for all DHS data.[3 16 17] A weighting variable generated using the sample weight variable in the DHS data was applied in all statistical commands. In the analysis, we started with a descriptive summary of study variables (either as percentages for the categorical variables or mean for the count variable). We then quantified whether the prevalence of teenage pregnancy was equitably distributed across the socioeconomic status (wealth index) or it was more concentrated in particular population subgroups over time using equiplots. Equiplots were designed by International Center for Equity in Health, with the aim of analysing social inequalities over years (http://www.equidade.org/equiplot.php). This was followed by fitting a multivariate logistic regression model for the purpose of identifying the predictors of teenage pregnancy for the study period.

Measurement of the inequality

The concentration curve and concentration index were adopted to further explore the inequalities in teenage pregnancy as proposed by Wagstaff *et al*.[19] This approach has been widely adopted in several health studies elsewhere.[20 21] The concentration curve shows a graphical representation of how the prevalence of teenage pregnancy is equitably distributed across the study population, ranked according to household wealth index. If the outcome variable is equally distributed across household wealth index, it implies that there is no inequality and the concentration curve will be a 45° line (line of equality). However, if an outcome variable takes higher (lower) values among teenagers living in lower household wealth index, the concentration curve lies above (below) the line of equality. Concentration index on the other hand is used to measure the extent to which teenage pregnancy is concentrated among the disadvantaged or the advantaged. This was assessed using commands downloaded from the International Center for Equity in Health.[20 22] The concentration index, C, can be computed as:

$$C = \frac{2}{n\bar{y}} \sum_{i=1}^{n} y_i r_i - 1 \quad (1)$$

where y_i is the teenage pregnancy outcome of individual, i; r_i is the fractional rank of individual i in terms of the index of household's economic status; $\bar{y}$ is the mean prevalence of teenage pregnancy. The concentration index is equivalent to two times the area between the concentration curve and the line of equality with its value ranging between −1 and +1.[23] A positive (negative) value of the concentration index indicates that an outcome is more concentrated among the higher (lower) wealth groups, while a zero value reveals no income-related inequality in the distribution of the outcome.

This approach of obtaining the concentration index, C , was initially designed for continuous related outcomes and this limited its application to the bounded nature of binary outcomes. Our outcome variable being binary, we used Erreygers normalised corrected concentration index (E) which was proposed for both ordinal and dichotomous variables.[24] According to Erreygers correction, the concentration index of the outcome variable is given as:

$$E = \frac{4\bar{y}}{y_{max} - y_{min}} C \quad (2)$$

where y_{max} and y_{min} are the the upper and lower bounds of the outcome variable, respectively.

Decomposition of the inequality

In order to further reveal the factors that contribute to socioeconomic inequalities in the prevalence of teenage pregnancy, the concentration index was decomposed into contributions of various determining factors using Wagstaff decomposition analysis.[25] For any linear regression model of health variable, y_i such as:

$$y_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \quad (3)$$

where x_{ki} is a set of k explanatory variables for the ith individual; β_k is a coefficient of x_k from a linear regression and ε_i is the error term for the ith individual. The concentration index, C, for y, is given by:

$$C = \sum_k \left(\frac{\beta_k \bar{x}_k}{\bar{y}} \right) C_k + \frac{GC_\varepsilon}{\bar{y}} \quad (4)$$

where $\bar{x}_k$ is the mean of x_k ; $\bar{y}$ is the mean of the outcome variable; C_k is the normalised concentration index of x_k and GC_ε is the generalised concentration index for the error term, ε.

The element $\left(\frac{\beta_k \bar{x}_k}{\bar{y}}\right) C_k$ is the explained component, while $\frac{GC_\varepsilon}{\bar{y}}$ is the unexplained component (or residual). In the explained component, C_k reflects the magnitude of unequal distribution of each predictor and $\eta_k = \left(\frac{\beta_k \bar{x}_k}{\bar{y}}\right)$ is the elasticity that indicates the impact of each C_k on the total C of y.[23 25 26] In order to identify the percentage contribution of each predictor to the inequality of the outcome, the partial contribution of each predictor is divided by C and multiplied by 100 using the following equation:

$$\text{Percentage contribution} = \frac{\left(\frac{\beta_k \bar{x}_k}{\bar{y}}\right) C_k}{\sum_k \left(\frac{\beta_k \bar{x}_k}{\bar{y}}\right) C_k} \times 100 \quad (5)$$

Marginal effect based on logistic regression model was fitted by maximum likelihood to approximate the decomposition analysis. The linear approximation of the non-linear estimation of a binary outcome can be written as:

$$y_i = \alpha^m + \sum_k \beta_k^m x_{ki} + u_i \quad (6)$$

The concentration index for the outcome variable can be written as:

$$C = \sum_k \left(\frac{\beta_k^m \bar{x}_k}{\bar{y}}\right) C_k + \frac{GC_\varepsilon}{\bar{y}} \quad (7)$$

When the Erreygers normalised corrected concentration index is used, the decomposition of inequality is expressed as:

$$E = 4 \sum_k \left(\frac{\beta_k^m \bar{x}_k}{\bar{y}}\right) C_k + GC_\varepsilon \quad (8)$$

Where β_k^m is the marginal effects of each explanatory variable x evaluated at sample means; u_i is the error generated by linear approximation. Marginal effects have been used in the analysis of health-related inequalities in non-linear settings in prior studies.[26 27] The results of the decomposition analysis, were summarised as elasticity, concentration index of the contributing factor and the percentage contribution to the overall concentration index.

Oaxaca decomposition

Further, Wagstaff and colleagues proposed the decompostion of health inequalities over time so as to unpack the causes of change in health inequalities by applying Oaxaca decomposition for 2006–2011 and 2011–2016.[23] This decomposition method has also been used extensively in health-related fields when analysing two social groups.[28 29] Other researchers have also used the same approach to measure the changes of inequalities between time periods.[30 31] The change in the Erreygers normalised concentration index $(\Delta E = E_t - E_{t-1})$ between 2006–2011 and 2011–2016 can be formulated as follows:

$$\Delta E = \sum_k \eta_{kt} \left(E_{k,t} - E_{k,t-1}\right) + \sum_k E_{kt-1} \left(\eta_{kt} - \eta_{kt-1}\right) + \Delta \left(\frac{GC_{\varepsilon,t}}{\bar{y}_t}\right) \quad (9)$$

$$\Delta E = \sum_k \eta_{kt} \Delta E_k + \sum_k E_{kt-1} \Delta \eta_k + \Delta \left(\frac{GC_{\varepsilon,t}}{\bar{y}_t}\right) \quad (10)$$

ΔEindicates the change in the Erreygers normalised concentration index of teenage pregnancy; $\Delta \eta_k$ is the change in the elasticity of the predictor (k) for 2006–2011 and 2011–2016; t refers to time period.

In equation 10, for 2011–2016, we weighted the difference in concentration indices by the 2016 elasticity and then weighted the difference in elasticities by 2011 concentration index for each of the predictor. Also, for 2006–2011, we weighted the difference in concentration indices by the 2011 elasticity and then weighted the difference in elasticities by 2006 concentration index for each predictor. All the data analysis was done using STATA V.16 statistical software. The variance inflation factor was also performed to detect any multi-collinearity among the explanatory variables. None of the variables showed multi-collinearity problems.

Patient and public involvement

The study used secondary data and therefore, there was no direct patient or public involvement.

RESULTS

Trends in teenage pregnancy and background characteristics

Results in table 1 show that the prevalence of teenage pregnancy in Uganda has been steadily high in the past 10 years at 26% in 2006, 25% in 2011 and 26% in 2016. Similarly, the trend in child marriage has almost remained constant (22% in 2006 and 23% in 2016). Also to note, is a consistent increase in the proportion of adolescents who engage in sex before their 18th birthday from 39% in 2006 to 41% in 2011 and 2016 with an average of only 6 years of education. Results also show that majority of the adolescents across the study period were: below 17 years, from the highest wealth quintile, catholic and residing in rural areas. About 21% of adolescents were from the Central region while the lowest proportion (6%) was from West-Nile. The proportion of adolescents who could access all the three forms of media slightly increased from 14% in 2006 to 17% in 2011 before declining to 13% in 2016.

Results in figure 1, also show the trend in prevalence of teenage pregnancy among adolescents stratified by region, wealth index, place of residence, early sexual debut and child marriage. Despite significant reductions in the prevalence of teenage pregnancy in Kampala, adolescents in eastern region still lag behind in the study period having the highest prevalence. Similarly, the prevalence of teenage pregnancy is also higher among adolescents from poorest households, those who initiate sex

Table 1 Weighted distribution of respondents by selected background characteristics

	2006		2011		2016	
Variables	**N**	**%**	**N**	**%**	**N**	**%**
Teenage pregnancy						
Yes	497	25.7	517	25.3	1106	25.9
No	1439	74.3	1530	74.7	3158	75.1
Child marriage						
Yes	434	22.4	466	22.7	972	22.8
No	1502	77.6	1581	77.3	3292	77.2
Teenager's age						
15	466	24.1	480	23.4	871	20.4
16	411	21.2	414	20.2	966	22.6
17	347	17.9	367	17.9	792	18.6
18	379	19.6	417	20.4	851	20.0
19	334	17.2	370	18.1	785	18.4
Years of education (mean±SD)	1936	*6.1* (2.8)	2047	*6.3* (2.6)	4264	*6.6* (2.7)
Household wealth index						
Poorest	296	15.3	316	15.4	764	17.9
Poorer	339	17.5	346	16.9	840	19.7
Middle	334	17.3	368	18.0	815	19.1
Richer	390	20.2	481	23.5	854	20.0
Richest	577	29.8	537	26.2	990	23.2
Religion						
Catholic	794	41.0	831	40.6	1710	40.1
Anglican	658	34.0	597	29.2	1304	30.6
Muslim	229	11.8	273	13.4	564	13.2
Others	255	13.2	345	16.9	686	16.1
Place of residence						
Rural	1594	82.3	1652	80.7	3230	75.7
Urban	342	17.7	395	19.3	1034	24.3
Region						
Kampala	173	8.9	190	9.3	200	4.7
Central	409	21.1	428	20.9	931	21.9
East-central	199	10.3	202	9.9	389	9.1
Eastern	236	12.2	318	15.5	859	20.1
Northern	270	14.0	246	12.0	581	13.6
West-Nile	109	5.7	127	6.2	321	7.5
Western	296	15.3	288	14.1	547	12.8
Southwest	243	12.6	249	12.2	435	10.2
Early sexual debut						
No	1175	60.7	1217	59.4	2529	59.3
Yes	761	39.3	831	40.6	1735	40.7
Access to media						
None	286	14.8	203	9.9	992	23.3
One of the three	910	47.0	832	40.6	1613	37.8
Two of the three	477	24.6	659	32.2	1110	26.0
All the three	263	13.6	354	17.3	550	12.9

N is the frequency.
SD, standard deviation.

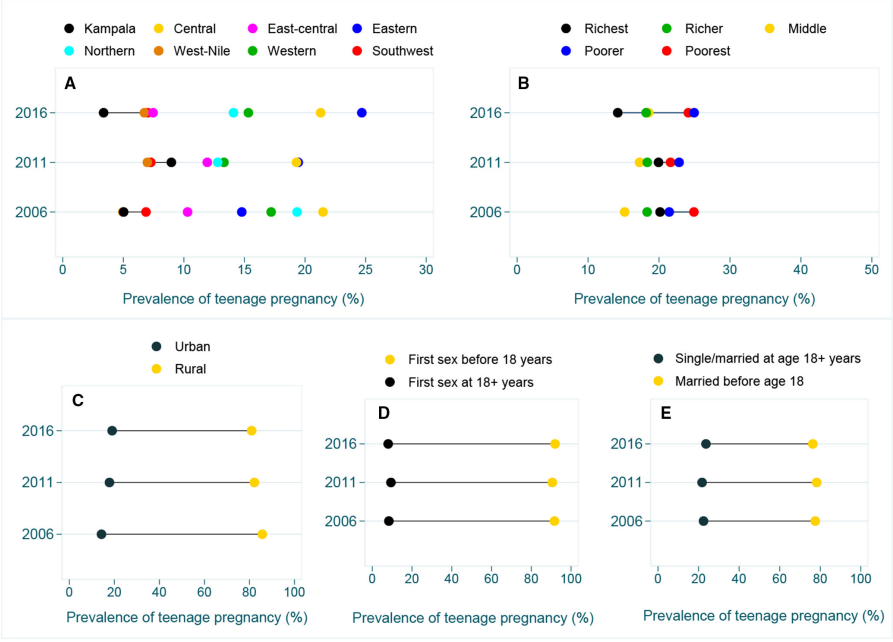

Figure 1 Prevalence of teenage pregnancy by different population groups from 2006 to 2016; (A) region, (B) wealth index, (C) place of residence, (D) sexual debut and (E) child marriage.

earlier, engaging in early marriage and staying in rural areas.

Predictors of teenage pregnancy

Results in table 2 reveal that teenager's age, years of education, wealth index, early sexual debut, access to media and child marriage were significantly associated with teenage pregnancy. More specifically, the risk of teenage pregnancy increases with teenage age across the study period. Still, the probability of experiencing teenage pregnancy was higher with early sexual debut in 2006, 2011 and 2016, respectively (adjusted OR (AOR)=21.09, 95% CI 13.18 to 33.74; AOR=18.61, 95% CI 11.44 to 30.27; and AOR=22.84, 95% CI 16.45 to 31.70). Relatedly, compared with those who had never been in marriage or married after the age of 18, teenagers who experienced early marriages were at an increased risk of having teenage pregnancies in all the years studied (AOR=22.53, 95% CI 13.15 to 38.63 in 2006; AOR=25.34, 95% CI 15.98 to 40.18 in 2011; and AOR=20.19, 95% CI 14.15 to 28.81 in 2016).

However, an increase in the years of education among teenagers significantly reduced the risk of teenage pregnancy in 2016 (AOR=0.88, 95% CI 0.83 to 0.93). Further, adolescents who could access all the three sources of media in 2006 (AOR=0.28, 95% CI 0.09 to 0.86) were less likely to experience teenage pregnancy as compared with those who had no access to any media. In 2011 and 2016, adolescents in lower wealth quintile were at an increased risk of experiencing teenage pregnancy (AOR=2.82, 95% CI 1.17 to 6.78; AOR=2.23, 95% CI 1.27 to 3.90, respectively).

The concentration curves in figure 2 further prove that teenage pregnancy concentrates among the poor with all curves lying above the line of equality in all the study period. This shows that there is an inequality in the prevalence of teenage pregnancy in Uganda and this inequality disfavours the poor.

Table 3 shows the concentration indices for teenage pregnancy over the study period as proposed by Erreygers. The results indicate that income-related inequality is statistically significant and being more prevalent among adolescents from low-income households, thus supporting the results in figure 2. The trend in Erreygers normalised concentration indices for teenage pregnancy (in absolute value) worsened from −0.190 in 2006 to −0.149 in 2011 and then −0.162 in 2016. Using this evidence of the existence of socioeconomic inequality, table 4 specifically shows the decomposition analysis of Erreygers concentration index and how much each contributes to the observed differences from 2006 to 2016.

Decomposition of the inequality in teenage pregnancy

The decomposition analysis in table 4 shows that generally, child marriage was the largest contributor to the inequality in teenage pregnancy in 2006, 2011 and 2016 accounting to 17%, 21% and 18%, respectively. The second contributor was household wealth index explaining 3% in 2006, 18% in 2011 and 20% in 2016. Education also plays an important role with teenagers' years of schooling contributing 9%, 6% and 21% in 2006, 2011 and 2016, respectively. Further, access to media contributed 6% in 2006, 3% in 2011 and 2% in 2016 to the inequality in teenage pregnancy. It is also shown that early sexual initiation contributed 7%, 6% and 13% to the inequality in teenage pregnancy among adolescents in 2006, 2011 and 2016, respectively.

The contribution rates of religion (−1% in 2016, 1% in 2006 and 2011) and teenager's age (2% in 2006, −2% in

Table 2 Multivariate analysis of the predictors of teenage pregnancy

	2006	2011	2016
Variable	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Teenager's age			
15†	1.00	1.00	1.00
16	3.29 (1.14 to 9.51)*	2.65 (0.99 to 7.12)	1.11 (0.57 to 2.14)
17	4.86 (1.72 to 13.77)**	3.24 (1.34 to 7.80)**	1.78 (0.91 to 3.48)
18	10.46 (3.51 to 31.13)**	9.83 (4.12 to 23.44)**	4.48 (2.38 to 8.46)**
19	34.46 (12.71 to 93.43)**	25.07 (9.95 to 63.20)**	9.79 (5.40 to 17.74)**
Years of education	0.95 (0.86 to 1.05)	0.97 (0.87 to 1.09)	0.88 (0.83 to 0.93)**
Place of residence			
Urban†	1.00	1.00	1.00
Rural	0.86 (0.38 to 1.97)	0.60 (0.29 to 1.28)	0.96 (0.58 to 1.59)
Wealth index			
Richest†	1.00	1.00	1.00
Richer	1.05 (0.56 to 1.99)	1.22 (0.67 to 2.24)	1.57 (0.90 to 2.74)
Middle	1.23 (0.62 to 2.45)	1.47 (0.72 to 2.99)	1.66 (0.93 to 2.98)
Poorer	0.73 (0.33 to 1.58)	2.82 (1.17 to 6.78)*	2.23 (1.27 to 3.90)**
Poorest	1.57 (0.59 to 4.19)	1.80 (0.61 to 5.26)	2.12 (1.15 to 3.93)*
Religion			
Catholic†	1.00	1.00	1.00
Anglican	0.87 (0.51 to 1.50)	0.85 (0.44 to 1.67)	0.94 (0.98 to 1.29)
Muslim	0.99 (0.53 to 1.84)	1.11 (0.58 to 2.12)	1.31 (0.81 to 2.13)
Others	0.72 (0.33 to 1.54)	0.54 (0.23 to 1.25)	0.99 (0.65 to 1.50)
Region			
Kampala†	1.00	1.00	1.00
Central	1.77 (0.66 to 4.77)	1.12 (0.49 to 2.55)	0.93 (0.44 to 1.98)
East-central	1.70 (0.59 to 4.90)	1.31 (0.50 to 3.43)	0.65 (0.27 to 1.56)
Eastern	0.83 (0.27 to 2.49)	0.68 (0.23 to 2.00)	0.81 (0.38 to 1.76)
Northern	0.99 (0.32 to 3.08)	0.44 (0.14 to 1.33)	0.52 (0.24 to 1.12)
West-Nile	0.74 (0.24 to 2.25)	0.65 (0.22 to 1.93)	0.45 (0.17 to 1.17)
Western	0.76 (0.25 to 2.34)	0.84 (0.29 to 2.42)	1.11 (0.51 to 2.46)
Southwest	0.84 (0.26 to 2.70)	0.79 (0.31 to 2.02)	0.72 (0.31 to 1.63)
Early sexual debut			
No†	1.00	1.00	1.00
Yes	21.09 (13.18 to 33.74)**	18.61 (11.44 to 30.27)**	22.84 (16.45 to 31.70)**
Access to media			
None†	1.00	1.00	1.00
One of the three	0.84 (0.38 to 1.89)	1.48 (0.66 to 3.32)	1.05 (0.74 to 1.50)
Two of the three	0.80 (0.32 to 1.97)	1.05 (0.45 to 2.47)	0.81 (0.55 to 1.22)
All the three	0.28 (0.09 to 0.86)*	1.29 (0.49 to 3.43)	1.08 (0.60 to 1.95)
Child marriage			
No†	1.00	1.00	1.00
Yes	22.53 (13.15 to 38.63)**	25.34 (15.98 to 40.18)**	20.19 (14.15 to 28.81)**

*p<0.05, **p<0.01; the assessment was based on a logistic regression model with χ^2 =0.000.
†Reference category.
AOR, adjusted OR.

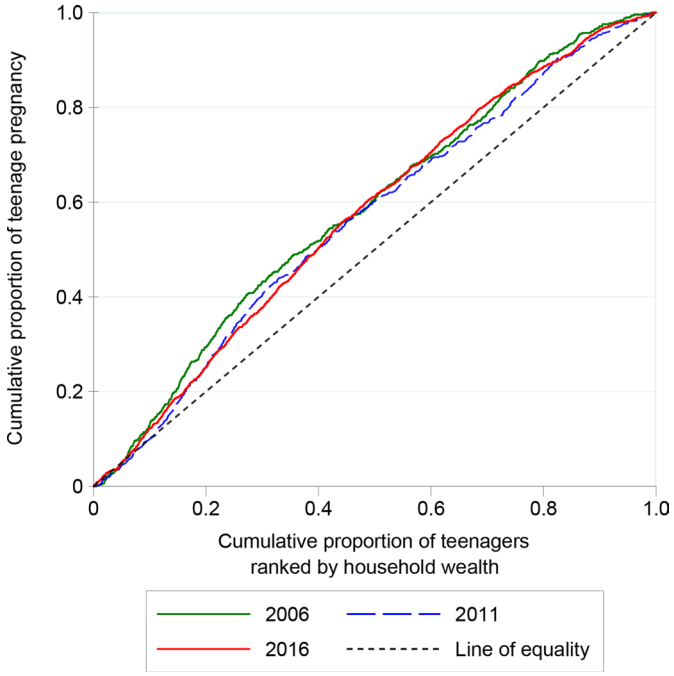

Figure 2 Concentration curve for teenage pregnancy from 2006 to 2016.

2011 and 2016) to the concentration indices were relatively very small indicating that they played less important roles in explaining the inequality in teenage pregnancy. Additionally, all the contributions for the period 2006–2016 were offset by negative contributions from place of residence (−7% in 2006, −34% in 2011 and −2% in 2016) and region (−4% in 2006, −10% in 2011 and −7% in 2016).

Determinants of change in teenage pregnancy

Oaxaca-type decomposition results for the change in inequality of teenage pregnancy in Uganda between two time periods of 2006–2011 and 2011–2016 are presented in table 5. Overall, changing inequalities and changing elasticities contributed equally to the inequality in teenage pregnancy. The results revealed that wealth index (48%) accounted for the largest contribution to the observed increase in teenage pregnancy between 2006 and 2011 with the adolescents living in the poorer and poorest households contributing the highest proportion. However, in 2011–2016, an opposite trend was observed with more than half (52%) of the highest contribution of teenage pregnancy being attributed to those in the middle or richer households. Also teenagers aged 17 years and those residing in Central region showed an increase in the inequality of teenage pregnancy in 2006–2011 with 3% and 13%, respectively despite an improvement in 2011–2016. Further, Muslim and Anglican religions (14%), and Central region (13%) showed an increase in the inequality of teenage pregnancy in 2006–2011. However, the contribution of Central region decreased in 2011–2016.

Over the study period of 2011–2016, the largest contributors to the reduction of teenage pregnancy were: rural residence and years of education with almost four times and two times, respectively. It can also be shown that adolescents aged 16 years contributed 14% to an increase in the inequality in teenage pregnancy. Access to only one form of media worsened the inequality in teenage pregnancy from 27% between 2006 and 2011 to 57% between 2011 and 2016. In contrast, access to two forms of media decreased the inequality in teenage pregnancy by almost the same amount (47%) in 2006–2011 and 2011–2016. Similarly, child marriage accounted to 19% of an increase in the inequality in teenage pregnancy in 2011–2016 as compared with the reverse in 2006–2011.

Table 3 Erreygers normalised concentration indices for teenage pregnancy, 2006–2016

Year	E	SE
2006	−0.1900*	0.0256
2011	−0.1490*	0.0293
2016	−0.1616*	0.0172

*Significant with p<0.001

SE, is the standard error.

DISCUSSION

The study was to examine the determinants of change in the inequality and associated predictors of teenage pregnancy in Uganda for the period from 2006 to 2016. Several studies have been conducted on the prevalence and factors influencing teenage pregnancy, though limited literature exists on the related inequalities in low-income and middle-income countries. To our knowledge, this is one of the first few studies to comprehensively investigate and examine the determinants of change in the inequality and associated predictors of teenage pregnancy in Uganda.

The findings of the study show that: from 2006 to 2016, the prevalence of teenage pregnancy seemingly remained high and almost constant. For example, 26%, 25% and 26% of the adolescents have ever been pregnant (currently pregnant, ever had a terminated pregnancy/miscarriage or a birth) in 2006, 2011 and 2016, respectively. Results indicate that teenage pregnancy occurs across all parts of Uganda though it is disproportionately prevalent over the past decade. This can be explained by socioeconomic and demographic heterogeneity of the population (figure 1).

According to the adjusted ORs, teenage pregnancy is significantly associated with teenager's age, years of education, wealth index, early sexual debut, access to media and child marriage. More specifically, we found that an increase in the years of education among teenagers significantly reduces their risk of teenage pregnancy. This is in line with other findings.[12] This indicates that as the child gets higher access to education, opportunities for avoiding early sexual behaviours improve

Table 4 Decomposition of the inequality in teenage pregnancy in Uganda for 2006, 2011 and 2016

	2006			2011			2016		
Variable	η_k	E_k	% Contr.	η_k	E_k	% Contr.	η_k	E_k	% Contr.
Teenager's age									
16	0.057	−0.036	1.08	0.046	−0.036	1.10	0.006	−0.004	0.01
17	0.063	0.034	−1.14	0.048	0.018	−0.57	0.026	−0.007	0.11
18	0.099	−0.029	1.53	0.108	0.014	−0.99	0.071	0.012	−0.52
19	0.132	−0.012	0.86	0.139	0.015	−1.35	0.100	0.021	−1.28
Sum		−0.044	2.33		0.010	−1.81		0.021	−1.68
Years of education	−0.072	0.240	9.04	−0.037	0.228	5.70	−0.199	0.173	21.31
Place of residence									
Rural	−0.026	−0.480	−6.57	−0.083	−0.617	−34.40	−0.007	−0.437	−1.95
Household wealth index									
Richer	0.002	0.159	−0.17	0.010	0.185	−1.25	0.020	0.306	−3.83
Middle	0.007	−0.095	0.37	0.015	−0.099	0.96	0.023	0.028	−0.40
Poorer	−0.012	−0.324	−2.01	0.038	−0.299	7.68	0.041	−0.304	7.66
Poorest	0.017	−0.580	5.30	0.025	−0.602	10.23	0.039	−0.672	16.21
Sum		−0.841	3.49		−0.815	17.62		−0.643	19.64
Religion									
Anglican	−0.010	0.048	0.26	−0.010	0.082	0.54	−0.005	−0.003	−0.01
Muslim	−0.001	0.137	0.02	0.004	0.103	−0.25	0.008	0.121	−0.59
Other	−0.009	0.049	0.23	−0.022	0.056	0.83	−0.001	0.045	0.01
Sum		0.234	0.51		0.241	1.12		0.163	−0.59
Region									
Central	0.025	0.252	−3.34	0.005	0.192	−0.59	−0.003	0.216	0.34
East-central	0.013	0.034	−0.23	0.006	0.024	−0.10	−0.009	0.031	0.17
Eastern	−0.004	−0.093	−0.20	−0.010	−0.124	−0.85	−0.011	−0.110	−0.75
Northern	−0.001	−0.431	−0.09	−0.033	−0.329	−7.26	−0.028	−0.345	−6.05
West-Nile	−0.006	−0.085	−0.26	−0.012	−0.137	−1.14	−0.015	−0.076	−0.69
Western	−0.007	−0.030	−0.10	−0.004	0.027	0.08	0.004	0.020	−0.04
Southwest	−0.004	0.017	0.04	−0.006	0.024	0.09	−0.008	0.064	0.33
Sum		−0.335	−4.18		−0.323	−9.77		−0.200	−6.69
Early sexual debut									
Yes	0.254	−0.065	8.65	0.271	−0.025	4.55	0.310	−0.070	13.52
Access to media									
One of the three	−0.017	−0.196	−1.76	0.035	−0.221	5.24	0.005	−0.137	0.39
Two of the three	−0.012	0.171	1.07	0.004	0.024	−0.06	−0.012	0.223	1.68
All the three	−0.038	0.357	7.08	0.011	0.312	−2.31	0.002	0.232	−0.32
Sum		0.332	6.39		0.115	2.87		0.318	1.75
Child marriage									
Yes	0.151	−0.219	17.45	0.172	−0.182	20.93	0.169	−0.171	17.86

$\eta_k$is the elasticity of the *k*th variable, is the Erreygers' normalised corrected concentration index, Contr. is the contribution, % Contr. is the percentage contribution; reference groups were age group 15, urban residence, richest wealth index, catholic, Kampala region, no access to media and no child marriage.

due to increased knowledge and agency to prevent unintended pregnancies.[12 32] With the introduction of free universal primary and secondary education in Uganda, some cultural perceptions that prohibit educating girl child should be changed to significantly lower the prevalence.

Table 5 Oaxaca-type decomposition for change in the inequality of teenage pregnancy in Uganda between 2006–2011 and 2011–2016

	2006–2011				2011–2016			
Determinant	$\eta_{kt}\,\Delta E_k$	$E_{kt-1}\Delta\eta_k$	**Total**	**%**	$\eta_{kt}\,\Delta E_k$	$E_{kt-1}\Delta\eta_k$	**Total**	**%**
Teenager's age								
16	0.0001	0.0004	0.0005	1.22	0.0002	0.0015	0.0017	−13.50
17	−0.0008	−0.0006	−0.0014	−3.42	−0.0007	−0.0005	−0.0012	9.53
18	0.0047	−0.0003	0.0044	10.74	−0.0002	−0.0005	−0.0007	5.56
19	0.0038	−0.0001	0.0037	9.03	0.0007	−0.0006	0.0001	−0.80
Sum	0.0078	−0.0006	0.0072	17.57	0.0000	−0.0001	−0.0001	18.36
Years of education	0.0005	0.0083	0.0088	21.47	0.0109	−0.0369	−0.0260	206.35
Place of residence								
Rural	0.0114	0.0274	0.0388	94.64	−0.0013	−0.0468	−0.0481	381.75
Household wealth index								
Richer	0.0003	0.0013	0.0016	3.91	0.0025	0.0020	0.0045	−35.72
Middle	−0.0001	−0.0007	−0.0008	−1.96	0.0030	−0.0009	0.0021	−16.67
Poorer	0.0010	−0.0163	−0.0153	−37.32	−0.0003	−0.0008	−0.0011	8.74
Poorest	−0.0006	−0.0046	−0.0052	−12.69	−0.0028	−0.0083	−0.0111	88.10
Sum	0.0006	−0.0203	−0.0197	−48.06	0.0024	−0.0008	−0.0056	44.45
Religion								
Anglican	−0.0004	0.0001	−0.0003	−0.74	0.0005	0.0005	0.0010	−7.94
Muslim	−0.0002	0.0006	0.0004	0.98	0.0002	0.0005	0.0007	−5.56
Other	−0.0002	−0.0007	−0.0009	−2.20	0.0001	0.0013	0.0014	−11.12
Sum	−0.0008	0.0000	−0.0008	−1.96	0.0008	0.0023	0.0031	−24.62
Region								
Central	−0.0003	−0.0052	−0.0055	−13.42	−0.0001	−0.0014	−0.0015	11.91
East-central	−0.0001	−0.0003	−0.0004	−0.98	−0.0001	−0.0004	−0.0005	3.97
Eastern	0.0004	0.0006	0.0010	2.44	−0.0002	0.0001	−0.0001	0.80
Northern	−0.0034	0.0141	0.0107	26.1	0.0005	−0.0015	−0.0010	7.94
West-Nile	0.0007	0.0006	0.0013	3.18	−0.0009	0.0004	−0.0005	3.97
Western	−0.0003	−0.0001	−0.0004	−0.98	−0.0001	0.0003	0.0002	−1.59
Southwest	−0.0001	−0.0001	−0.0002	−0.49	−0.0004	−0.0001	−0.0005	3.97
Sum	−0.0031	0.0096	0.0065	15.85	−0.0013	−0.0026	−0.0039	30.97
Early sexual debut								
Yes	0.0108	−0.0011	0.0097	23.66	−0.0141	−0.001	−0.0151	119.85
Access to media								
One of the three	−0.0009	−0.0103	−0.0112	−27.32	0.0004	0.0068	0.0072	−57.15
Two of the three	−0.0006	0.0028	0.0022	5.37	−0.0025	−0.0004	−0.0029	23.02
All the three	−0.0005	0.0174	0.0169	41.22	−0.0002	−0.0028	−0.0030	23.81
Sum	−0.0020	0.0099	0.0079	19.27	−0.0023	0.0036	0.0013	−10.32
Child marriage								
Yes	0.0065	−0.0046	0.0019	4.64	0.0018	0.0006	0.0024	−19.05

There was also a relationship between household wealth status of adolescents and the risk of teenage pregnancy. The finding revealed that adolescents in the low wealth quintile had the highest odds of being pregnant as compared with those in rich households consistent to other studies.[13 32 33] The reason for this could be that adolescents from poor households are likely to have low education and therefore tend to marry at an early age since their parents also use them as a way of achieving wealth to meet their economic difficulties. On the

other hand, adolescents from rich households tend to continue with education to pursue different carrier goals and this partly explains their low prevalence in teenage pregnancy.

The study also revealed that early sexual debut translate to teenage pregnancy and it was in agreement with a study carried out in five East African countries.[12] The reason for this could be related to financial reward in the process of having sex or limited knowledge on sex education. Findings have shown that sexually active adolescents are prone to low contraceptive use[3] and therefore the impact of early sexual debut automatically result into early pregnancies. There is need to make sex education compulsory in all learning institutions.

Similar to other findings,[12] adolescents who had access to all the three forms of media were at a lower risk of having teenage pregnancy as compared to their counterparts who could not access any form of media. Different forms of media help to educate and guide young people on the best approaches on safeguarding themselves from early pregnancies.

Relatedly, compared with those who had never been in marriage or married after the age of 18, teenagers who experienced early marriages were at an increased risk of having teenage pregnancies in all the years studied correlating with other findings.[33] Girls who marry young are often unable to use or access contraception and quickly become pregnant.[34] Studies elsewhere show that early marriages especially after early pregnancies among females are fuelled by parents.[32] This is done to keep the reputation of families and also overcome extra expenses that normally accompany such pregnancies. In a study carried out in Uganda in 2009, showed that most parents marry off their young girls because they believe they are a source of wealth in the form of bride price.[5] Such marriages hinder girls' education either due to lack of motivation for schooling after marriage or due to responsibilities they have to take on at a very early age which later impacts on their chances of employment and economic status of the family.[35]

The concentration curves and Erreygers concentration indices show that the inequality in the prevalence of teenage pregnancy disfavour the poor by having the highest concentration in all the study period. This propoor inequality that exists is similar to the pattern that could be seen in other countries.[13] The study still shows that adolescents with higher education were more concentrated among the higher economic groups. Also, those residing in the central, east-central and southwest regions of the country seemed to be economically well-off and there was an improvement in socioeconomic status among adolescents in the western region. However, the reverse was also true for those residing in the eastern, northern and West-Nile regions.

Relatedly, adolescents in rural areas, early sex initiation, child marriage, and those who could only access one source of media were more prevalent among the poor whereas those who could access at least two sources of media tended to be living in economically better-off families.

The decomposition of teenage pregnancy inequality revealed that unlike place of residence and region in 2006; teenager's age, place of residence and region in 2011 and 2016; other factors had a positive contribution to the inequality. Generally, child marriage was the largest contributor to the inequality in teenage pregnancy across all the study period. This was followed by household wealth index, teenagers' years of education and early sexual initiation in that order. Access to media also had a small positive contribution to the inequality in teenage pregnancy. All these findings are in agreements with those in prior studies.[13] Additionally, all the contributions for the period 2006–2016 were offset by negative contributions from place of residence and region while religion and teenager's age relatively played a very small contribution to the inequality in teenage pregnancy over the study period.

Table 5 further present the Oaxaca-type decomposition results inequalities of teenage pregnancy over time period of 2006–2011 and 2011–2016. Results indicated that living in the poorer and poorest households, being a teenager aged 17 years, residing in Central region, belonging to Muslim and Anglican religions all showed an increase in the inequality of teenage pregnancy in 2006–2011. Further, rural residence, early sexual debut, years of education were the largest contributors to the reduction of teenage pregnancy in 2011–2016. It can also be shown that adolescents aged 16 years, child marriage in 2011–2016 and access to only one form of media worsened the inequality in teenage pregnancy in both 2006–2011 and 2011–2016. However, the study period of 2011–2016 showed that belonging to middle or richer households, access to at least two forms of media pushed the inequality towards the equality line.

The strength of this study is that, it includes all self-reported pregnancies among teenagers. These include child deaths, live and stillbirths, terminated and miscarriages registered at the time of the surveys. The study also applied multiple analysis techniques to examine the levels of inequalities in the prevalence of teenage pregnancies over time. Nonetheless, there are study limitations that related to the nature of DHS data collection approaches. First, the cross-sectional nature of the data could not permit the establishment of causality. Second, the DHS sample size is only powered to measure reproduction, fertility and sexuality indicators of reproductive population aged 15–49 years, and thus limiting the analysis to a specific age-band such as adolescents may generate insufficient sample size that may make stratification difficult. Indeed, the effect of small sample sizes and stratification could be partly explained by the wider CI in our results. Finally, we also know that the reporting of information related to sexuality is usually affected by the desirability reporting bias that arise from legal, cultures and moral norms, as well as data collection approaches such as confidentiality and interviewer characteristics (age and gender).

CONCLUSION

The prevalence of teenage pregnancy has remained high in the past decade (2006–2016) with the risk worsening to the disadvantage of the poor. There was also a great relationship between early sexual debut, years of education and child marriage with teenage pregnancy. The results further revealed that more years of education, staying in wealthier household, delaying sexual debut, delaying marriage and access to media among teenagers significantly reduced the risk of teenage pregnancy. Still, the main contributors to the inequality of teenage pregnancy over the 10 years were child marriage, low household income and early sexual debut.

Regarding these findings, we recommend policy actions to sensitise communities and enforcement of child rights and child protection laws to stop child marriages. There is also a need to promote girl child education, improving household incomes and intensifying mass media awareness on the risks of early pregnancies. Further, ensuring that villages have operational adolescent and youth friendly services as well as incorporating sex education and other different adolescent reproductive health programmes in school curriculum will be key measures in reducing the large inequality in teenage pregnancy.

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Ethics approval This study used secondary data which is freely available online. The authors accessed the UDHS data by receiving permission through DHS measure online (http://dhsprogram.com/). Procedures and questionnaires for standard DHS surveys have been reviewed and approved by ICF Institutional Review Board (IRB). Additionally, UDHS survey protocols were reviewed by the ICF IRB and by an IRB in Uganda. ICF IRB ensures that the survey complies with the US Department of Health and Human Services regulations for the protection of human subjects (45 CFR 46), while the IRB-Uganda ensures that the survey complies with laws and norms of the nation. The study was therefore exempted from collecting ethical approval.

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