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Sociodemographic factors underlying lifetime fertility among ever-married Swazi women

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Abstract

Fertility rates remain high in certain subgroups of the population, and there is limited research about the sociodemographic factors influencing fertility, particularly in Eswatini where women are often considered minors. This study aims to investigate the changes in lifetime fertility, and the associations between sociodemographic factors and lifetime fertility among ever-married women. The study used secondary cross-sectional data from the 2010 and 2014 Eswatini Multiple Indicator Cluster Surveys (MICS), with a sample size of 2,295 and 2,351 women, respectively. The data was analysed using descriptive statistics and multivariable Poisson regression. The results showed that fertility rates decreased from 3.47 to 3.21 children between 2010 and 2014. The study found that child loss and age (25+ years) were significant factors associated with higher fertility, while delayed age at marriage and sexual debut (20+ years), at least secondary education, and being rich were strong predictors of lower fertility rates. The study recommends creating awareness about and strengthening laws to abolish early sexual debut and marriage. It also suggests empowering women through education, encouraging the use of contraceptives, and providing maternal and child health services in rural areas where fertility rates tend to be higher. *(Afr J Reprod Health 2024; 28 [3]: 38-49).*

Keywords: Children ever born, fertility change, proximate determinant of fertility, Poisson regression, Eswatini

Résumé

Les taux de fécondité restent élevés dans certains sous-groupes de la population, et les recherches sur les facteurs sociodémographiques influençant la fécondité sont limitées, en particulier à Eswatini où les femmes sont souvent considérées comme mineures. Cette étude vise à étudier les changements dans la fécondité au cours de la vie et les associations entre les facteurs sociodémographiques et la fécondité au cours de la vie chez les femmes déjà mariées. L'étude a utilisé des données transversales secondaires des enquêtes par grappes à indicateurs multiples (MICS) d'Eswatini de 2010 et 2014, avec un échantillon de 2 295 et 2 351 femmes, respectivement. Les données ont été analysées à l'aide de statistiques descriptives et d'une régression de Poisson multivariée. Les résultats ont montré que les taux de fécondité ont diminué de 3,47 à 3,21 enfants entre 2010 et 2014. L'étude a révélé que la perte d'enfants et l'âge (25 ans et plus) étaient des facteurs importants associés à une fécondité plus élevée, tandis qu'un âge plus tardif au mariage et aux débuts sexuels (20 ans et plus)), au moins une éducation secondaire, et le fait d'être riche étaient de puissants prédicteurs de taux de fécondité plus faibles. L'étude recommande de sensibiliser et de renforcer les lois visant à abolir les premiers rapports sexuels et le mariage précoces. Il suggère également d'autonomiser les femmes grâce à l'éducation, d'encourager l'utilisation de contraceptifs et de fournir des services de santé maternelle et infantile dans les zones rurales où les taux de fécondité ont tendance à être plus élevés. *(Afr J Reprod Health 2024; 28 [3]: 38-49).*

Mots-clés: Enfants déjà nés, évolution de la fécondité, déterminant immédiat de la fécondité, régression de Poisson, Eswatini

Introduction

Fertility transition and determinants of fertility have been extensively studied by demographers for several decades[1–3]. The global total fertility rate (TFR) decreased from about 4.7 to 2.4 between 1950 and 2017, respectively[4,5]. However, it should be noted that the fertility transition has been regional and country-specific[3]. Generally, sustained fertility decline has been achieved through socioeconomic development and improvements in health, subsequently reducing infant and child mortality[6,7].

Europe, Eastern and Southern Europe, Asia and the Pacific, and Northern America have experienced a decrease in fertility rates below the replacement fertility level of 2.1 children per woman, ranging from 1.5 to 1.9 by 2017[5]. Despite the decline in fertility levels in Africa from 6.7 in

1990 to 4.7 in 2015[4], Africa still has the highest fertility rate globally. The population growth of Africa is expected to surpass that of other regions, reversing social and economic gains in living standards achieved so far[7]. Changes in and determinants of fertility are of utmost significance to population scientists as high fertility undermines individual goals, opportunities for health, education, and investments for women, their children, families, and communities at large[8]. High fertility is a source of concern at national level as it constrains resources (such as food or land) and environmental sustainability[6,8]. The ability of women to achieve their desired fertility is directly or indirectly linked to Sustainable Development Goals (SDGs), including ending poverty (goal 1), promoting health and well-being (goal 3), and empowering women (goal 5)[9].

Regional variations in Africa indicate that while the total fertility rate reduced from 6.5 to 5.9 in Middle Africa between 1990 and 2015[4], the region still has the highest fertility rate. In Southern Africa, fertility declined from 5.6 to 2.2 between 1990 and 2015, respectively[4]. Family planning programs have been successful in accelerating fertility decline in Africa in the past decades, with increased uptake of modern birth control practices[6,10]. However, it is still crucial to understand why certain subgroups of the population in African countries, including Eswatini, continue to have high fertility rates despite these efforts[1,8,11].

Overall, Eswatini (previously Swaziland) has above replacement level fertility[12]. The national population policy framework of 2002 targeted reducing fertility from 4.5 in 1997 to 3 children per woman in 2022[12]. The country's fertility declined from 6.9 in 1990 to 4 in 2007 and 3.5 in 2015[4,13]. However, patriarchal norms and values that view women as minors in childbearing decision-making have sustained high fertility[11,14]. Addressing high unmet need for family planning[11,15] and unintended pregnancies[16] are among the challenges that need to be addressed for sustained fertility decline in Eswatini. Achieving low fertility goals depends on individuals' or couples' fertility goals[8], nonetheless, national family planning programs and initiatives should be strengthened to help achieve desired results.

Several theories have been proposed to explain the factors contributing to fertility decline. Fertility change explanations stem from the theoretical frameworks of Davis and Blake[17] and Bongaarts[18], which postulated that an interplay of proximate determinants influence children ever born (CEB), a measure of lifetime fertility. Contraceptive use and marriage are considered to be the two most important proximate (biological and behavioural) factors underlying changes in fertility[6,19]. While the assumptions by Davis and Blake and Bongaarts are important in fertility analysis, it should be noted that to comprehend fertility dynamics, background factors as argued by Richard Easterlin's "supply of and demand for children" framework[20] influences are just important as proximate determinants. Hence to explain any changes in fertility, the current study adapts both the Davis and Blake, Bongaarts and Easterlin 'supply of and demand for children'frameworks. It assumes that any change in fertility is an interplay of both demographic, social, and economic factors and proximate determinants.

The hypothesised background variables influencing fertility include *inter alia*: level of education, wealth and place of residence. Previous studies have found education status as a background factor that negatively influences fertility[1,21–27]. While economic status or wealth negatively influenced fertility in previous research[27–30], it should be noted that no such association was noted in some studies[2,31,32]. Higher levels of education and economic status tend to suppress childbearing as women's aspirations, awareness of family planning, and the need to raise the quality rather than quantity of children increases[7,33]. Place of residence, where women in urban areas would have fewer children ever born when compared to rural counterparts, has been noted as a background factor underlying fertility in several studies[10,24,34,35]. Costs of childbearing and rearing are higher in urban areas[36]. Therefore, urbanisation is a socioeconomic development indicator that has a negative association with fertility[7].

While some studies have found that contraceptive use was has an inverse relationship with fertility[2,24,25], other studies have revealed that there was no association between contraceptive use and fertility[31,32]. An increase in the proportion of unmarried women of reproductive age inversely influences fertility[1,24,37]. In traditional African societies, the higher prevalence of marriage tends to increase fertility[20]. However, in Eswatini, marriage is complex. Pre-marital childbearing seems to be a prerequisite for marriage, proving fecundity and the ability of a woman to bear more children in marriage[15]. Variation in marital fertility reflects compositional (or individual) differences in age, sexual debut, and age at first marriage[11].

The average age at first union remains young in many African societies[6]. Studies have shown that delayed age at marriage among women is associated with school attendance[28]. Findings reveal an inverse association between age at first marriage and sexual debut, and fertility[29,38,39]. Child mortality reflects the socioeconomic development and health status of a population[40]. The higher the socioeconomic status, the lower the child mortality[41]. Child loss tends to increase fertility through either replacing the one lost or hoarding children in anticipation of a child loss[8,30,38].

Notwithstanding these aforementioned findings in unraveling the background and proximate determinants of fertility, it should be noted that there is a lacuna of scholarly inquiry on a comparative study on both the proximate and background factors underlying fertility in Eswatini. Chemhaka and Odimegwu[13] undertook a study on fertility analysis in Eswatini. Without undermining the importance of their study to the fertility discourse, it should be argued that the gist of the study was to examine the impact of only the four proximate variables, notable, contraception, postpartum fecundity, abortion, and sexual activity on fertility. Consistently, Chemhaka and Odimegwu[11] investigated the individual and community factors influencing lifetime fertility. Nonetheless, it should be further argued that the study utilised secondary data from a one-time dated national representative sample of the Eswatini 2006-7 Demographic Health Survey.

The current study aims to go beyond the limitations of previous research by utilising two recent data sources from the 2010 and 2014 Eswatini Multiple Cluster Indicator Surveys (MICS) to analyse fertility. As new patterns of marriages, unions, and family formation emerge, along with changes in contraceptive methods and socioeconomic conditions, understanding fertility levels and underlying factors becomes increasingly important in Africa[6,10]. Notwithstanding, there is a lack of research on changes in lifetime fertility and risk factors associated with fertility among Swazi women. Hence the first objective of this study is to establish changes in lifetime fertility in Eswatini based on the mean number of children ever born. The second objective is to examine the associations between sociodemographic factors and lifetime fertility in Eswatini for the years 2010 and 2014.

Methods

Secondary data used for this study came from the recent 2010 and 2014 Eswatini Multiple Indicator Cluster Surveys (MICS). The MICS programme is designed to collect national, representative, reliable information for women on most variables including reproductive behaviour, demographic, and socioeconomic domains. The 2010 and 2014 Eswatini MICS collected cross-sectional nationally representative data on fertility behaviour from 4,688 and 4,762 interviewed women, respectively. This paper focuses on the sample of ever-married women[42] (n=2,295 in 2010 and n=2,351 in 2014). The combined data[27] (pooled sample) from both surveys was 4,228 after deleting missing cases in the dataset. Most frequent sexual intercourse and childbearing are sanctioned in marital and consensual unions in African studies[6,7]. A two-stage stratified sampling design was used to collect data for both the 2010 and 2014 MICS surveys. During the first stage, 365 and 347 enumeration areas (EAs) were selected in 2010 and 2014, respectively, stratified by urban-rural status and region using the probability proportional to the size of the EA. In the second stage, a systematic sample of 15 households was selected in each EA from which all women aged 15-49 were eligible for interview. Sample weights applied were based on the 2007 census. Written informed consent was obtained from all study participants before the interview[14,43].

Dependent variable

The study utilised the number of children ever born (CEB) to women who were ever married as the dependent variable, with the range being from 0 to 13 in both the 2010 and 2014 surveys. A histogram of CEB for both surveys is illustrated in Figure 1. The dependent variable was observed to be skewed right, with a decrease in the mean from 3.47 to 3.22 children over the studied period. The median number of children remained constant at 3.00 in both survey years, while the variance was 5.63 in 2010 and 4.20 in 2014. This indicates that there is overdispersion in the data for both surveys, with the variance being greater than the mean.

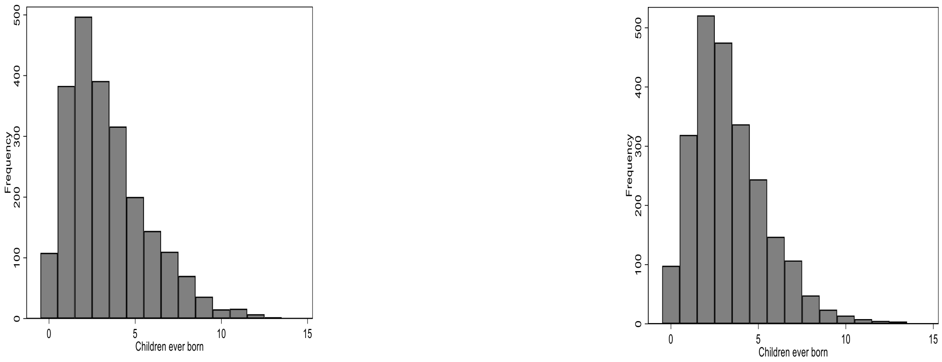

Figure 1: Distribution of the Swazi women's fertility, EMICS 2010 and 2014

Explanatory variables

Drawing on existing literature, and based on the availability of data in the 2010 and 2014 EMICS data, we examined sociodemographic variables related to lifetime fertility (CEB), including age (15-24, 25-34, 35-49), age at first marriage (<15, 15-19, 20-24, 25+), age at sexual debut (<15, 15-19, 20-24, 25+), marital status (previously married, married/cohabiting), education (none, primary, secondary or higher), child loss (no, yes), modern contraceptive use (no, yes), residence (rural, urban), and household wealth status. The latter was combined into three categories: poor for the first two quintiles (poorest and poorer), middle, and rich for the last two quintiles (richer and richest).

Statistical analysis

The data were analysed using Stata 15.0 and weighted with a *svyset* command. The distribution of sample characteristics was presented as frequencies and percentages. A Chi-square test was conducted to examine the differences in the characteristics' distribution between 2010 and 2014. Traditional generalised linear modeling techniques were employed, assuming that the dependent variable (CEB) follows a Poisson distribution. The natural logarithm of women's current age was used as an offset variable to model the factors associated with CEB in each survey. The coefficients were interpreted as incident rate ratios (IRR) to explain the impact of each independent variable on the number of CEB. Only the adjusted IRRs with 95% Confidence Intervals (CIs) were reported. No collinear variables were identified, as the variance inflation factors (VIFs) for testing multicollinearity were not greater than 10[45]. The deviance and Wald Chi-square test were performed to determine the best overall model fit. Additionally, the Akaike Information Criteria (AIC) was used to assess the goodness of fit test between models, where a lower value indicates a better model fit. A p-value less than 0.05 ($p<0.05$) was considered statistically significant.

Both the datasets of 2010 and 2014 were initially analysed separately to avoid generalising that the underlying factors of fertility remained constant during the study period. The data were combined after obtaining similar results in fertility among women included in both surveys and selecting variables for the multivariable Poisson regressions.

Due to overdispersion, where the mean number of children is larger than the variance in both surveys, a comparison of the Poisson and Negative binomial models was conducted. If overdispersion is observed, the Negative binomial regression model should be preferred over the Poisson model. However, in this study, the Poisson regression was determined to provide the best fit to the data, and the results of this model are interpreted. The final generalised linear Poisson model, with a log link function, had a dispersion parameter of 1 in both surveys, suggesting that the model met the mean/variance requirement and was not overdispersed. The deviance test showed a significant goodness of fit for both 2010 and 2014 surveys including the pooled data, indicating that the Poisson model was appropriate (p>0.05). Additionally, in both surveys, the value of alpha (α)=0 for Negative binomial regression suggested that the mean and variance were the same, further supporting the use of a Poisson model. Therefore, the basic Poisson model, for a set of (y_i, x_i) observations where y_i is the total number of children ever born for i^{th} woman in a given time and x_i is the corresponding vector of independent sociodemographic variables, is as follows[11,39,42]:

$$P(Y_i = y_i) = \frac{e^{-u_i} u^{y_i}}{y_i!} \quad y_i = 0,1,2,\ldots, \quad u_i > 0 \tag{1}$$

and

$$ln(\mu_i) = \alpha + \sum_{i=1}^{j} \beta_i x_i + \varepsilon_i \tag{2}$$

The log-linear equation (2) is exponentiated to get:

$$\mu_i = exp\left(\alpha + \sum_{i=1}^{j} \beta_i x_i + \varepsilon_i\right) \tag{3}$$

Where u_i is the mean number of children per woman, ε_i is the error term and α and β_i are regression coefficients. An offset or exposure variable of age was incorporated into the regression coefficients to allow for the fact that childbearing differs by the age of the mother. The parameter estimates for the independent variables were given as incidence rate ratios (IRRs).

Results

Sample characteristics

There were 2,295 and 2,351 women in the sample survey for Eswatini MICS in 2010 and 2014, respectively. The distribution of age, wealth index, and urban-rural residence differed significantly between 2010 and 2014 (p<0.05). There were higher proportions of women aged 35-49 (46.3% vs. 40.0%), poor (33.0% vs. 19.9%) and who resided in rural (69.8% vs. 41.6%) in 2010 compared with 2014. The present study reported that four-fifths of the women in the study are beginning sexual intercourse as adolescents (age 10-19). About a third (35.3%) and a quarter (23.9%) were getting married as adolescents in 2010 and 2014, respectively Table 1.

Trends and differentials in lifetime fertility

Table 2 shows the mean parity or the mean number of children ever born (CEB) among reproductive-aged women (15-49) who have been married in their lifetime. The study found a significant reduction in mean parity from 3.47 children in 2010 to 3.21 children in 2014 (p<0.001). The study found significant differences in the mean parities for all sociodemographic variables included in the study. The mean parities were higher among women who were older (age 35-49), previously married, had early age at first marriage and sexual debut under the age of 15 years, had child loss, in the poor households, with no formal education and in rural areas. The decline in mean parity was observed across all sociodemographic characteristics. The most significant declines in mean parity were observed among women who were older (age 35-49), previously married and not using modern contraceptives (p<0.001). Overall, the reduction in fertility levels across all subgroups may have contributed to the overall decline in fertility levels at the national level.

Sociodemographic factors associated with lifetime fertility

The adjusted incident rate ratios (IRR) and 95% confidence intervals (CI) for the association between sociodemographic characteristics and lifetime fertility are presented in Table 3. The multivariable regression results are in line with the mean parity findings of the bivariate analyses in Table 2, except for contraceptive use and marital status variables. The selected sociodemographic variables (excluding residence in 2014) were significant predictors of fertility in Eswatini in both 2010 and 2014 (p<0.05). The significant Wald Chi-square statistics of 1069.65 and 1016.17 in 2010 and

Table 1: Percent distribution of ever married women by selected sociodemographic characteristics of respondents, EMICS 2010 and 2014

Variable	2010 (N=2295)	2014 (N=2351)	Difference (%)
Age group**			
15-24	15.03	17.00	1.97
25-34	38.71	43.04	4.33
35-49	46.25	39.96	-6.29
Marital status			
Previously married	19.09	26.18	7.09
Married/cohabiting	80.91	73.82	-7.09
Age at first marriage			
<15	3.71	1.99	-1.72
15-19	31.54	21.86	-9.68
20-24	36.39	46.15	9.76
25+	28.36	29.99	1.63
Age at sexual debut			
<15	9.87	6.32	-3.56
15-19	70.9	74.73	3.83
20-24	16.65	16.03	-0.62
25+	2.586	2.923	0.34
Child loss			
No	74.71	73.34	-1.37
Yes	25.29	26.66	1.37
Contraceptive use			
No	37.87	32.56	-5.31
Yes	62.13	67.44	5.31
Household wealth***			
Poor	33.00	19.89	-13.11
Middle	19.82	13.58	-6.24
Rich	47.18	66.52	19.34
Education			
None	39.50	26.95	-12.55
Primary	30.49	44.19	13.70
Secondary or higher	30.01	28.86	-1.15
Residence***			
Rural	69.82	41.60	-28.22
Urban	30.18	58.40	28.22

***P<0.001, **P<0.01, *P<0.05

2014, respectively, indicate that the explanatory variables in the multivariable Poisson models are significant (p<0.001). The Wald test for the combined data (1967.14, p<0.001) also showed model adequacy.

The multivariable regression findings from both the 2010 and 2014 surveys suggest an inverse association between fertility (number of children born per woman) and wealth, education, age at first marriage, and age at sexual debut. Fertility was positively associated with women's age, experiencing child loss, and living in rural areas. In both surveys, married or cohabiting women had more children than previously married women, and women who currently used modern contraceptives had higher fertility than those who did not. However, this is not a cause for concern, as it suggests that women may be using family planning for spacing or postponing births to achieve their desired family size. The direction of association and the incident rate ratios in both surveys were quite similar, as shown in Table 3. The pooled or combined survey data findings are interpreted in this study (Table 3).

The pooled results indicate that secondary or higher education attainment (IRR=0.82, 95% CI: 0.78-0.85, p<0.001), delayed or older age (25+) at first marriage (IRR=0.75, 95% CI: 0.69-0.80, p<0.001) and sexual debut (IRR=0.67, 95% CI: 0.60-0.74, p<0.001), and being rich (IRR=0.81,

Table 2: Trends and differentials in mean number of children ever born among ever married women by selected background characteristics, EMICS 2010 and 2014

Variable	2010 Mean	SD	2014 Mean	SD	Mean Difference	T-test
Age group						
15-24	1.50	0.95	1.44	0.86	0.06	0.83
25-34	2.65	1.54	2.60	1.38	0.05	0.72
35-49	4.80	2.51	4.19	2.22	0.61	6.05***
Marital status						
Previously married	3.77	2.29	3.31	2.00	0.46	3.17***
Married/cohabiting	3.40	2.39	3.19	2.06	0.21	2.89**
Age at first marriage						
<15	4.53	2.61	4.20	2.39	0.33	1.37
15-19	3.56	2.38	3.31	2.04	0.25	3.19***
20-24	2.69	1.98	2.64	1.76	0.05	0.38
25+	2.27	1.41	1.79	1.18	0.48	2.16*
Age at sexual debut						
<15	4.76	2.55	4.59	2.65	0.17	0.40
15-19	3.89	2.64	3.60	2.41	0.29	2.10*
20-24	3.15	2.19	3.04	1.84	0.11	1.13
25+	3.25	2.13	3.00	1.83	0.25	2.37**
Child loss						
No	3.16	1.99	2.82	1.82	0.34	5.25***
Yes	4.95	2.66	4.58	2.20	0.37	2.48**
Contraceptive use						
No	3.90	2.74	3.47	2.36	0.43	3.36***
Yes	3.32	2.09	3.16	1.85	0.16	2.13*
Household wealth						
Poor	4.36	2.70	4.06	2.35	0.30	2.37**
Middle	3.59	2.49	3.39	2.04	0.20	1.33
Rich	2.80	1.80	2.56	1.54	0.24	3.25***
Education						
None	4.34	2.70	4.01	2.37	0.33	2.72**
Primary	3.34	2.14	3.11	1.86	0.23	2.19*
Secondary or higher	2.47	1.60	2.47	1.51	0.00	0.00
Residence						
Rural	3.82	2.51	3.51	2.18	0.31	3.68***
Urban	2.67	1.78	2.62	1.60	0.05	0.55
Total	3.47	2.37	3.21	2.05	0.26	4.00***

***P<0.001, **P<0.01, *P<0.05,
SD= Standard deviation; N= sample observations

95% CI: 0.78-0.85, p<0.001) are the factors most likely to lower fertility. Women living in urban areas had lower fertility than those living in rural areas (IRR=0.95, 95% CI: 0.91-0.99, p<0.001). Older women (age 35-49) and those who experienced child loss had the highest incidence of fertility (IRR=1.56, 95% CI: 1.49-1.64, p<0.001 and IRR=1.25, 95% CI: 1.21-1.30, p<0.001, respectively). Married or cohabiting women had higher fertility, with 14% more children than previously married women (IRR=1.14, 95% CI: 1.10-1.19, p<0.001). Women currently using modern contraception had 9% higher fertility than those who had never used it (IRR=1.09, 95% CI: 1.05-1.12, p<0.001), while controlling for all other variables in the model.

Table 3: Poisson regression results predicting determinants of children ever born among ever married women by selected background characteristics, EMICS 2010 and 2014

	2010			2014			Pooled		
Variable	**IRR**	**SE**	**95% CI**	**IRR**	**SE**	**95% CI**	**IRR**	**SE**	**95% CI**
Age group									
15-24 (ref.)	1.00			1.00			1.00		
25-34	1.32	0.04	1.24-1.41***	1.38	0.05	1.28-1.49***	1.34	0.03	1.28-1.41***
35-49	1.59	0.05	1.49-1.69***	1.55	0.06	1.44-1.67***	1.56	0.04	1.49-1.64***
Marital status									
Previously married (ref.)	1.00			1.00			1.00		
Married/cohabiting	1.17	0.03	1.11-1.23***	1.11	0.03	1.05-1.18***	1.14	0.02	1.10-1.19***
Age at first marriage									
<15 (ref.)	1.00			1.00			1.00		
15-19	0.94	0.05	0.86-1.03	0.85	0.05	0.76-0.95**	0.90	0.03	0.84-0.97**
20-24	0.88	0.04	0.80-0.97**	0.79	0.04	0.71-0.88***	0.83	0.03	0.77-0.89***
25+	0.78	0.04	0.71-0.86***	0.71	0.04	0.64-0.79***	0.75	0.03	0.69-0.80***
Age at sexual debut									
<15 (ref.)	1.00			1.00			1.00		
15-19	0.96	0.03	0.90-1.03	0.93	0.03	0.88-1.00*	0.95	0.02	0.90-1.00*
20-24	0.84	0.04	0.77-0.91***	0.80	0.03	0.74-0.87***	0.82	0.03	0.77-0.87***
25+	0.75	0.06	0.65-0.87***	0.60	0.04	0.52-0.69***	0.67	0.04	0.60-0.74***
Child loss									
No (ref.)	1.00			1.00			1.00		
Yes	1.24	0.03	1.19-1.30***	1.25	0.03	1.19-1.32***	1.25	0.02	1.21-1.30***
Contraceptive use									
No (ref.)	1.00			1.00			1.00		
Yes	1.06	0.02	1.01-1.10*	1.12	0.03	1.07-1.18***	1.09	0.02	1.05-1.12***
Household wealth									
Poor (ref.)	1.00			1.00			1.00		
Middle	0.96	0.03	0.90-1.01	0.91	0.02	0.87-0.96***	0.94	0.02	0.90-0.98**
Rich	0.82	0.02	0.78-0.87***	0.79	0.02	0.75-0.84***	0.81	0.02	0.78-0.85***
Education									
None (ref.)	1.00			1.00			1.00		
Primary	0.94	0.02	0.89-0.99*	0.94	0.03	0.89-0.99*	0.93	0.02	0.90-0.97***
Secondary or higher	0.80	0.03	0.75-0.85***	0.87	0.03	0.81-0.93***	0.82	0.02	0.79-0.86***
Residence									
Rural (ref.)	1.00			1.00			1.00		
Urban	0.94	0.02	0.90-0.99*	0.97	0.03	0.91-1.02	0.95	0.02	0.91-0.99**
N	2071			2157			4228		
Log-likelihood	-3788.52			-3835.03			-7748.41		
Wald criteria	1069.65***			1016.17***			1967.14***		
Deviance	1306.38		P=1.0000	1440.67		P=1.0000	2796.76		P=1.0000
AIC	7611.05			7704.06			15330.83		

***P<0.001, **P<0.01, *P<0.05

Discussion

The study's first objective was to examine the changes in lifetime fertility in Eswatini, using children ever born as a measure of past fertility. The study found that the mean parity declined significantly by 0.3 children, from 3.47 children in 2010 to 3.21 children in 2014 (p<0.001), consistent with global[39] and regional trends[30]. As expected, fertility levels varied by women's age, marital status, age at first marriage, age at sexual debut, child loss, modern contraceptive use, household wealth, level of education, and urban-rural residence. Between 2010 and 2014, the study found that the mean parities declined considering all women's sociodemographic characteristics included in the study. Between the survey years, there were notable significant differences found in the mean parities among women who were older (age 35+), and previously married. Over time the number of children ever born tend to decline among older women resulting in fertility declines.

The second objective of the study was to examine the associations between sociodemographic factors and lifetime fertility among ever-married Swazi women for the period between 2010 and 2014. The Poisson regression findings revealed that the factors significantly associated with lifetime fertility among ever-married women were similar in both 2010 and 2014, except for the place of residence, which was only significant in 2010. In pooled results, all selected sociodemographic variables, including age, marital status, age at first marriage, age at sexual debut, child loss, modern contraceptive use, household wealth, level of education, and urban-rural residence, were significantly associated with lifetime fertility. In general, higher fertility was associated with women who had an early sexual debut, early age at first marriage, experienced child loss, resided in rural areas, and who were older (age 35+ years), poor, and uneducated. Marriage, due to high sexual exposure, increases the likelihood of higher fertility, especially among currently married women when compared with their previously married counterparts.

Our study found that age is positively associated with children ever born in line with previous studies[27,30]. Women aged 35-49 had a higher total number of children ever born compared to younger women. This is consistent with the fact that women complete childbearing at the end of their reproductive lifespan[27]. Therefore, age is an important determinant of cumulative fertility.

Child loss is an important variable that influences fertility, as seen in a previous studies conducted in Malawi[30], Kenya[38] and Eswatini[11]. According to their findings, women who experienced child loss had more children than those who did not. This finding highlights the significance of traditional African values that prioritise the importance of children for security in old age and continuity of family lineage[11,30].

The current study also established that women who were currently using modern contraception, compared to those who had never used it, had higher fertility. This finding is contrary to Davis and Blake's[17] postulation that contraceptive use is a proximate determinant of fertility with an inhibitive effect on fertility, as well as findings in sub-Saharan Africa[2,24,25] where contraceptive use was inversely associated with fertility. However, our findings suggest that contraceptives are probably being used not necessarily for stopping childbearing, but for postponing and spacing out births[3].

The age at sexual debut and first marriage are important predictors of lifetime fertility as they affect women's exposure to childbearing. Our study found that age at first marriage and sexual debut were inversely associated with children ever born, similar to findings from studies in Malawi[30], Kenya[38], India[25,39], and Ghana[28,46]. Women who married or had their first sexual experience at ages 10-14 had the highest fertility or CEB. Therefore, it is crucial to disseminate information to adolescents about the socio-economic and reproductive health challenges related to early sexual debut and marriage. Finding interventions to delay sexual debut and entry into marriage may regulate fertility for young girls[27].

Marriage, a proximate factor, is a cornerstone of the social fabric and fertility transition in patriarchal African societies[20,27], including Eswatini[11,15]. Our study found that married or cohabiting women had higher fertility, 14% more children, than previously married women. This is consistent with a previous study conducted in Ghana[27], which found that married women or those living together had higher fertility than those who were previously married (widowed, separated or divorced). To further reduce fertility, policies should aim to change some of the pronatalist norms and practices associated with Swazi marriages. For example, early marriages should be discouraged, and fertility control should be encouraged within marriages. Additionally, empowering women through improved wealth status and education, as found in the study, can help to reduce fertility.

In contrast to previous findings in sub-Saharan Africa[2], which found no association between fertility and wealth, our current study revealed that wealth is a background variable that inversely influences fertility. Women from rich households had the highest likelihood of lowering fertility when compared to those in the poor households. However, it should be noted that our findings not only support the postulations from fertility theories[17,18], but also findings from sub-

Saharan Africa[28] including Malawi[25,30], South Africa[36], Ethiopia[24], Ghana[27], Uganda[29], and Eswatini[13]. In commitment to Sustainable Development Goal (SDG) 1 of eliminating poverty[9], reducing fertility could be achieved more quickly for women through improving wealth status.

Consistent with the postulations from Davis and Blake[17] theory, modified by Bongaarts[18], the current study found an inverse association between fertility and education. Women with primary, secondary or higher education had lower fertility compared to those with no education. This finding is consistent with observations from other sub-Saharan African countries such as South Africa[36], Uganda[8,29], Ghana[28,46], Zambia[23], and Ethiopia[24,33]. Women with higher levels of education are typically better informed about using contraception and have control of when to get married, give birth or become pregnant, which makes them achieve low fertility goals[30,42]. Our finding shows the importance of female education in the reduction of fertility. It highlights the importance of female education in reducing fertility rates and emphasises the influence of education on the desired number of children, contraceptive use, and delaying age at first marriage.

Consistent with findings in Malawi[25], Zambia[23], and Ethiopia[24,27], the current study found that women residing in urban areas had lower fertility compared to those living in rural areas. This highlights the need for the government of Eswatini to not only improve access to family planning services in rural areas, but also increase information, education, and communication to rural women on the health and economic benefits associated with the use of contraceptives and delaying sexual debut and marriages.

This study has its limitations, including the fact that information from surveys is self-reported and may be subject to social desirability and recall bias on some useful demographic information including age and live births or parity. While not the main focus of this paper, lifetime or parity misreporting, particularly, parity omissions, have been reported in surveys, leading to an underestimation of fertility levels as measured by the total fertility rate[12]. Also, the exclusion of never-married women may have led to an underestimation of average parities. It should be noted that the multivariable analysis in the study does not explain all the variation in lifetime fertility because the secondary data provided only a limited number of sociodemographic variables in the model. Despite these limitations, the multivariable model controlled for several confounders mentioned in the literature. Further, the cross-sectional data were nationally representative, with a large sample size, and sourced from reputable and globally standardised MICS survey initiatives. The MICS provided two-time points (although it did not follow the same age cohort) that revealed the dynamics of lifetime fertility with the selected sociodemographic variables between 2010 and 2014.

Ethical consideration

In this study, we used publicly available Eswatini MICS secondary data that was granted permission for use from http://mics.unicef.org/surveys. The collection of data adhered to ethical guidelines approved by both local and international ethics committee boards[14,43]. The data used were anonymised for analysis

Conclusion

This study has provided valuable evidence on the fertility transition in Eswatini, as measured by the mean number of children ever born (or average parity). The study found a significant decrease in fertility at the national level between 2010 and 2014. The study found a noticeable similar variation in mean parities by the selected nine sociodemographic variables when comparing 2010 and 2014 Eswatini MICS data. This pattern of fertility variation observed was consistent with the results of multivariable Poisson regression analysis.

The study found that women's age, age at first marriage, age at sexual debut, marital status, educational status, household wealth, child loss, contraceptive use, and place of residence were all factors contributing to fertility decline. Women's age had a positive relationship with lifetime fertility, while married women tended to have higher fertility rates due to traditional norms. The current use of modern contraceptives was associated with higher lifetime fertility, which may suggest a high unmet need for family planning services in Eswatini. However, contraceptives may also be used for postponing or delaying childbearing. Child mortality had a significant positive influence on lifetime fertility and needs to be addressed in reproductive health initiatives. Household wealth, education, age at marriage and sexual debut, and urban residence had a negative association with lifetime fertility.

Our study highlights the need for a multifaceted approach to achieve sustained fertility transition and reduce fertility disparities in Eswatini. It is essential to consider several sociodemographic variables simultaneously rather than focusing on a single variable. To achieve low fertility levels, we recommend creating awareness of and strengthening laws that abolish early sexual debut and marriage.

These findings demonstrate the prevailing gender socioeconomic disadvantages towards women's fertility behaviour in Eswatini. Therefore, interventions and policies should be strengthened to curb the current gender inequalities that align with SDG number 5[9]. These interventions must be aimed at reducing fertility disparities among women and curbing high fertility. Based on the findings of this study, improving the socioeconomic status of women in Eswatini is crucial to achieving a sustained fertility transition. Ethnographic and longitudinal studies may also be explored to examine in-depth the reasons for fertility disparities and achieve the goal of reducing fertility.

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Conflict of interests

We declare no conflict of interests.

Contributions of authors

GBC conceived the idea, conceptualised the paper, analysed, and wrote the methodology and results of the paper. SM wrote the introduction and discussion of the paper. MSS contributed to the study design, statistical analysis, validation and the writing of the manuscript. All authors revised the manuscript. All authors mentioned in the article approved the manuscript.

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