Statistical Modelling of the Determinants of Fertility Among Women of 15 – 49 Years of Age in Uganda

Babalola Bayowa Teniola[1*], Basigirenda Miriam[2]

[1]Department of Mathematics and Statistics, School of Mathematics and Computing, Kampala International University, Uganda

[2]Department of Statistics, Faculty of Science, Ekiti State University, Nigeria.

[*]Corresponding Author

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ABSTRACT

Background: The purpose of this study is to identify the factors associated with fertility among women of reproductive age in Uganda. The study aimed to determine the prevalence of the total fertility rate in Uganda, establish the sociodemographic and economic factors associated with fertility identify reproductive factors associated with fertility, and fit a predictive model for the Total Fertility Rate (TFR).

Method: The study utilized secondary data from the 2016 Uganda Demographic and Health Survey (UDHS). The analysis focused on a subset of 13,741 women aged 15 to 49 who had children, excluding those without children. Descriptive statistics were employed to ascertain fertility prevalence, while a multivariate analysis using negative binomial regression was used to identify associated factors.

Results: The study found that the average total fertility rate in Uganda is approximately 4 children per woman. Key sociodemographic and economic factors associated with fertility include a woman's age, education level, marital status, wealth index, and region of residence. The reproductive factors such as age at first sexual intercourse, age at first marriage, and the duration of breastfeeding were significantly associated with fertility rate in Uganda

Conclusion: In conclusion, the social demographic, economic, and reproductive factors play a significant role towards fertility rates in Uganda. The study recommends implementing targeted family planning programs for women aged 20 to 49 years. It also suggests strengthening initiatives to increase access to education for girls, particularly in rural areas and expanding access to family planning services for married women, women in partnerships, widows, and those who are divorced or separated

Keywords: Fertility, Women, Family, Negative Binomial Regression, Uganda.

INTRODUCTION

On a yearly basis, up to 80 million more people are added to the world population [1]. Whereas developed countries are experiencing a decreased population growth, the countries in third world and mainly in Africa are experiencing a rather rapid population growth [2]. Globally, the average woman of childbearing age is expected to have approximately 2.3 children over her lifetime [3]. This lower fertility rate (FR) is more common in developed countries compared to less developed countries (LDCs) [4]. In Africa, the TFR has stayed elevated, averaging 3.8 children per woman compared to other regions [5]. Sub-Saharan Africa (SSA) contributes significantly to this figure, with an average of 4.5 children per woman [3]. The Total Fertility Rates in the East, Central, South, as well as West African regions are 4.7, 5.6, 3.2, and 5.4 children per woman, respectively [6]. High Fertility Rates pose health risks for both children and their mothers, hinder investment in human capital,

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slow economic growth, and intensify environmental challenges [7]. In Nigeria, TFR is highly affected by education level and occupation of both women and men [8].

In East Africa, the TFR is projected at 4.7, surpassing the continent's average [6]. Mozambique is estimated to have one of the highest TFR among East African countries, averaging 5.9 children per woman [6]. The high TFR in East Africa has several significant consequences. Firstly, it poses health risks for both mothers and children, with higher maternal and infant mortality rates due to complications during pregnancy and childbirth. Secondly, it places a strain on healthcare systems, making it difficult to provide adequate maternal as well as child health services [9, 10]. The high TFR in East Africa stems from a complex relationship of cultural, socioeconomic, and health-related factors [11]. Cultural norms that value large families as a source of social status and security contribute significantly, promoting early and frequent childbearing among women [12]. Limited access to family planning services, due to inadequate healthcare infrastructure, low levels of education, and cultural barriers, hinders effective contraception use and family size planning [13]. Early marriage practices also extend reproductive periods for women, increasing their lifetime Fertility Rates [14].

Uganda's TFR stands at 5.2 children [15], exceeding the East African average of 4.7 [6]. The TFR in Uganda varies significantly, ranging from 3.5 to 7.9 children in Kampala and Karamoja respectively due to high poverty levels and low family planning adoption [16]. Additional causes of the high total fertility rate in Uganda include older age at first marriage [17], income [18], low contraceptive use, and cultural practices among others. The high TFR in Uganda presents significant challenges for safe motherhood, child survival, and sustainable development [19].

Theoretical Consideration

This research relied on the Poisson regression model (PRM) to establish the determinants of fertility rate among women. The Poison Regression Model predicts the probability of a certain number of events occurring in a fixed time period, assuming events happen at a constant rate and independently of each other [20]. Poison Regression Model is a generalized linear model (GLM) used for predicting discrete count data. Count data is typically modelled using the Poisson distribution, which has a rate parameter,$E(Y) = \mu$, where $\mu = (\mu_1 \ + \mu_2 + \ldots \mu_n)$ represents the mean vector associated with the random vector $Y = (Y_1, Y_2, \ldots Y_n)$. A common method for linking the rate parameter to the covariates is the log link function, $ln(\mu) = X\beta$, where $X = (X_1, X_2, \ldots . X_n)$ is an $n \times p$ matric of covariates for the n subjects, and $\beta = (\beta_0, \beta_1, \ldots . \beta_{p-1})$ is a$p \times 1$ coefficient vector [21].

The association among the rate parameter (mean count) as well as explanatory variables is typically modeled using a log link function, ensuring that predicted counts are non-negative. This log-linear relationship is expressed as $ln(\mu) = X\beta$, where μ is the mean count, X is the matrix of independent variables, and $\beta$is the vector of coefficients. PRM is flexible and can be extended to handle over dispersion (when the variance exceeds the mean) through models such as the Negative Binomial Regression Model (NBRM). This makes Poison Regression model a powerful tool for analysing count data across various fields, including epidemiology, ecology, and social sciences [22]. Poison Regression Model is highly applicable to the current study on for several reasons. TFR is naturally a count variable (i.e., 0, 1, 2, etc.). Poison Regression Model is specifically designed to model count data, making it a suitable choice for this study.

METHODS

Data Sources

The study utilized secondary data from the 2016 Uganda Demographic and Health Survey (UDHS). This national survey segmented Uganda into 112 districts, further categorized into 15 regions, and targeted a total of 20,880 households using a two-stage stratified sampling method. From these households, 18,506 women were interviewed. The eligibility criteria for respondents included women aged 15 to 49 who were either permanent residents or visitors staying in the selected households the night before the survey. For the purpose of this study, the analysis focused on a subset of 13,741 women aged 15 to 49 who had children, excluding those without children.

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Variable Measurements

The outcome variable, Total Fertility Rate (TFR), was measured as a count. Sociodemographic and economic factors included variables measured in count (mother's current age), ordinal scale (education level, wealth index), and nominal scale (religion, place of residence, marital status, region, and occupation). Reproductive factors were assessed as counts (age at first sexual intercourse, age at first marriage) and nominal categories (exposure to family planning, duration of breastfeeding, postpartum abstinence, postpartum amenorrhea, contraceptive use, and marital/cohabitation status).

Univariate Analysis

Univariate analysis involves the examination of individual variables in isolation. This analysis provides descriptive statistics that summarize the central tendency, dispersion, and distribution shape of each variable. Key measures include frequencies, percentages/proportions, and mean. Univariate analysis is essential for understanding the basic characteristics of the data and for identifying any anomalies or patterns that may exist within individual variables [23]. The study presented variables with count data using means and standard deviations, whereas frequencies and percentages were used to describe variables with nominal and ordinal data.

Variable Selection Process

Selecting the most relevant independent variables helps in creating a more accurate and predictive model. Including only the variables that significantly contribute to the outcome reduces noise and enhances the model's performance [24]. The study employed a stepwise backward selection method to choose predictor variables for multivariate analysis. This approach iteratively removes variables that contribute the least to the model's predictive capability, ensuring only the most significant variables are retained [25]. The process began with the inclusion of all potential predictor variables in the initial model. A NBRM was constructed with these variables. Subsequently, any variable with a p-value exceeding the significance level of 0.05 was excluded. Variables with p-values below 0.05 were retained for further multivariate analysis [26]. The backward selection method was guided by the following equation;

$$F = \frac{\left(\frac{SSE_{(i-x_r)} - SSE_j}{DF_{x_r}}\right)}{MSE_j} \quad (1)$$

where;

F is F-test.

$SSE_{(i-x_r)}$ is the sum of squares due to Error for the model that includes all predictors except the one being tested (i.e., the model without the x_r variable).

SSE_j is the SSE for the model that includes the predictor variable x_r being tested.

MSE_j is the mean Squared Error for the model that includes the predictor variable x_r.

Model Selection Process for Multivariate Analysis

A well-chosen model generalizes better to new unseen data. This means that the conclusions and predictions derived from the model are more likely to hold true across different scenarios, increasing the robustness of the findings [27]. The study tested one assumption to select the appropriate model (PRM or NBRM). Since the dependent variable is in count form, the descriptive statistics were performed for the dependent variable to ascertain if the mean and variance were the same or close to each [28]. If the assumption is met, then a PRM would be used otherwise a Negative Binomial Regression Model (NBRM) would be considered.

The Poison Regression model is given below;

$$P(\gamma_i; \mu_i) = \frac{\mu^{\gamma_i} e^{-\mu_i}}{\gamma_i!}, \gamma_i = 1,2.. \quad (2)$$

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$$\mu_i = \mu_i(X_{ij}) = exp\left(\sum_{j=0}^{k} \beta_j X_{ij}\right) \quad (3)$$

where; y is the outcome variable which is the TFR, $X_{ij}(j = 0,1,2\ldots, k \text{and } X_{i0} = 0)$ are covariates which include social demographic, economic, and reproductive factors, $\beta_{(j=0,1,\ldots k)}$are the regression parameters. The mean and variance of γ_i are equal and is given by

$$E\left(\frac{\gamma_i}{x_{ij}}\right) = V\left(\frac{\gamma_i}{x_{ij}}\right) = \mu_i \quad (4)$$

where the term μ_i represents the expected value (mean) of the response variable γ_i given the predictor variables x_{ij}.

The NBRM is given below;

$$P(Y = \gamma_i|\mu_i, \alpha) = \left(\frac{\Gamma(\gamma_i+\alpha^{-1})}{\Gamma(\alpha^{-1})\Gamma(\gamma_i+1)}\right)\left(\frac{1}{1+\alpha\mu_i}\right)\alpha^{-1}\left(\frac{\alpha\mu_i}{1+\alpha\mu_i}\right)\gamma_i \quad (5)$$

where; γ_i is the dependent variable, 1and α are scale parameters, Γ is the gamma noise variable,

$$\mu_i = exp(\, ln(\, t_i) + \beta_0 + \beta_1 X_{1i} + \ldots + \beta_k X_{ki}) \quad (6)$$

where $\beta_0$is an intercept, β_k are the regression parameters, and X_k are independent variables which include sociodemographic, economic, and reproductive factors.

Model Diagnostics

After applying the multivariate Poisson Regression Model (PRM) or Negative Binomial Regression Model (NBRM), it was essential to evaluate the overall fit and quality of the model. The diagnostic assessments included the Deviance Goodness-of-Fit Test, Likelihood Ratio Test, Zero-Inflation Test, Autocorrelation of Residuals, Deviance Residuals Test, and Multicollinearity Test.

Ethical Considerations

The study maintained the confidentiality of participants by implementing robust privacy measures. Personal information and responses were kept secure through anonymization techniques, and data was stored in a way that prevented unauthorized access. Prior to commencing, the study received approval from both the Institutional Review Board (IRB) and the Department of Human Services (DHS) program. All research protocols were designed to adhere to stringent ethical guidelines and standards.

RESULTS

Prevalence of Fertility Rate among Women of Reproductive Age in Uganda

This section presents the prevalence of TFR among women in Uganda with the findings detailed Table 1

Table 1: Prevalence of Fertility Rate among Women of Reproductive Age

N	Mean	Std. deviation	Minimum	Maximum
13,741	4.21	2.72	1	18

The results in Table 1 indicate that the average TFR among women of reproductive age (15 to 49) in Uganda was 4 children, with a standard deviation of 3. The number of children per woman ranged from a minimum of 1 to a maximum of 18.

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Distribution of Respondents by Sociodemographic, Economic, and Reproductive Factors

This section presents the frequency counts and percentages of the sociodemographic, economic, and reproductive characteristics of women of reproductive age in Uganda as indicated in Table 2.

Table 2: Distribution of Respondents by Sociodemographic, Economic, and Reproductive Factors

Covariate	**Frequency (n=13,741)**	**Percentage**
Age		
15-19	836	6.08
20-24	2,829	20.59
25-29	2,796	20.35
30-34	2,531	18.42
35-39	1,996	14.53
40-44	1,588	11.56
45-49	1,165	8.48
Education level		
No education	1,933	14.07
Primary	8,304	60.43
Secondary	2,662	19.37
Higher	842	6.13
Religion		
No Religion	21	0.15
Anglican	4,299	31.29
Catholic	5,662	41.21
Muslim	1,641	11.94
Seventh day Adventist	214	1.56
Orthodox	8	0.06
Pentecostal/Born Again/evangelical	1,726	12.56
Baptist	15	0.11
Other	155	1.13
Place of Residence		
Urban	2,963	21.56
Rural	10,778	78.44
Marital Status		
Never in union	731	5.32
Married	5,603	40.78
Living with Partner	5,087	37.02
Widowed	521	3.79

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Divorced	138	1
No longer living together/separated	1,661	12.09
Wealth Index		
Poorest	3,092	22.5
Poorer	2,828	20.58
Middle	2,629	19.13
Richer	2,536	18.46
Richest	2,656	19.33
Region		
Central	3,100	22.56
Eastern	3,741	27.23
Northern	3,281	23.88
Western	3,619	26.34
Occupation		
Not working	2,011	14.64
Working	11,730	85.36
Age at first sex		
Less than 15	2,849	20.73
15-19	9,459	68.84
20 and above	1,433	10.43
Exposure to family planning		
No	5,671	54.42
Yes	4,749	45.58
Age at first marriage		
Less than 15	1,810	13.17
15-19	7,407	53.9
20 and above	4,524	32.92
Duration of breastfeeding		
Not currently breastfeeding	4,968	48.43
Never breastfed	275	2.68
Still breastfeeding	5,016	48.89
Postpartum abstinence		
Not Abstaining	8,629	84.11
Abstaining	1,630	15.89
Postpartum amenorrhea		
Period returned	7,277	70.93
Period not returned	2,982	29.07

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Contraceptive use		
No	8,704	63.34
Yes	5,037	36.66
Married/cohabitation		
No	731	23.96
Formerly married	938	30.74
Lived with a man	1,382	45.3

The findings revealed that the majority of women were aged between 20 and 24 years (20.6%), followed by those aged 25 to 29 years (20.4%), and the smallest group was aged between 15 and 19 years (6.1%). Most women had attained primary education (60.4%), while only a few had received higher education (6.1%). A significant proportion of women were Catholic (41.2%), followed by Anglican (31.3%) and a small proportion was Orthodox with 0.06%. The majority resided in rural areas (78.4%), while 21.6% lived in urban areas. Nearly 40.8% of the women were married, with only 1% being divorced. Most women were in the poorest wealth index category (22.5%) while the smallest group was in the richer wealth index category (18.5%). The largest proportion of women was from the eastern region (27.2%) and the smallest were from the central region (22.6%).

A majority of the respondents were employed (85.4%) with 14.6% not working. Regarding age at first sexual intercourse, most women-initiated sex between 15 and 19 years (68.8%) while a smaller group started at 20 years or older (10.4%). A majority had not been exposed to family planning (54.4%) with 45.6% having been exposed. Most women married between 15 and 19 years of age (53.9%) while a smaller percentage married before the age of 15 (13.2%). Concerning breastfeeding, a significant proportion of women were still breastfeeding (48.9%) while 2.7% had never breastfed. Regarding postpartum abstinence, the majority of women did not abstain after childbirth (84.1%) while 15.9% practiced abstinence. In terms of postpartum amenorrhea, most women had resumed menstruation after childbirth (70.9%) while 29.1% had not. In addition, most women were not using contraceptives (63.3%), while 36.7% were using them. Lastly, nearly 45.3% of the surveyed women were living with a man while a smaller percentage (23.96%) had never been formally married.

Model Selection

The study tested one assumption in order to select the appropriate model (PRM or NBRM). The descriptive statistics was performed for the dependent variable to ascertain if the mean and variance are the same or close to each [28]. The findings are presented in Table 4.3.

Table 3: Descriptive Statistics Comparing the Mean and Variance of TFR

N	Mean	Variance	Std. Deviation
13,741	4.21	7.42	2.72

The results in Table 3 indicate that the mean (4.21) and variance (7.42) of the Total Fertility Rate (TFR) are not equal, which indicates a violation of the assumption of equality of mean and variance. Given that the assumption of equality of mean and variance was violated, the Negative Binomial Regression Model was used instead of the Poisson Regression Model for variable selection and estimating the factors associated with TFR among women in Uganda.

Variable Selection Using Stepwise Method

The study employed a stepwise backward selection method to choose predictor variables for multivariate analysis. This approach iteratively removes variables that contribute the least to the model's predictive capability, ensuring only the most significant variables are retained [25]. The process began with the inclusion of all predictor variables in the initial NBRM model. Subsequently, any variable with a p-value exceeding the

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significance level of 0.05 was excluded. Variables with p-values below 0.05 were retained for further multivariate analysis [26]. The results are presented in Table 4.

Table 4: Results of the Stepwise Backward Selection Method using NBRM

Covariate	**p-value**
Age	0.000
Education Level	0.000
Marital status	0.001
Wealth index	0.039
Region	0.039
Age at first sex	0.000
Age at first marriage	0.000
Duration of breastfeeding	0.001

The stepwise backward selection findings in Table 4 identifies several key factors using stepwise method that significantly influence the TFR among women in Uganda at 5% significance level. The identified factors included a woman's age (p=0.000), education level (p=0.000), marital status (p=0.001), wealth index (p=0.039), region of residence (p=0.039), age at first sexual intercourse (p=0.000), age at first marriage (p=0.000), and duration of breastfeeding (p=0.001). these variables were selected as significant predictors through the stepwise backward method using the Negative Binomial Regression Model (NBRM) at a 5% significance level. The variables which were not significant and were excluded from the model include religion, place of residence, occupation, exposure to family planning, postpartum abstinence, postpartum amenorrhea, contraceptive use, and ever been married.

Multivariate Analysis

After identifying the key sociodemographic and reproductive variables through the stepwise selection method, a Negative Binomial Regression Model was employed to explore their relationship with the TFR among women in Uganda. The model's results in Table 5 highlight the specific factors that most significantly influence fertility rates in Uganda. These findings provide the significant demographic and reproductive characteristics that are closely associated with fertility among Ugandan women.

Table 5: Negative Binomial Regression Findings on Sociodemographic and Reproductive Factors Associated with Fertility Among Women

Factors	Incidence Rate Ratios (IRR)	P-value	95% Confidence Interval	
			Lower Confidence Interval (LCI)	Upper Confidence Interval (UCI)
Sociodemographic and Economic Factors				
Age				
15-19 (Ref)	1.000			
20-24	1.747	0.000	1.632	1.871
25-29	2.980	0.000	2.786	3.187
30-34	4.339	0.000	4.058	4.639

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35-39	5.719	0.000	5.345	6.118
40-44	6.860	0.000	6.397	7.355
45-49	8.050	0.000	7.429	8.723
Education level				
No education (Ref)	1.000			
Primary	0.968	0.021	0.942	0.995
Secondary	0.851	0.000	0.818	0.886
Higher	0.686	0.000	0.643	0.731
Marital Status				
Never in union (Ref)	1.000			
Married	1.281	0.000	1.194	1.374
Living with partner	1.223	0.000	1.141	1.311
Widowed	1.200	0.000	1.091	1.320
Divorced	1.175	0.028	1.018	1.356
No longer living together/separated	1.147	0.000	1.064	1.237
Wealth Index				
Poorest (Ref)	1.000			
Poorer	0.963	0.012	0.935	0.992
Middle	0.960	0.010	0.930	0.990
Richer	0.937	0.000	0.906	0.970
Richest	0.835	0.000	0.801	0.870
Region				
Central (Ref)	1.000			
Eastern	1.004	0.794	0.973	1.036
Northern	0.907	0.000	0.876	0.939
Western	0.926	0.000	0.898	0.956
Reproductive Factors				
Age at first sex				
Less than 15 (Ref)	1.000			
15-19	0.894	0.000	0.871	0.918
20 and Above	0.751	0.000	0.718	0.786
Age at first marriage				
Less than 15 (Ref)	1.000			
15-19	0.904	0.000	0.877	0.933
20 and above	0.766	0.000	0.739	0.794
Duration of breastfeeding				

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Not currently breastfeeding (Ref)	1.000			
Never breastfed	1.120	0.000	1.058	1.186
Still breastfeeding	1.117	0.000	1.094	1.140

The findings in Table 5 indicate a higher likelihood of bearing more children among women aged 20 to 24 years (IRR = 1.747, 95% CI = 1.632 to 1.871, p = 0.000), 25 to 29 years (IRR = 2.980, 95% CI = 2.786 to 3.187, p = 0.000), 30 to 34 years (IRR = 4.339, 95% CI = 4.058 to 4.639, p = 0.000), 35 to 39 years (IRR = 5.719, 95% CI = 5.345 to 6.118, p = 0.000), 40 to 44 years (IRR = 6.860, 95% CI = 6.397 to 7.355, p = 0.000), and 45 to 49 years (IRR = 8.050, 95% CI = 7.429 to 8.723, p = 0.000) compared to women aged 15 to 19 years. In terms of education, women with primary education (IRR = 0.968, 95% CI = 0.942 to 0.995, p=0.021), secondary education (IRR = 0.851,95% CI = 0.818 to 0.886, p = 0.000), and higher education (IRR = 0.686, 95% CI = 0.643 to 0.731, p = 0.000) were less likely to have more children compared to those with no formal education. Marital status played a significant role, with higher chances of bearing more children observed among married women (IRR = 1.281, 95% CI = 1.194 to 1.374, p = 0.000), women living with partners (IRR = 1.223, 95% CI = 1.141 to 1.311, p = 0.000), widowed women (IRR = 1.200, 95% CI = 1.091 to 1.320, p = 0.000), divorced women (IRR = 1.175, 95% CI = 1.018 to 1.356, p = 0.028), and separated women (IRR = 1.147, 95% CI= 1..064 to 1.237, p = 0.000) compared to women who had never been in a union.

Regarding wealth, the likelihood of bearing more children decreased among women from poorer income backgrounds (IRR = 0.963, 95% CI = 0.935 to 0.992, p = 0.012), middle-income backgrounds (IRR = 0.960, 95% CI = 0.930 to 0.990, p=0.010), richer backgrounds (IRR = 0.937, 95% ci = 0.906 to 0.970, P = 0.000), and the richest backgrounds (IRR = 0.835, 95% ci = 0.801 to 0.870, P = 0.000) compared to women from the poorest backgrounds. Regional differences were also significant with women from the Northern region (IRR = 0.907, 95% CI = 0.876 to 0.939, p = 0.000) and the Western region (IRR = 0.926, 95% CI = 0.898 to 0.956, p = 0.000) being less likely to have more children compared to women from the Central region.

In terms of reproductive factors, the study found that women who initiated sex between the ages of 15 to 19 years (IRR = 0.894, 95% CI = 0.871 to 0.918, p=0.000) and at 20 years or older (IRR = 0.751, 95% CI = 0.718 to 0.786, p = 0.000) were less likely to have more children compared to those who initiated sex before the age of 15. Similarly, women who entered marriage at ages 15 to 19 years (IRR = 0.904, 95% CI =0.877 to 0.933, p=0.000) and at 20 years or older (IRR = 0.766, 95% CI = 0.739 to 0.794, p = 0.000) were less likely to have more children compared to those who married before the age of 15. In addition, women who never breastfed (IRR = 1.120, 95% CI = 1.058 to 1.186, p = 0.000) and those who were still breastfeeding (IRR = 1.117, 95% CI = 1.094 to 1.140, p = 0.000) were more likely to have more children compared to those who were not currently breastfeeding.

DISCUSSION

The primary goal of this study was to identify the factors associated with fertility among women of reproductive age in Uganda. The specific objectives were to determine the prevalence of the total fertility rate (TFR) among women in Uganda, to identify the sociodemographic and economic factors linked to fertility rates, and to examine the reproductive factors influencing fertility rates among these women. The study found that the average total fertility rate in Uganda is approximately 4 children per woman. Key sociodemographic and economic factors associated with fertility include a woman's age, education level, marital status, wealth index, and region of residence. In addition, reproductive factors such as age at first sexual intercourse, age at first marriage, and the duration of breastfeeding were found to be significantly associated with fertility rates among women Uganda.

The study found that the sociodemographic and economic factors associated with fertility among women in Uganda included a woman's age, education level, marital status, wealth index, and region of residence. The study found that Ugandan women aged 20 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44, and 45 to 49 years had a significantly higher likelihood of bearing more children compared to women aged 15 to 19 years. The findings

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imply that fertility in Uganda is highest among women in their 20s through their late 40s, indicating that these age groups are the most active in childbearing. This could mean that women in Uganda tend to start having children in their early 20s and continue to do so throughout their reproductive years [29]. The findings align with those of Tegegne, Fekadu [30] who conducted a study in Ethiopia to analyze the association among maternal age and FRs. Their findings indicated that the average FR of mothers under the age of 25 was significantly lower compared to mothers aged between 35 and 49. This implies that older mothers tend to have more children on average, which could be attributed to several factors such as longer reproductive periods and accumulated life experience that encourage having more children as women age [31].

The study found that women with primary, secondary, or higher education were significantly less likely to have more children compared to those with no formal education. This indicates that education plays a crucial role in reducing fertility rates among women in Uganda. For instance, educated women may have better access to information about family planning, greater career opportunities, and increased autonomy in making reproductive decisions, leading to a preference for smaller family sizes [18]. The findings are in agreement with those of Berlie and Alamerew [32] who conducted a study in Ethiopia and found that women without formal education had higher FRs than those with secondary education. This showed that educational attainment has a significant impact on FRs, with higher education levels associated with lower fertility. Similarly, Alaba, Olubusoye [33] analyzed fertility patterns in Nigeria and their results showed that women with secondary or higher education had lower FRs than those with less education.

The study revealed that women who were married, living with partners, widowed, divorced, or separated had a higher likelihood of bearing more children compared to women who had never been in a union. This implies that women who are or have been in a union, whether through marriage or cohabitation, tend to have more children, likely due to the stability and social expectations associated with these relationships as compared to those who had never been in a union [34, 35]. The findings are consistent with those of Nibaruta, Elkhoudri [36] who found that married women were more likely to have more children than single women. This is due to factors such as greater social and economic stability, cultural and familial expectations, and the support of a partner. In many societies, marriage often provides a conducive environment for raising children, which may contribute to higher FRs among married women [36].

Regarding wealth, the study found that the likelihood of bearing more children decreased progressively among women from poorer, middle-income, richer, and the richest backgrounds compared to those from the poorest backgrounds. These findings imply that as women's economic status improves, they may prioritize smaller family sizes, possibly due to a greater focus on education, career, and personal development. Wealthier women might also have better access to family planning services and may be more likely to use them effectively, resulting in fewer children. In addition, with increased financial resources, wealthier women might choose to invest more in each child's upbringing, which could lead to a preference for having fewer children [37-39]. These findings are in agreement with previous studies. Ndahindwa, Kamanzi [40] conducted a study in Rwanda to explore the relationship between wealth and FRs. Their analysis showed that women in the highest wealth quintile had significantly lower FRs than those in the lowest quintile. Similarly, Moeeni, Pourreza [41] and Finlay, Mejia-Guevara [42] investigated the influence of household income on fertility in Iran and SSA countries. Their results indicated that women from low-income households were more likely to have more children than those from middle-income households.

Concerning region, the study found that women from the Northern and Western regions of Uganda were less likely to have more children compared to women from the Central region. This may imply that women in the Central region might experience social pressures to have larger families, or they might have different levels of access to education and family planning services compared to those in the Northern and Western regions. On the other hand, women in the Northern and Western regions may have better access to or utilization of reproductive health services, different cultural norms regarding family size, or economic conditions that encourage smaller families. However, the findings are contrary to those of Zaake, Amongin [43] who found that infertility rates were highest in the Central region of Uganda. This indicates that geographical location significantly influences infertility rates, which may be due to access to healthcare, socio-economic conditions, cultural practices, and environmental influences [43].

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The study found that reproductive factors, including age at first sexual intercourse, age at first marriage, and duration of breastfeeding were significantly associated with fertility rates among women in Uganda. The study found that women who began sexual activity between the ages of 15 to 19 or at 20 years and older were less likely to have more children compared to those who initiated sexual activity before the age of 15. The findings imply that women who start sexual activity at a younger age may have longer periods of childbearing, leading to more children. This could be due to increased opportunities for pregnancy and childbirth over a longer reproductive span [44-46].

Similarly, it was revealed that women who entered marriage between the ages of 15 to 19 or at 20 years and older were less likely to have more children compared to those who married before the age of 15. The findings imply that earlier marriage is associated with higher fertility rates. Women who marry at a younger age might have longer periods of childbearing and may be more likely to have larger families [47, 48]. In contrast, those who marry later may have fewer children due to a shorter reproductive period or different life priorities [49]. The findings are consistent with those of Ariho and Kabagenyi [14] who found in Uganda that early age at first marriage and first sexual intercourse were linked to rising FRs. Similarly, Orwa, Gatimu [49] found in Kenya that the expected number of children reduced with the prolonged age at first sexual intercourse and the age at first marriage.

The study also found that women who had never breastfed and those who were still breastfeeding were more likely to have more children compared to those who had already weaned and were not currently breastfeeding. The findings imply that women who have never breastfed may have had more children because they might not have experienced the natural contraceptive effect that breastfeeding can provide [50]. On the other hand, women who are still breastfeeding may be in the midst of an extended reproductive period, indicating ongoing childbearing [51]. These findings align with those of Maralani and Stabler [52] who reported that women who breastfed for longer durations were more likely to have more children compared to those who breastfed for shorter periods. In contrast, Kabir and Islam [53] found that in Bangladesh, a longer duration of breastfeeding was associated with a lower incidence of FR. Their study indicated that extended breastfeeding significantly delays the return of ovulation and menstruation postpartum, which in turn prolongs the interval between births. This extended period of lactational amenorrhea reduces the overall number of pregnancies a woman has over her reproductive lifespan [54].

CONCLUSION

In conclusion, the factors associated with fertility among women of reproductive age in Uganda include a woman's age, education level, marital status, wealth index, region of residence, age at first sexual intercourse, age at first marriage, and the duration of breastfeeding. Higher fertility incidences were observed among older women, women with no formal education, and women who were married, living with partners, widowed, divorced, or separated, compared to those who had never been in a union. In addition, increased fertility was more likely among women from the poorest backgrounds, those residing in the Central region compared to the Northern and Western regions, women who initiated sexual intercourse before the age of 15, women who married before the age of 15, and women who had never breastfed or were still breastfeeding compared to those who were not currently breastfeeding. Moving forward, it is crucial to consider these factors in the design and implementation of reproductive health programs to better meet the needs of women in Uganda.

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Availability of Data and Materials: The dataset is available for access after request to DHS (Demographic and

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Health Surveys) and ICF International website, via https://dhsprogram.com/data/Access-Instructions.cfm.

REFERENCES

1. Laelago, T., Y. Habtu, and S. Yohannes, Proximate determinants of fertility in Ethiopia; an application of revised Bongaarts model. Reproductive Health, 2019. 16(1): p. 13.
2. Gu, D., K. Andreev, and M.E. Dupre, Major Trends in Population Growth Around the World. China CDC Wkly, 2021. 3(28): p. 604-613.
3. World Bank Report, Fertility rate, total (births per woman). 2024.
4. Ariho, P., A. Kabagenyi, and A. Nzabona, Determinants of change in fertility pattern among women in Uganda during the period 2006-2011. Fertil Res Pract, 2018. 4: p. 4.
5. United Nations Economic Commission for Africa (UNECA), As Africa's Population Crosses 1.5 Billion, The Demographic Window Is Opening; Getting The Dividend Requires More Time And Stronger Effort. 2024.
6. Tesfa, D., et al., The pooled estimate of the total fertility rate in sub-Saharan Africa using recent (2010-2018) Demographic and Health Survey data. Front Public Health, 2022. 10: p. 1053302.
7. Bongaarts, J., Trends in fertility and fertility preferences in sub-Saharan Africa: the roles of education and family planning programs. Genus, 2020. 76(1): p. 32.
8. Adarabioyo, M.I., B.T. Babalola, and K.A. Adigun, Predicting Fertility Pattern in Nigeria. International Journal of Applied Research and Technology, 2015. 4(7): p. 179 – 186.
9. Seifu, B.L., et al., Determinants of high-risk fertility behavior among women of reproductive age in Kenya: a multilevel analysis based on 2022 Kenyan demographic and health survey. BMC Public Health, 2023. 23(1): p. 2516.
10. Seidu, A.-A., et al., High-risk fertility behaviours among women in sub-Saharan Africa. Journal of Public Health, 2023. 45(1): p. 21-31.
11. Kebede, E., E. Striessnig, and A. Goujon, The relative importance of women's education on fertility desires in sub-Saharan Africa: A multilevel analysis. Population Studies, 2022. 76(1): p. 137-156.
12. Achen, S., P. Atekyereza, and C.B. Rwabukwali, The role of culture in influencing sexual and reproductive health of pastoral adolescent girls in Karamoja sub-region in Uganda. Pastoralism, 2021. 11(1): p. 25.
13. Gahungu, J., M. Vahdaninia, and P.R. Regmi, The unmet needs for modern family planning methods among postpartum women in Sub-Saharan Africa: a systematic review of the literature. Reproductive Health, 2021. 18: p. 1-15.
14. Ariho, P. and A. Kabagenyi, Age at first marriage, age at first sex, family size preferences, contraception and change in fertility among women in Uganda: analysis of the 2006–2016 period. BMC women's health, 2020. 20: p. 1-13.
15. Uganda Bureau of Statistics (UBOS), Uganda Demographic and Health Survey 2022. 2024.
16. United Nations Population Fund, Unmasking Inequalities: Going Beyond National Averages - Family Planning Atlas. 2021. p. 4.
17. Ariho, P., A. Kabagenyi, and A. Nzabona, Determinants of change in fertility pattern among women in Uganda during the period 2006–2011. Fertility Research and Practice, 2018. 4(1): p. 4.
18. Kizza, J. and G. Wasswa, Education and Fertility preference among women in Uganda. Tanzania Journal of Health Research, 2024. 25(3): p. 989-1002.
19. Kisamba, M., The 50th session of the Commission on Population and Development. 2017, United Nations.
20. Dreassi, E., Poisson Models, in Encyclopedia of Quality of Life and Well-Being Research, A.C. Michalos, Editor. 2014, Springer Netherlands: Dordrecht. p. 4848-4850.
21. Sellers, K.F. and B. Premeaux, Conway–Maxwell–Poisson regression models for dispersed count data. Wiley Interdisciplinary Reviews: Computational Statistics, 2021. 13(6): p. e1533.
22. Lukman, A.F., et al., A new estimator for the multicollinear Poisson regression model: simulation and application. Scientific Reports, 2021. 11(1): p. 3732.
23. Canova, S., D.L. Cortinovis, and F. Ambrogi, How to describe univariate data. Journal of thoracic disease, 2017. 9(6): p. 1741.
24. Andersen, C.M. and R. Bro, Variable selection in regression—a tutorial. Journal of chemometrics, 2010.

24(11-12): p. 728-737.
25. Zhang, Z., Variable selection with stepwise and best subset approaches. Annals of translational medicine, 2016. 4(7).
26. Famoye, F. and D.E. Rothe, Variable selection for Poisson regression model. Journal of Modern Applied Statistical Methods, 2003. 2: p. 380-388.
27. Ding, J., V. Tarokh, and Y. Yang, Model selection techniques: An overview. IEEE Signal Processing Magazine, 2018. 35(6): p. 16-34.
28. Hayat, M.J. and M. Higgins, Understanding poisson regression. Journal of Nursing Education, 2014. 53(4): p. 207-215.
29. Amongin, D., et al., Time trends in and factors associated with repeat adolescent birth in Uganda: Analysis of six demographic and health surveys. PLoS One, 2020. 15(4): p. e0231557.
30. Tegegne, M.A., A.A. Fekadu, and G.M. Negassa, Determinants of fertility status among reproductive age women in rural Ethiopia: Evidence from 2016 Ethiopian Demographic Health Survey. Mathematical Theory and Modeling, 2019. 9(10): p. 1-11.
31. Ely, D.M. and B.E. Hamilton, Trends in fertility and mother's age at first birth among rural and metropolitan counties: United States, 2007-2017. 2018.
32. Berlie, A.B. and Y.T. Alamerew, Determinants of fertility rate among reproductive age women (15-49) in Gonji-Kollela District of the Amhara National Regional State, Ethiopia. Ethiopian Journal of Health Development, 2018. 32(3).
33. Alaba, O.O., O.E. Olubusoye, and J. Olaomi, Spatial patterns and determinants of fertility levels among women of childbearing age in Nigeria. South African Family Practice, 2017. 59(4): p. 143-147.
34. Magdalenić, I., The influence of marital status on fertility in Serbia and the European Union. Demografija, 2016. 13: p. 175-190.
35. Sánchez-Páez, D.A. and B. Schoumaker. Marital status and fertility among adolescents under 15 years of age. in International Conference on Family Planning (ICFP). 2022.
36. Nibaruta, J.C., et al., Determinants of fertility differentials in Burundi: evidence from the 2016-17 Burundi demographic and health survey. Pan African Medical Journal, 2021. 38(1).
37. Liu, H., L. Liu, and F. Wang, Housing wealth and fertility: evidence from China. Journal of Population Economics, 2023. 36(1): p. 359-395.
38. Colleran, H., et al., Fertility decline and the changing dynamics of wealth, status and inequality. Proceedings of the Royal Society B: Biological Sciences, 2015. 282(1806): p. 20150287.
39. Hackman, J. and D. Hruschka, Disentangling wealth effects on fertility in 64 low-and middle-income countries. Evolutionary Human Sciences, 2020. 2: p. e58.
40. Ndahindwa, V., et al., Determinants of fertility in Rwanda in the context of a fertility transition: a secondary analysis of the 2010 Demographic and Health Survey. Reproductive Health, 2014. 11(1): p. 87.
41. Moeeni, M., et al., Analysis of economic determinants of fertility in Iran: a multilevel approach. Int J Health Policy Manag, 2014. 3(3): p. 135-44.
42. Finlay, J.E., I. Mejia-Guevara, and Y. Akachi, Inequality in total fertility rates and the proximate determinants of fertility in 21 sub-Saharan African countries. PloS one, 2018. 13(9): p. e0203344.
43. Zaake, D., et al., Prevalence, regional distribution, and determinants of infertility in Uganda between 2006 and 2016: analysis of three Demographic and Health Surveys. Journal of Global Health Reports, 2024. 8: p. e2024008.
44. Lara, L.A. and C.H. Abdo, Age at time of initial sexual intercourse and health of adolescent girls. Journal of Pediatric and Adolescent Gynecology, 2016. 29(5): p. 417-423.
45. Okigbo, C.C. and I.S. Speizer, Determinants of sexual activity and pregnancy among unmarried young women in urban Kenya: a cross-sectional study. PloS one, 2015. 10(6): p. e0129286.
46. Heywood, W., et al., Associations between early first sexual intercourse and later sexual and reproductive outcomes: A systematic review of population-based data. Archives of sexual behavior, 2015. 44: p. 531-569.
47. Marphatia, A.A., G.S. Ambale, and A.M. Reid, Women's marriage age matters for public health: a review of the broader health and social implications in South Asia. Frontiers in public health, 2017. 5: p. 269.
48. Rindfuss, R.R., S.P. Morgan, and C.G. Swicegood, First births in America: Changes in the timing of parenthood. Vol. 2. 2023: Univ of California Press.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue III March 2025

49. Orwa, J., et al., Trends and factors associated with declining lifetime fertility among married women in Kenya between 2003 and 2014: an analysis of Kenya demographic health surveys. BMC Public Health, 2023. 23(1): p. 718.
50. Ellison, P.T., Breastfeeding, fertility, and maternal condition, in Breastfeeding. 2017, Routledge. p. 305-346.
51. McNeilly, A.S., Lactational control of reproduction. Reproduction, Fertility and Development, 2001. 13(8): p. 583-590.
52. Maralani, V. and S. Stabler, Intensive parenting: Fertility and breastfeeding duration in the United States. Demography, 2018. 55(5): p. 1681-1704.
53. Kabir, A. and M.F. Islam, The effect of breastfeeding on fertility in Bangladesh. International Quarterly of Community Health Education, 2002. 21(3): p. 283-290.
54. Prior, J.C., Postpartum Lactational Amenorrhea and Recovery of Reproductive Function and Normal Ovulatory Menstruation, in Maternal-Fetal and Neonatal Endocrinology. 2020, Elsevier. p. 207-214.