

Age-specific Fertility and Sociodemographic Variations on Fertility Outcomes in Namibia

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Abstract

The Namibian fertility rate has declined over the years from average children of 6.1 (1991) to 3.7(2023). As size of the population is an important social, political and economic aspect to determine a country's future, there is a need for an in-depth analysis to understand contributing factors to the population growth of the country. While doing so, the age group and social categories of women that may be experiencing an incline and decline in fertility among women, especially when it comes to developing (age-sex fertility) policies and interventions to further address issues related to reproductive health, family planning and maternal health. Using the 2013 NDHS data this study examined the pattern of the Age-Specific Fertility Rates (ASFRs) as well as the effect of sociodemographic characteristics on the total number of births in Namibia. Results showed that the age group 25-34 had the highest ASFR. Also, the total number of births in Namibia were significantly associated with the women's sociodemographic characteristics such as regions ($p<0.001$), place of residence ($p<0.001$), religion ($p=0.001$), educational level ($p<0.001$), wealth index ($p<0.001$), marital status ($p<0.001$) and employment status ($p<0.001$), with notable variations in fertility rates across women in urban and rural locations as well as between regions.

Keywords: Age-sex fertility, live births, ASFR, NDHS, Namibia

Introduction

Age-Specific Fertility Rate (ASFR) is the number of births to females in a particular age category in a particular year compared to the number of females in that age category (Gaire et al., 2022). This rate classifies women and births into single- or five-year age ranges, to examine relative frequencies of childbearing within certain age groups. Since fertility is one of the three primary components of population dynamics that determine the size, structure, and composition of the population in any given country and births are evaluated in a special group of women (usually those with the same date of birth), ASFR can be regarded as a cohort method of investigating fertility (Ghaem, et al., 2019). Fertility rate per age category has gone through changes over the past years from an average of 5.4 children among women aged 15-44 years to 2.5 average children (Nyoni, Chihoho & Nyoni, 2021). According to the World Bank Group (2025), fertility rates in sub-Saharan Africa have been on a declining trend, with contemporary live births for the region estimated to be around 4.3 children per woman, a continued decline from its highest rate of 6.8 children per woman in 1971-1980 (World Bank Group, 2025). Namibia has experienced a decline in fertility over the years from 6.1 children per woman in 1991 to 3.6 in 2013 and 3.7 in 2023 during her reproductive life (Namibia Statistics Agency [NSA], 2024). With fertility rate projected for 2024/2025 standing at around 3.1 to 3.2 children per woman, these rates further show that the current fertility rate in the country has declined over the years, to almost half of the Total Fertility Rate (TFR) in 1991 (6.1 children). This should raise a crucial concern of the possible causes and implications of a lower rate in

childbearing. However, the decline in fertility rate is not uniform across age groups and sociodemographic characteristics. For example, according to NSA (2024), the current TFR was higher in rural areas (4.8 children) compared to the urban areas (3.0 children), while it was highest in the Kavango West (5.2 children), Oshana (5.0 children) and Oshana (5.0) Regions compared to the Kunene (2.6 children) and Erongo (2.9 children) Regions.

Africa, being regarded as the world's poorest continent in terms of per capita income where many of its citizens live below the poverty line and high birth rate at young age, has experienced a decline in fertility rate, generally due to change in sociodemographic aspects. From literature the variation on fertility in relation to specific age is linked to different factors such as health awareness (Wang et al., 2020; Götmark & Andersson, 2020; MoHSS, 2014; Andegiorghis et al., 2022; Ghaem et al., 2019), level of education (Sacco et al., 2018; Wang et al., 2020; MoHSS, 2014; Andegiorghis et al., 2022; Bongaarts & Casterline, 2022; Ghaem et al., 2019; Sunder et al., 2020, Nyarko, 2021; Kebede et al., 2022), marriage status (Biney et al., 2021; Götmark & Andersson, 2020; Nyoni et al., 2021; Shinyemba et al., 2022; Bongaarts & Casterline, 2022; Harwood-Lejeune, 2001; Bukenya, 2019; Ghaem et al., 2019, Nyarko, 2021), cultural beliefs and requirements (MoHSS, 2014; Nyoni et al., 2021; Ghaem et al., 2019), regional disparities (MoHSS, 2014; Andegiorghis et al., 2022; Nyoni et al., 2021; Ghaem et al., 2019, Nyarko, 2021; Kebede et al., 2022), employment status (Wang et al., 2020; Ghaem et al., 2019, Sugisawa et al., 2018, Nyarko, 2021), wealth index (MoHSS, 2014; Bongaarts & Casterline, 2022; Ghaem et

al., 2019, Nyarko, 2021; Kebede et al., 2022), age group (Wang et al., 2020; Azmoude et al., 2017; Andegiorgish et al., 2022; Bukenya, 2019; Ghaem et al., 2019, Nyarko, 2021) and desired family size (Nyoni et al., 2021; Bongaarts & Casterline, 2022; Ghaem et al., 2019). Even though most girls do not conceive their first child at the age of 15, using data from 103 Demographic and Health Survey (DHS) programs in 25 countries within the sub-Saharan Africa Region, Bongaarts (2020) found a high number of girls conceiving their first child before turning 20 years old, of which they are likely to continue conceiving due to lack of education, cultural requirements such as early child marriage. Differences in the TFR across the age groups may also reflect the different levels of socioeconomic status with some women's decision on conceiving based on financial status (Bongaarts, 2020). It is believed that at a young age women spend most of their time pursuing careers and business for financial freedom and only at age 30 more women get their financial freedom, and they start making babies knowing that the future of their children is assured by the legacy they have established. In Namibia, the adolescent fertility rate (births per 1,000 women aged 15-19) fell gradually from 117.9 births per 1,000 women in 1971 to 57.64 births per 1,000 in 2020 (Nkalu, 2023). In a study by the Ministry of Health and Social Services [MoHSS] in 2014, it was highlighted that Namibia's fertility has gradually decreased since independence except for the age categories of 20-24 and 30-34, with women aged 25-29 experiencing the most severe reproductive decrease. On a normal basis fertility usually decreases more at older ages than at younger ages resulting in the lowering of the mean age at childbearing without considering other factors

such as the sociodemographic and socioeconomic factors. MoHSS (2014) found that childbearing in Namibia begins early, with low fertility rates among adolescents, and then increasing among the 20-29 age group and drastically reducing thereafter as most women are faced with health problems such as cervical cancer and fibroids amongst others and some reaching their menopause earlier before the age of 45.

Although the latest official survey and census carried out in Namibia over the years such as the 2013 Namibia Demographic Health Survey (NDHS) and 2023 Population and Housing Census highlighted the decline in the national fertility rates and rates across age categories in their respective reports, these reports did not provide an in-depth analysis on the characteristics of the women behind the numbers neither did they provide an empirical analysis to understand which group of women contributed to the population growth of the country and the age group that may be experiencing an incline and decline in fertility among women, especially when it comes to developing (age-sex fertility) policies and interventions to further address issues related to reproductive health, family planning and maternal health in the country. Thus, there is a need to further understand the patterns and trends as well as determinants of fertility rate among the different age groups of women in the population. Addressing these complex sociodemographic dynamics shaping age-specific fertility in Namibia is crucial for shaping reproductive health policies and interventions tailored to the specific needs of different demographic groups within the Namibian population. Therefore, this study was aimed at investigating the sociodemographic

variations on ASFR in Namibia. By identifying the sociodemographic characteristics associated with age-specific fertility and investigating how these dynamics have evolved over time, this research can inform evidence-based policymaking and contribute to the design of targeted interventions aimed at improving reproductive health outcomes in Namibia. In addition, given the significant demographic changes occurring in Namibia including shifts in population distribution and age structure, this study has the potential to provide valuable insights into how these changes intersect with sociodemographic characteristics to shape fertility patterns, thereby offering a comprehensive understanding of the underlying dynamics driving variations in fertility rates.

Research Methods

This study followed a quantitative research design using secondary data obtained from the 2013 NDHS, the latest of its kind in Namibia. The 2013 NDHS is the latest national-level population and health survey that provides demographic, socioeconomic and health information needed for national health and population programs development, implementation, monitoring and assessment in Namibia. It measures a wide range of demographic and health indicators including fertility, family planning, infant and child mortality, maternal and child health, nutrition, domestic and violence, knowledge and prevalence of HIV/AIDs and other non-

communicable diseases (Ministry of Health and Social Services & ICF International, 2014). The NDHS is funded by the United States Agency for International Development (USAID) and Global Fund in collaboration with Namibia's MoHSS, as part of their global Demographic and Health Survey (DHS) programs. This survey was administered through a face-to-face interview using a stratified two-stage cluster sample design as a representative at national, residence (urban/rural) and regional level. The first stage included enumeration regions extracted from census files, while the second stage included a subset of the households in each enumeration area that were chosen from a list of all the households in that area (Ministry of Health and Social Services & ICF International, 2014). The target study population for this study was all married women in the fertility age group (15-49 years) in Namibia who had and had no births in the last 72 months preceding the survey and interviewed in 2013 as captured in the 2013 NDHS. A total of 5,929 births and 9,100 women in the fertility age group were recorded in the NDHS 2013. More information about the survey can be found in the NDHS 2013/14 report freely available online on the DHS website. The sociodemographic characteristics of the women considered in this study were their educational level, wealth index, place of residence, marital status, regions, employment status and religion. Table 1 gives a brief description of these characteristics.

Table 1: Study Variables Description

Variable name	Description
Total number of births	Total number of live births and still births in the last 72 months preceding the survey
Age group	Age group of the women (in years): 15-24, 25-34, 35-44, 45-49
Educational level	Highest Educational level of the women: no education, primary education, secondary education, higher education
Wealth index	Wealth index of the women's household: poorest, poorer, middle, richer, richest
Place of residence	Area location of the women's household: urban, rural
Marital status	Marital status of the women: never in union, married, living with partner, widowed, divorced, no longer living together/separated
Region	Administrative region of the women's: Caprivi, Erongo, Hardap, //Karas, Kavango, Khomas, Kunene, Ohangwena, Omaheke, Omusati, Oshana, Oshikoto, Otjozondjupa
Employment status	Employment status of the women: employed, not employed
Religion	Theological affiliation of the women: Evangelical Lutheran Church in Namibia (ELCIN), Protestant/Anglican, Roman Catholic, Seventh-day Adventist, no religion, other religion

Data Analysis

This study used a period approach to study the fertility patterns of Namibian women. According to Weeks (2012), period data refers to a specific year in the calendar and captures a snapshot of the population at a particular moment. By using this approach, this study calculated the ASFRs for each year which gave a snapshot of the fertility patterns of Namibian women at a particular moment in time. This allowed for the comparison of the rates between different years and identified any patterns or changes in fertility over time. The ASFR was calculated as the number of births occurring annually per 1,000 women of a specific age group. To be precise,

$${}_n f_x^t = \frac{{}_n B_x^t}{{}_n P_x^t} \times 1000$$

where ${}_n f_x^t$ is the ASFR for women between age x and $x + n$ for year t , ${}_n B_x^t$ is the number of births to women between ages x and $x + n$ in year t , ${}_n P_x^t$ is the number of women between ages x and $x + n$ in year t . The ASFR was estimated over 72 months to account for more births and improve the reliability of the results. This time-period helps in the tracking of short-term fertility changes and enables for more in-depth analysis of various age groups. The ASFR values were estimated for the years 1992, 2000, 2006 and 2013 using the NDHS of 1992, 2000,

2006 and 2013 respectively. This was only done for comparison purposes in terms of birth rates for women age groups across these years, with the 1992 NDHS having 4,634 births and 5,362 women, the 2000 NDHS having 4,709 births and 6,697 women, and the 2006 NDHS having 6,046 births and 9,709 women in the fertility age group.

A Negative Binomial regression was used to examine the effect of the women's sociodemographic characteristics on their fertility outcome. This model was chosen because it was particularly suited to handle the observed variation in the outcome variable, i.e., the number of live births, which may not be adequately accounted for by other statistical methods (Nyarko, 2021). In Negative Binomial regression, the goal is to estimate the parameters of the model that relate the predictors (independent variables) to the logarithm of the mean of the Negative Binomial distribution such that

$$\log(E(y)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \varepsilon$$

where $\log(E(y))$ is the logarithm of the expected count (mean) of the dependent variable y , β_0 is the model intercept, $\beta_1, \beta_2, \dots, \beta_p$ are the coefficients, $X_1, X_2, \dots, X_p$ are the independent variables and ε is the error term (Dharmaraja, et al., 2014). For this study, y was the total number of births while $X_1, X_2, \dots, X_p$ were the age group and sociodemographic characteristics (educational level, wealth index, place of residence, marital status, regions, employment status and religion). A p-value < 0.05 was considered significant. All descriptive analysis, cross tabulations and model analyses were conducted using the R software (version 4.5.1) while Microsoft Excel (2019 version) was used to analyse fertility patterns.

Results

ASFR

The estimated ASFR values are shown in Figure 1. An overall decreasing trend in terms of birth rates for women age groups can be observed. The 15-24 age group experienced a steady decrease from a high of 409 children per 1,000 women in 1992 to 241 children per 1,000 women in 2006, before scaling a little to 261 children per 1,000 women by the year 2013. The ASFR for the age group 25 to 34 peaked in 1992 with the rate of 527 children per 1,000 women, which then reduced to 309 children per 1,000 women in 2013. Likewise, the upward trend for the 35-44 age group went down from 295 children per 1,000 women to 154 children per 1,000 women between 1992 and 2013. ASFR for the age group 45-49 had been low throughout, with the highest level within this age bracket at 21 children per 1,000 women in 2000 followed by a decrease after. It can be seen clearly that for all women in all age brackets the highest ASFR occurred in the year 1992 after which the rates began a steady downward slide in the next following years.

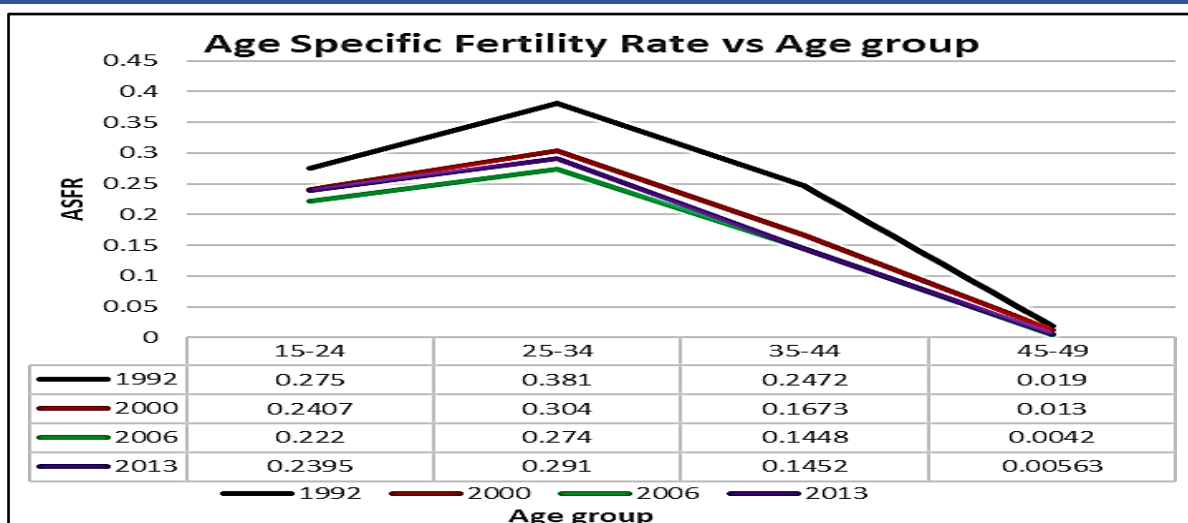


Figure 1: Distribution of ASFRs for the years 1992, 2000, 2006 and 2013

Looking at the percentage of women based on the number of total births they have had for the last 72 months preceding the 2013 survey (Figure 2), it can be observed that the largest group of

women (51.7%) had never had children, while about 33.3% of women had one child, and 12.5% had two. As the number of children grows, the proportion of women in each group declines.

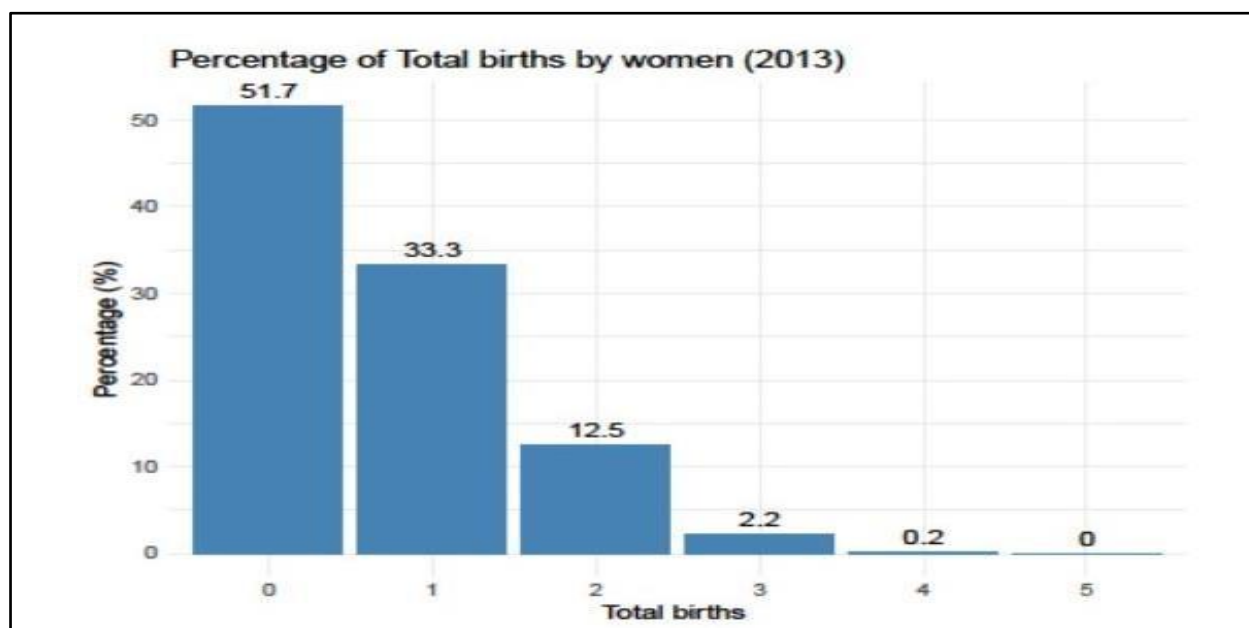


Figure 2: Total Children ever Born by Women

Sociodemographic Characteristics

Table 2 shows the sociodemographic characteristics of the 9,100 women between the fertility age group as reported in the 2013 NDHS data. Regarding regional distribution, the Khomas (10.7%) and Erongo (9.3%) Regions had the most percentage of sampled women, while the Omaheke Region (5.8%) had the lowest. In most regions, the biggest proportion of women were in the 15-24 age range, suggesting that younger women were better represented in this survey and a population characterized by young people in the country. When it came to where the women resided, there was a slight variation between the urban areas (52.6%) and rural areas (47.4%). In terms of educational level, 65.6% of the respondents had secondary education, 20.9% had primary education and 6% had never attended any formal schooling. All age categories showed a similar lower percentage (7.5%) of those with higher education, with younger women aged 15-24 years old more likely to have finished secondary school. Regarding religion, most of the respondents (41.3%) identified as ELCIN followers, followed by the Protestant/Anglican (22.4%) and Roman Catholics (20.7%) followers. The range of religious affiliations among the

respondents was highlighted by the miniature percentage of women (1.4%) who identified as not practicing any religion and the 8.5% who practiced other religions.

In terms of distribution of wealth, most women fell to the richer category (23.5%), which was followed by those who fell in the richest group (21.60%), with the poorest group making up 16.0% of the women (Table 2). The employment status of the women revealed that over half (58.1%) of them were not working, with women between the ages of 45 and 49 having the highest employment rate of 57.5%. Younger women, specifically those between the ages of 15 and 24, had no employment (80.8%) probably because many of them were still in school or depending on their respective families for support. Regarding marital status, 19.38% of the women were married, while 17.3% were living with a partner, and most (56.5%) had never been in a union. A low proportion of women (2.1%) were widowed, while 1.1% were divorced. It is not surprising to note that the age group 15-24 had the highest percentage (84.3%) of women who were single at the time of the survey, while the age group of 35-44 had the highest percentage of married women (36.3%).

Table 2: Sociodemographic Characteristics Distribution of the Sampled Women in 2013 (n=9,100)

	Age Group				
	15-24 Count (%)	25-34 Count (%)	35-44 Count (%)	45-49 Count (%)	Total Count (%)
Region					
Caprivi	260 (7.33)	203 (7.43)	135 (6.51)	45 (6.01)	643 (7.07)
Erongo	309 (8.72)	281 (10.29)	194 (9.35)	65 (8.68)	849 (9.33)
Hardap	215 (6.06)	178 (6.52)	138 (6.65)	62 (8.28)	593 (6.52)
//Karas	261 (7.36)	227 (8.31)	215 (10.37)	71 (9.48)	774 (8.51)

Kavango	322 (9.08)	229 (8.38)	140 (6.75)	44 (5.87)	735 (8.08)
Khomas	395 (11.14)	304 (11.13)	206 (9.93)	66 (8.81)	971 (10.67)
Kunene	194 (5.47)	191 (6.99)	144 (6.94)	50 (6.68)	579 (6.36)
Ohangwena	310 (8.74)	184 (6.73)	144 (6.94)	55 (7.34)	693 (7.62)
Omaheke	174 (4.91)	167 (6.11)	130 (6.27)	57 (7.61)	528 (5.80)
Omusati	310 (8.74)	166 (6.08)	174 (8.39)	69 (9.21)	719 (7.90)
Oshana	265 (7.48)	202 (7.39)	151 (7.28)	50 (6.68)	668 (7.34)
Oshikoto	275 (7.76)	190 (6.95)	131 (6.32)	57 (7.61)	653 (7.18)
Otjozondjupa	255 (7.19)	210 (7.69)	172 (8.29)	58 (7.74)	695 (7.64)
Place of Residence					
Urban	1798 (50.72)	1527 (55.89)	1104 (53.23)	364 (48.60)	4793 (52.67)
Rural	1747 (49.28)	1205 (44.11)	970 (46.77)	385 (51.40)	4307 (47.33)
Educational Level					
No Education	102 (2.88)	174 (6.37)	173 (8.34)	97 (12.95)	546 (6.00)
Primary	680 (19.18)	462 (16.91)	500 (24.11)	257 (34.31)	1899 (20.87)
Secondary	2523 (71.17)	1878 (68.74)	1255 (60.51)	313 (41.79)	5969 (65.59)
Higher	240 (6.77)	218 (7.98)	146 (7.04)	82 (10.95)	686 (7.54)
Religion					
Roman Catholic	759 (21.41)	560 (20.50)	406 (19.58)	154 (20.56)	1879 (20.65)
Protestant/Anglican	756 (21.33)	639 (23.39)	467 (22.52)	178 (23.77)	2040 (22.42)
ELCIN	1452 (40.96)	1111 (40.67)	884 (42.62)	311 (41.52)	3758 (41.30)
Seventh-day Adventist	227 (6.40)	153 (5.60)	115 (5.54)	24 (3.20)	519 (5.70)
No Religion	57 (1.61)	30 (1.10)	32 (1.54)	8 (1.07)	127 (1.40)
Other Religion	294 (8.29)	239 (8.75)	170 (8.20)	74 (9.88)	777 (8.54)
Wealth Index					
Poorest	574 (16.19)	417 (15.26)	353 (17.02)	114 (15.22)	1458 (16.02)
Poorer	660 (18.62)	483 (17.68)	371 (17.89)	134 (17.89)	1648 (18.11)
Middle	709 (20.00)	602 (22.04)	431 (20.78)	149 (19.89)	1891 (20.78)
Richer	832 (23.47)	691 (25.29)	454 (21.89)	160 (21.36)	2137 (23.48)
Richest	770 (21.72)	539 (19.73)	465 (22.42)	192 (25.63)	1966 (21.60)
Marital Status					
Never in Union	2979 (84.30)	1338 (48.98)	651 (31.39)	175 (23.36)	5143 (56.52)
Married	113 (3.20)	571 (20.90)	753 (36.31)	327 (43.66)	1764 (19.38)

Living with Partner	387 (10.95)	671 (24.56)	418 (20.15)	97 (12.95)	1573 (17.29)
Widowed	2 (0.06)	19 (0.70)	87 (4.19)	85 (11.35)	193 (2.12)
Divorced	5 (0.14)	17 (0.62)	50 (2.41)	24 (3.20)	96 (1.05)
No Longer Living Together/Separated	59 (1.67)	116 (4.25)	115 (5.54)	41 (5.47)	331 (3.64)
Employment Status					
Not Employed	2864 (80.79)	1242 (45.46)	861 (41.51)	318 (42.46)	5285 (58.08)
Employed	681 (19.21)	1490 (54.54)	1213 (58.49)	431 (57.54)	3815 (41.92)

Furthermore, Table 3 shows that a total of 5,929 births took place in the 72 months before the 2013 survey, and this data was further utilized to determine the ASFRs. With respect to regional distribution, women between 25-34 years old gave birth the most in almost all regions, especially in the Kavango (10.0%) and Ohangwena (9.2%) Regions. On the other hand, women between the ages of 45 and 49 consistently had the fewest births, making a small contribution in regions such as Omusati (3.6%) and Oshana (2.9%) Regions, showing a decrease in fertility as women aged. Overall, the Kavango Region had the highest number of births with 10.4%, while the Oshana Region had the lowest number of births with 5.6%. Examining the place of residence, women aged 25-34 continued to have the most births in rural areas (51.5%) while the urban areas had 48.5%. Those in the 45-49 age group had the lowest numbers of births, particularly in the urban areas (31.7%), aligning with general fertility patterns as women approach menopause. Overall, it can be observed that there were more births in the rural areas (54.4%) than in the urban areas (45.6%).

When looking at the educational level, women who completed secondary education had the highest births within the 25-34 age interval (64.7%), suggesting that this group is typically in

their peak of childbearing years. On the other hand, women between the ages of 45 to 49 who had completed their higher education level had the lowest births (4.3%). Overall, when it came to all women in all age groups, they tend to have fewer offspring, especially if they had obtained a higher level of education. The 25-34 age group was once again the most prevalent in terms of religion, with the highest number of births occurring among different religious groups like Protestants/Anglican (24.1%) and ELCIN (38.7%). On the other hand, the 45-49 age group had the lowest number of births among all religious groups, with the Roman Catholics accounting for only 18.7% and those without any religious attachment contributing roughly 2.9%. The ELCIN followers had the highest number of births (38.6%), while those with no religion had the lowest number of births (2.2%). This further shows the impact of religious beliefs on both family size and attitudes towards having children. Observing the different wealth index categories, the 25-34 age group had the most births among all wealth index categories, especially within the middle (22.7%) and richer (22.4%) categories. On the other hand, the age group of 45-49 had the least number of births across all wealth categories with 13.7% of births in the richer category, showing a continual decrease in fertility among

older women, regardless of their financial standing.

In terms of marital status, the 25-34 age group had the highest birth rates among both never in union (42.4%) and women cohabiting with a partner (28.6%), underlining that this age range was typically when women were most likely to be in committed relationships and started their own families. On the other hand, women between the ages of 45 and 49 had the least number of births across various marital statuses, with only 4.3% of births occurring among widowed women and 1.4% among divorced and no longer living together. This further shows that older women had the lowest childbirths regardless of their relationship status. In terms of employment status, the 25-34 age group with unemployed women had the highest births at 53%, indicating that women who were not working in this age group had more children. However, women aged 15-24 who were employed had the lowest births of 28.3%. This further shows that working

women in this age group tended to have less children than older women due to them typically either still in school or starting their careers. Similarly, women who were unemployed had a higher birth (58.1%), while those who were employed had low births (41.9%). This suggested that women who were unemployed tended to have a larger number of children, possibly due to having no work commitments. Overall, it can be observed that women aged 25-34 consistently had the most births regardless of sociodemographic factors, whereas those aged 45-49 had the lowest childbirths due to biological limitations associated with aging. Moreover, at a 5% level of significance, the Pearson chi-square tests for association revealed that there existed significant associations between the total number of births and the women's regions ($p < 0.001$), place of residence ($p < 0.001$), religion ($p = 0.001$), educational level ($p < 0.001$), wealth index ($p < 0.001$), marital status ($p < 0.001$), and employment status ($p < 0.001$) as shown in Table 3.

Table 3: Distribution of Total Births among Women by their Sociodemographic Characteristics (n=5,929)

	Age Intervals					χ^2 -value, df, p-value
	15-24 Count (%)	25-34 Count (%)	35-44 Count (%)	45-49 Count (%)	Total Births Count (%)	
Region						
Caprivi	143 (8.67)	218 (7.92)	104 (7.48)	15 (10.79)	480 (8.10)	81.97, 36, <0.001*
Erongo	105 (6.37)	225 (8.18)	90 (6.47)	11 (7.91)	431 (7.27)	
Hardap	122 (7.40)	172 (6.25)	82 (5.90)	6 (4.32)	382 (6.44)	
//Karas	133 (8.07)	207 (7.52)	94 (6.76)	7 (5.04)	441 (7.44)	
Kavango	208 (12.61)	275 (10.00)	121 (8.71)	15 (10.79)	619 (10.44)	
Khomas	118 (7.16)	244 (8.87)	102 (7.34)	6 (4.32)	470 (7.93)	
Kunene	149 (9.04)	208 (7.56)	126 (9.06)	16 (11.51)	499 (8.42)	

Ohangwena	153 (9.28)	252 (9.16)	145 (10.43)	17 (12.23)	567 (9.56)	
Omaheke	111 (6.73)	197 (7.16)	85 (6.12)	15 (10.79)	408 (6.88)	
Omusati	105 (6.37)	184 (6.69)	125 (8.99)	5 (3.60)	419 (7.07)	
Oshana	68 (4.12)	160 (5.82)	98 (7.05)	4 (2.88)	330 (5.57)	
Oshikoto	105 (6.37)	208 (7.56)	89 (6.40)	13 (9.35)	415 (7.00)	
Otjozondjupa	129 (7.82)	201 (7.31)	129 (9.28)	9 (6.47)	468 (7.89)	
Place of Residence						
Urban	729 (44.21)	1333 (48.46)	595 (42.81)	44 (31.65)	2701 (45.56)	25.60, 3, <0.001*
Rural	920 (55.79)	1418 (51.54)	795 (57.19)	95 (68.35)	3228 (54.44)	
Educational Level						
No Education	80 (4.85)	227 (8.25)	168 (12.09)	33 (23.74)	508 (8.57)	178.81, 9, <0.001*
Primary	386 (23.41)	596 (21.66)	388 (27.91)	60 (43.17)	1430 (24.12)	
Secondary	1129 (68.47)	1781 (64.74)	768 (55.25)	40 (28.78)	3718 (62.71)	
Higher	54 (3.27)	147 (5.34)	66 (4.75)	6 (4.32)	273 (4.60)	
Religion						
Roman Catholic	377 (22.86)	600 (21.81)	285 (20.50)	26 (18.71)	1288 (21.72)	37.54, 15, 0.001*
Protestant/Anglican	380 (23.04)	663 (24.10)	320 (23.02)	39 (28.06)	1402 (23.65)	
ELCIN	608 (36.87)	1065 (38.71)	574 (41.29)	44 (31.65)	2291 (38.64)	
Seventh-day Adventist	118 (7.16)	153 (5.56)	74 (5.32)	11 (7.91)	356 (6.00)	
No Religion	42 (2.55)	38 (1.38)	44 (3.17)	4 (2.88)	128 (2.16)	
Other Religion	124 (7.52)	232 (8.43)	93 (6.69)	15 (10.79)	464 (7.83)	
Wealth Index						
Poorest	356 (21.59)	562 (20.43)	357 (25.68)	31 (22.30)	1306 (22.03)	51.71, 12, <0.001*
Poorer	390 (23.65)	559 (20.32)	291 (20.94)	44 (31.65)	1284 (21.66)	
Middle	357 (21.65)	624 (22.68)	286 (20.58)	27 (19.42)	1294 (21.82)	
Richer	369 (22.38)	616 (22.39)	250 (17.99)	19 (13.67)	1254 (21.15)	
Richest	177 (10.73)	390 (14.18)	206 (14.82)	18 (12.95)	791 (13.34)	
Marital Status						
Never in Union	1030 (62.46)	1165 (42.35)	361 (25.97)	28 (20.14)	2584 (43.58)	716.68, 15, <0.001*
Married	126 (7.64)	651 (23.66)	551 (39.64)	66 (47.48)	1394 (23.51)	
Living with Partner	424 (25.71)	788 (28.64)	348 (25.04)	35 (25.18)	1595 (26.90)	
Widowed	4 (0.24)	22 (0.80)	35 (2.52)	6 (4.32)	67 (1.13)	

Divorced	7 (0.42)	10 (0.36)	29 (2.09)	2 (1.44)	48 (0.81)	
No Longer Living Together/Separated	58 (3.52)	115 (4.18)	66 (4.75)	2 (1.44)	241 (4.06)	
Employment Status						
Not Employed	1182 (71.68)	1458 (53.00)	732 (52.66)	75 (53.96)	3447 (58.14)	172.23, 3, <0.001*
Employed	467 (28.32)	1293 (47.00)	658 (47.34)	64 (46.04)	2482 (41.86)	

* 5% level of significance

Negative Binomial Analysis

Table 4 shows the output obtained from the fitted Negative Binomial regression analysis. Women aged 35-44 years (aIRR=1.441) and 25-34 years (aIRR=2.165) had a 1.44- and 2.17-times higher births compared to the number of births for the younger group (15-24). However, those aged 45-49 (aIRR=0.472) had a 0.47 times lower births, which is attributed to the normal decrease in fertility as women near the end of their reproductive lifespan. Similarly, across the regions of Namibia, women in the Kavango (aIRR=1.133) and Kunene (aIRR=1.164) Regions had a 1.13- and 1.16-times higher births compared to the number of births for those in the Caprivi Regions, which is attributed to both regions being considered as high fertility regions in terms of human birth rates in the country. However, women in the Khomas (aIRR=0.652), Oshana (aIRR=0.664), Erongo (aIRR=0.681), //Karas (aIRR=0.768), Omusati (aIRR=0.786), Oshikoto (aIRR=0.857) and Hardap (aIRR=0.869) Regions had a 0.65- and 0.86-times lower births. In the same way, women in the rural locations (aIRR=1.337) had a 1.34 times higher births compared to the number of births for those in the urban locations, further suggesting that living in rural areas was linked to increased fertility.

Looking at the educational level, women who had higher (aIRR=0.425), secondary (aIRR=0.657) and primary (aIRR=0.809) education had a 0.43- and 0.81-times lower births compared to the number of births for those with no education. This discovery emphasizes the significant connection between education and fertility, showing that women with higher educational levels tend to delay or restrict the number of children they want to have. Likewise, those who are followers of other religion (aIRR=0.877) and ELCIN (aIRR=0.896) faith had a 0.88- and 0.90-times lower births compared to the number of births for those following the Roman Catholic faith. On the other hand, those who did not follow any religious beliefs (aIRR=1.470) had 1.47 times higher births, indicating that religion could influence decisions regarding family size and reproduction. Women in the richest (aIRR=0.450), richer (aIRR=0.652), middle (aIRR=0.764) and poorer (aIRR=0.871) wealth categories had a 0.45- and 0.87-times lower births compared to the number of births for those in the poorest wealth category (Table 4). In other words, wealthy women typically have fewer births, possibly because of improved access to family planning and a greater importance on their career or personal goals. Likewise, women who were widowed (aIRR=0.760) had 0.76 times lower

births compared to the number of births for those who were never in a union. However, those who were no longer living together/separated

(aIRR=1.495), married (aIRR=1.617) and living with partner (aIRR=2.032) had a 1.50- and 2.03-times higher births.

Table 4: Outputs from the Fitted Negative Binomial Regression

	Adjusted Incidence Rate Ratio	P-Value	95% Confidence Interval
(Intercept)	1.268	<0.001*	1.105-1.431
Age Group			
25-34	2.165	<0.001*	2.104-2.226
35-44	1.441	<0.001*	1.369-1.512
45-49	0.472	<0.001*	0.299-0.645
15-24 (Ref)	1		
Region			
Erongo	0.681	<0.001*	0.551-0.811
Hardap	0.869	0.041*	0.735-1.004
//Karas	0.768	<0.001*	0.639-0.898
Kavango	1.133	0.040*	1.014-1.252
Khomas	0.652	<0.001*	0.525-0.779
Kunene	1.164	0.018*	1.038-1.289
Ohangwena	1.110	0.093	0.988-1.232
Omaheke	1.035	0.610	0.903-1.167
Omusati	0.786	<0.001*	0.654-0.917
Oshana	0.664	<0.001*	0.523-0.804
Oshikoto	0.857	0.020*	0.725-0.988
Otjozondjupa	0.905	0.126	0.778-1.033
Caprivi (Ref)	1		
Place of Residence			
Rural	1.337	<0.001*	1.286-1.388
Urban (Ref)	1		
Educational Level			
Primary	0.809	<0.001*	0.708-0.910
Secondary	0.657	<0.001*	0.564-0.750

Higher	0.425	<0.001*	0.278-0.572
No Education (Ref)	1		
Religion			
Protestant/Anglican	1.009	0.808	0.934-1.085
ELCIN	0.896	0.002*	0.828-0.964
Seventh-day Adventist	0.997	0.954	0.879-1.114
No Religion	1.470	<0.001*	1.289-1.652
Other Religion	0.877	0.015*	0.771-0.983
Roman Catholic (Ref)	1		
Wealth Index			
Poorer	0.871	<0.001*	0.794-0.948
Middle	0.764	<0.001*	0.688-0.841
Richer	0.652	<0.001*	0.574-0.729
Richest	0.450	<0.001*	0.362-0.539
Poorest (Ref)	1		
Marital Status			
Married	1.617	<0.001*	1.550-1.682
Living with Partner	2.032	<0.001*	1.969-2.094
Widowed	0.760	0.026*	0.517-1.002
Divorced	1.035	0.811	0.750-1.321
No Longer Living Together/Separated	1.495	<0.001*	1.363-1.627
Never in Union (Ref)	1		
Employment Status			
Employed	1.008	0.756	0.957-1.060
Not Employed (Ref)	1		

(Ref) = Reference Category; *5% Level of Significance

Discussion

This study examined the pattern of ASFRs among women in Namibia and the relationships of sociodemographic characteristics on their fertility outcome. Younger women (aged 15-24) and older

women (aged 45-49) had fewer children, following the pattern of earlier research such as Bongaart and Casterline (2022) who noted that women between 25-34 years had peak childbearing years with the highest fertility rates.

This also agrees with the findings from Wang et al. (2020), Azmoude et al. (2017), Andegiorgish et al. (2022), Bukenya (2019) and Ghaem et al. (2019) who showed how age influenced fertility, with women under the age of 25 or above the age of 34 having fewer children. The findings of this study also shows that the ASFRs have declined over the years (1992-2013), especially for women aged 25-34 years. This may be associated with enhanced education attainment, access to health care and family planning services, which agrees with Nyoni et al. (2021) and Nyarko (2021) who concluded that the better the education and family planning services are, the lower the fertility rates become. Additionally, while fertility rates were on the decline, rates of rural women and that of certain regions of the country remained higher. This was related to differentials in resource availability within the areas and regions as noted in MoHSS (2014), and because of limited access to education and family planning awareness /services as highlighted in Andegiorgish et al. (2022), Nyoni et al. (2021), , Ghaem et al. (2019), MoHSS (2014) and Kebede et al. (2022).

Furthermore, this study showed that less educated women who are poorer and in consensual unions are more likely to realize higher fertility compared to those who are wealthier, more educated, or legally married. More educated women tend to have fewer children because they are focused on their careers and building themselves up, and understand family planning better, hence making suitable decisions regarding the birth of children and the timing. This finding concurs with those by Nyoni et al. (2021), Sacoer et al. (2018), Wang et al. (2020), MoHSS (2014), Andegiorgish et al. (2022), Bongaarts & Casterline (2022), Ghaem et al. (2019), Nyarko

(2021), Sunder et al. (2020) and Kebede et al. (2022) who concluded that education was a significant factor in fertility, with Nyoni et al. (2021) further suggesting that most uneducated or lowly educated women tended to have more children because of the inaccessibility to family planning information and services. Also, women in wealthier levels having less children are not surprising as wealthier women tend to control their fertility better with access to health and family planning services compared to those within poorer levels of wealth. This finding agrees with those highlighted in MoHSS (2014), Bongaarts & Casterline (2022), Ghaem et al. (2019), Nyarko (2021) and Kebede et al. (2022) who indicated that economic indicators such as wealth index also faces inequalities in fertility rates. Women in consensual unions and never in union have more children probably because they were less likely to worry about family limitation. This agrees with Nyoni et al. (2021) who concluded that single and cohabiting women had a higher birth rate compared to married, divorced, or widowed women. Similarly, these findings concur with Sacoer et al. (2018) who noted that marriage and women's level of education respectively have the most positive and the most negative relationships on their fertility rate.

Across the regions of Namibia, women in the Kavango and Kunene Regions had higher births compared to the number of births for those in the Caprivi Regions (now called Zambezi Region), while those in the Khomas, Oshana, Erongo, //Karas, Omusati, Oshikoto and Hardap Regions had lower births. This is not surprising as the Kavango (now split into Kavango East and Kavango West) and Kunene Regions are considered high-fertility regions in Namibia in

terms of human birth rates. In the same way, women in the rural locations had higher births compared to those in the urban locations. This may be due to the lack of resources and information on reproductive health while access to health care and family planning services are often less prevalent in rural areas. This concurs with the findings by Nyoni et al. (2021), Nyarko (2021) and Kebede et al. (2022) who also established that fertility in rural areas remained high because of limited health care services and a consequence of relatively lower levels of education, while MoHSS (2014) highlighted that women in rural areas were observed to have more children because of a lack of resources and information on reproductive health.

Looking at the educational level, women who had higher, secondary and primary education had lower births compared to those with no education. This is due to a high status of education among women often led to lower number of children, since educated women are often career-oriented and have better access to family planning awareness and services, and health care services. This finding is similar to those reported in Nyoni et al. (2021), Wang et al. (2020) and Andegiorgish et al. (2022). Nyoni et al. (2021) explained that educated women could make knowledgeable decisions about childbirth, and Andegiorgish et al. (2022) revealed that there was a positive association between education and family planning usage, while Wang et al. (2020) indicated that the level of education has a significant relationship on women's fertility decision making, noting that an educated person determines when to have kids and at what age, depending on resources availability, health consideration and other life responsibilities such

as career. Women in the richest, richer, middle and poorer wealth categories had lower births compared to those in the poorest wealth category. This is not surprising as poorer women most often do not have access to health care and family planning awareness and services and thus cannot utilize family planning methods to control the number of children, compared to the wealthier women. This finding agrees with those highlighted in MoHSS (2014), Ghaem et al. (2019), Nyarko (2021), Kebede et al. (2022) and Bongaarts & Casterline (2022) where wealth category was identified as one of the impacting factors with poorer women having more children compared to the wealthier ones. MoHSS (2014) further highlighted that the wealthier a woman is the more career and lifestyle-oriented goals she would have, thus enabling them to decide on when to start their childbearing and the number of children they want to have.

Across the religious beliefs, women who are followers of other religions and ELCIN faith had lower births compared to those following the Roman Catholic faith, while those who did not follow any religious beliefs had higher births. Although religion doctrines have long been seen as advocates of childbearing with majority stating and believing that children are gifts from God and forbidding contraceptive use as they are considered sin against nature, some religious denominations have started advocating for family planning awareness for their followers due to several reasons such as the high cost of living, high household expenses, individual health status and economy instability. In addition, women who were widowed had lower births compared to those who were never in a union, while those who were no longer living together/separated, married

and living with a partner had higher births. This finding agrees with Sacoor et al. (2018), Wang et al. (2020), MoHSS (2014), Andegiorgish et al. (2022), Bongaarts & Casterline (2022), Ghaem et al. (2019), Shinyemba et al. (2022) and Nyoni et al. (2021) who indicated that birth rates among never married and cohabiting women were higher. Nyoni et al. (2021) further refer to a fact that women in consensual unions more often have more children compared to the legally married ones because they are less likely to worry about family limitation, while Shinyemba et al. (2022) indicated that in Namibia women who have been married either traditionally or with a certificate have the highest rates of fertility.

Conclusion

Although there is some achievement with regard to declining general fertility rates, especially among educated urban women, setbacks are still highly more pronounced for rural women. With the age group 25-34 having the highest ASFR and women's sociodemographic characteristics such as regions, place of residence, religion, educational level, wealth index, marital status and employment status having significant association with the total number of births, with notable variations in fertility rates across women in urban and rural locations as well as between regions, it follows that addressing the fertility problem in Namibia calls for the tackling of sociodemographic inequities. For instance, women in urban areas were privileged through better education and access to health services which led to a decline in fertility. Yet because of either a lack of educational resources or services concerning family planning, women in most rural areas still have relatively high levels of fertility. Therefore, it is recommended that the Namibian

government and policy makers put more efforts in improving the livelihood of women in rural areas and in the formulation of interventions that could target female education and access to family planning resources with the aim of bringing down fertility rates in high-fertility regions such as Kavango (now split into Kavango East and Kavango West) and Kunene Regions. These interventions formulation could also include information campaigns, media attention, counselling of newly married pairs, contraception education in schools and so on.

Since fertility rates are considerably reduced with increased women's education, there is a dire need to further develop Namibia's educational sector in order to enhance women and girls' opportunities. Such developmental efforts could be directed toward creating scholarships, mentoring programs, community support and other means that will assist in keeping young girls at school and completing their education especially in the Kavango (now split into Kavango East and Kavango West) and Kunene Regions known for high teenage pregnancy rates driven by a combination of social, cultural, economic and geographic factors. This will enable them to make informed decisions about reproductive health, thus reducing the high fertility rates. Also, it is recommended that the government and non-governmental organizations collaborate in establishing family planning clinics with outreach programs at the community level, especially within rural communities. This should be expanded to include distribution and information about contraceptives and family planning to enable women to make choices in regard to their reproductive status. The distributed information should also be written and prepared

in the local languages of each community. Moreover, this study recommends that future fertility surveys should include men. The majority of fertility research has focused on women, yet men clearly have a central part to play in fertility decisions about family size and planning are not made by women alone. Including men in fertility surveys will not only begin to balance the historical bias in fertility research but also give a better understanding of the male half of the equation in fertility dynamics.

Limitations

This study was limited to women in the 15-49 age range based on the 2013 NDHS data, only covering this age range since women within this range are in their natural fertility stage of life. However, given the high teenage pregnancy rates in the country, there are a considerable number of births that occur before the age of 15 years that were excluded from the survey due to the age limit of the survey. As with any secondary data analysis, this study's findings were limited by the variables availability within the 2013 NDHS data, thus while the study aims to identify sociodemographic characteristics associated with age-specific fertility, it may not capture all relevant variables that could influence fertility rates in Namibia. Factors such as cultural norms, empowerment status and husband's/partner's fertility status which could play significant roles were not captured in the 2013 NDHS data. Additionally, the cross-sectional nature of the NDHS surveys may limit the study's ability to establish causal relationships between sociodemographic factors and age-specific fertility. While the study covers data from multiple survey rounds spanning over two decades, it may not capture more recent changes

or trends in fertility patterns, potentially limiting the generalizability of the findings to the current context.

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Conflict of Interest

The authors have no competing interests.

Author Contributions

OO and NS researched literature while OO and IS conceived the study. NS collected the data while OO conducted the data analysis and prepared the manuscript. All authors reviewed the manuscript and approved the final version of the manuscript for publication.

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Ethical Approval

Ethical approval was not sought for this study since the 2013 NDHS data used in this study is freely available on a public domain and downloadable from the DHS website.

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