Insights into Fertility Variability in Africa: A Path Toward Achieving the SDGs

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Abstract

Background: The Total Fertility Rate (TFR) is a major demographic index used to measure population growth. This indicator (TFR) varies significantly across Africa. This variation is influenced by cultural, economic, and policy-related factors.

Methods: This research examines regional differences by applying Analysis of Variance (ANOVA) to World Bank data from 2018 and 2022

Results: The results of the study show that there are significant differences in the TFR across Africa's regional blocks (North, West, East, Central, and Southern Africa), with Central and West Africa showing the highest rates and North Africa having the lowest. The results highlight the necessity for region-specific policies to address fertility patterns and their implications for sustainable development.

Conclusion: The insight provided by this study is a necessary tool for policymakers to design demographic interventions that align with regional realities and contribute to progress toward achieving the United Nations Sustainable Development Goals (SDGs).

Keywords: Total Fertility Rate (TFR), Africa, regional variation, demographic transition, SDGs

Introduction

Total Fertility Rate (TFR), by definition, is the average number of children a woman would have throughout her reproductive lifetime on condition that current age-specific fertility rates prevail. In Africa, TFR is an evolving metric influenced by various cultural, socioeconomic, and policy factors. In the past, African nations were known to have experienced high fertility rates because of factors such as limited access to family planning, higher child mortality rates, and natalism (cultural preferences for larger families). There has been a shift in recent years due to improved healthcare systems, an increase in female educational opportunities, and the availability of contraceptives. This evolving landscape brings to the fore the need for a detailed examination of regional variability in TFR to better understand the complex interplay of factors influencing fertility patterns across Africa (Kamau & Mwangi, 2024; Muriuki & Maina, 2024; Siaw & Dake, 2024).

Even though recent notable changes have been witnessed in fertility patterns

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in Africa, we still suspect variations in the TFR between and within regional blocks of the continent. Despite the demographic transition, many regions in Africa are experiencing persistently high fertility rates, while some show significant decreases. Considerable research has been conducted in this area. These studies often focus on country-level data or generalized continental trends, thus omitting crucial regional dynamics within individual countries or groups of countries. This creates a gap in the literature, leaving policymakers with an incomplete understanding of how fertility rates vary across African regions. The lack of insight into regional variability impedes the design and implementation of effective targeted interventions. In addition, no comparative statistical analysis exists for these variations, limiting our ability to identify significant patterns that could inform population policies. This research seeks to fill these gaps by employing ANOVA to compare the TFR across different regions of Africa.

The primary objective of this study was to conduct a rigorous statistical analysis using ANOVA to examine regional variations in the TFR across Africa. By applying ANOVA, this study tests the null hypothesis that there is no significant difference in TFR among African regions, as the alternative is that there is at least one African regional block whose TFR is different from the rest. Identifying these regional differences is the key to developing effective targeted population policies and interventions that address regional realities.

Our research is not only timely but also urgent, knowing that Africa has a rapidly growing population and that there is a pressing need to address population-related development challenges. High fertility rates in certain regions are known to hinder progress toward achieving the United Nations Sustainable Development Goals (SDGs), especially Goal 3 (Good Health and Well-being) and Goal 5 (Gender Equality). These goals advocate improved maternal health, universal access to reproductive healthcare, and gender equity in education and employment. Crafting policies that ensure sustainable population growth, improve child and maternal health outcomes, and support broader socioeconomic development goals based on understanding regional variations will ultimately aid in accelerating progress toward the SDGs across the continent.

Literature Review

Demographic analysis in terms of population size and composition cannot be conclusively discussed without fertility rate. Studies indicate that countries with consistently low fertility face long-term population declines, which stress social support systems, particularly pension and healthcare services (Aitken, 2024; Lee & Mason, 2014; Vollse, 2020). However, high fertility rates, often seen in developing nations, contribute to rapid population growth that can outpace economic development, leading to resource strain and heightened poverty levels (Bongaarts, 2016; Götmark & Andersson, 2023).

High fertility rates are especially critical in Sub-Saharan Africa, where population growth is outstripping infrastructure and economic development. This rapid population expansion exacerbates issues, such as unemployment, educational gaps, and food insecurity (Canning *et al*., 2015; Turner & Götmark, 2023). In contrast, in countries with declining fertility, governments face a shrinking workforce and increased dependency ratios, where fewer workers support more retirees, causing economic strain (Billari, 2015).

Population policies are designed to influence fertility rates directly or indirectly. Some countries have adopted pro-natalist policies to counter low fertility rates, while others have implemented measures aimed at reducing high fertility rates. This divergence in policy reflects the country's unique demographic challenges. For instance, France and Sweden have developed policies that promote higher fertility by offering generous parental leave, childcare support, and financial incentives for families with children (Balbo *et al*., 2013; Zhang, et al., 2023). These policies aim to ease the financial and social burdens of childbearing, encourage larger families, and mitigate population aging.

Conversely, countries, such as China and India, have implemented policies to curb high fertility rates. China came out with "one-child policy," which was enforced between 1980 and 2015 (Feng *et al*., 2013). This policy was one of the most stringent population control measures ever adopted. The policy achieved its target of reducing birth rates, but also contributed to unintended consequences, such as gender imbalances and an aging population (Feng *et al*., 2013). In addition to China, other countries, notably India, have attempted to reduce the fertility rate. India's efforts to lower fertility rates have centered on family planning programs, increasing access to contraceptives, and improving education, particularly for women (Visaria, 2019). To a large extent, these policies have had varying degrees of success depending on regional and local socioeconomic conditions.

Bongaarts (2016) indicated that there is often a direct link between poverty and large family sizes. He mentioned that the stretch of household resources and limited investment in education and health are a result of this link. Limited investment in education and healthcare can create a cycle of poverty. In this cycle, there is a lack of access to reproductive health services and education due to high fertility rates. On the other hand, low fertility rates, which are beneficial in the short term by relieving pressure on public services, can lead to economic stagnation because a shrinking workforce results in reduced economic productivity and innovation (Lee & Mason, 2014).

Fertility also interacts with gender dynamics. Women's empowerment through education and career opportunities tends to correlate with reduced fertility rates (McDonald, 2013). Cleland (2015) noted that policies aimed at improving gender equality, such as providing access to reproductive health services and promoting women's education, are effective in reducing fertility and enhancing overall population health. This ultimately leads to fertility transition.

Fertility transitions (i.e., the shift from high to low fertility rates) have been observed globally. The pace of transition varies significantly among regions and continents. Bongaarts (2016) noted that high-income countries generally completed their fertility transition during the 20th century, while many developing nations, particularly Africa, are still undergoing this shift. He also noted that as countries progress through the fertility transition, many face the dual challenge of managing aging populations while ensuring that fertility does not fall too low to sustain population replacement.

When projecting population growth, there is a need to emphasize the importance of monitoring and influencing fertility rates. The United Nations predicts that global fertility rates will continue to decline, while the world's population will continue to grow owing to population momentum in countries with young age structures (United Nations, 2019). In this context, one can emphatically suggest the need for comprehensive population policies that address fertility and focus on improving health, education, and employment opportunities to sustainably manage population growth.

In his study, Gietel-Basten highlighted the importance of fertility indicators, particularly the Total Fertility Rate (TFR), in understanding population dynamics. He indicated that TFR remains a critical measure for assessing the average number of children a woman would bear during her reproductive years, and its analysis provides insights into population growth, aging, and sustainability (Gietel-Basten, 2022). Recent research emphasizes that while fertility indicators such as crude birth rate and age-specific fertility rates are useful, TFR is the most effective for cross-country comparisons and long-term population projections (Zeman et al., 2024). In addition, scholars argue that TFR provides a more stable and robust metric, especially when assessing policy impacts on fertility behavior in both high- and low-income countries (Basten & Sobotka, 2022). Another recent research finding noted that with the rise of delayed childbearing and sub-replacement fertility in many regions, understanding TFR trends has become essential for addressing demographic challenges, such as labor force deficits and population aging (Anderson & Kohler, 2023). Wilson and Pison (2024) documented that TFR is integral to evaluating the effectiveness of pro-natalist policies and family planning programs, as these directly influence fertility behaviors. Thus, a comprehensive analysis of the TFR is indispensable for demographic research and policymaking.

Comparing TFR across regions and countries has recently witnessed increasing importance in demographic research, focusing on understanding global and regional disparities in population growth and their socioeconomic implications. These comparisons are essential for evaluating the effectiveness of policies aimed at regulating fertility and addressing demographic challenges such as aging populations and labor shortages (Esping-Andersen & Billari, 2023). It highlights the cultural, economic, and policy factors influencing fertility behavior, offering insights into why certain countries, especially in Europe and East Asia, experience sub-replacement fertility. At the same time, many developing nations in Africa and South Asia have sustained high fertility rates (Sobotka, 2023). According to Basten and Frejka (2023), these comparisons reveal critical differences in how countries manage fertility transitions, with pro-natalist policies in low-fertility regions contrasting with family planning programs in high-fertility areas. Adding their voice to the existing disparities in regional fertility patterns, Kohler and Ortega (2024) state that understanding these differences is crucial for global policy coordination and addressing the demographic challenges associated with uneven fertility trends (Kohler & Ortega, 2024). In his works (comparative TFR analysis), Hirschman concluded that TFR comparison serves as a valuable tool in shaping population policies tailored to specific socioeconomic contexts (Hirschman, 2022).

From the paragraph above, global and regional comparisons have been extensively studied. These studies left a significant gap in the focused comparison of TFR across different regions within Africa (West, East, Central, North, and Southern Africa). To fill this gap, there is a need for comprehensive statistical analysis to quantify these regional differences in TFR within Africa.

Methodology

This study employed a quantitative research approach to analyze regional variations in total fertility rate (TFR) across Africa, utilizing a cross-sectional research design. The focus is on comparing the TFR values from different regions in 2018 and 2022 independently, enabling the identification of significant regional disparities in fertility patterns. The analysis employs descriptive statistics to provide an overview of fertility rates, followed by inferential statistics, specifically ANOVA, to examine whether the observed differences across regions are statistically significant. ANOVA is particularly suited to this study as it enables the comparison of means across multiple groups (in this case, regions), determining whether the variations are due to chance or indicative of meaningful regional differences in fertility rates.

The dataset for this study consists of secondary data on Total Fertility Rates (TFR) across African regions sourced from the World Bank. The data include TFR values for 2018 and 2022, allowing for a comparison of fertility variation over time. The source of the dataset used in the analysis is credible and authoritative. It is recognized for its comprehensive and reliable demographic data. The credibility of this data source ensures that the analysis is based on accurate, up-to-date, and representative information, lending robustness to the findings of this research.

To analyze the regional variations in the TFR across Africa, this study employed Analysis of Variance (ANOVA) as the primary statistical tool. ANOVA was used to assess whether the mean TFRs differed significantly between the regions for 2018 and 2022. In addition, Games-Howell Post Hoc analysis was performed on the 2022 dataset to establish pairwise variations in the TFR among regions.

The mathematical model for the one-way ANOVA employed in this study is as follows.

$$Y_{ij} = \mu + \tau_i + \omega_{ij}$$

Where:

Y_{ij} is the observed value of the jth observation in the ith group.

μ is the overall mean of the data

τ_i is the effect of the ith group (how much the mean of the ith group deviates from the overall mean).

ω_{ij} is the random term associated with the jth observation in the ith group.

ANOVA aims to test whether the group means are significantly different from each other by comparing the variance explained by group differences (between-group variance) to the variance that cannot be explained by group differences (within-group variance). ANOVA test of significance was performed by setting up the following hypotheses:

- Null Hypothesis: All group means are equal
- Alternative Hypothesis: At least one group mean is different from the others

To test these hypotheses, ANOVA decomposed the total variability in the data into two parts: between-group and within-group variability.

Total Sum of Squares (SST): Measures the total variability in the data around the overall mean.

$$SST = \sum_{I=1}^{K}\sum_{j}^{n_i}(y_{ij} - \bar{y})^2 \quad (1)$$

Where

$\bar{y}$ is the overall mean; K is the number of groups; and n_i is the number of observations in the ith group.

The between-groups Sum of Squares (SSB) measures the variability between the group means and the overall mean.

$$SSB = \sum_{I=1}^{K} n_i(\bar{y}_i - \bar{y})^2 \quad (2)$$

Where $\bar{y}_i$ is the mean of ith group.

Within-Groups Sum of Squares (SSW): Measures the variability within each group, that is, how individual observations deviate from their respective group means.

$$SSW = \sum_{I=1}^{K}\sum_{j}^{n_i}(y_{ij} - \bar{y}_i)^2 \quad (3)$$

$$SST = SSB + SSW \quad (4)$$

$$SST = \sum_{I=1}^{K} n_i(\bar{y}_i - \bar{y})^2 + \sum_{I=1}^{K}\sum_{j}^{n_i}(y_{ij} - \bar{y}_i)^2 \quad (5)$$

To arrive at the Mean Squares (for the various components), the sum of squares is divided by their respective degrees of freedom, as presented in Equations (6) and (7):

$$MSB = \frac{SSB}{k-1} \quad (6)$$

Where k−1 is the degrees of freedom for between-group variation (with k being the number of groups).

$$MSW = \frac{SSW}{N-k} \quad (7)$$

Where N−k is the degrees of freedom for within-group variation (with N being the total number of observations and k the number of groups).

To test this hypothesis, ANOVA compares the ratio of the between-group variance to the within-group variance using the F-statistic:

$$F = \frac{MSB}{SMW} \quad (8)$$

The F-statistic follows an F-distribution with k−1 and N−k degrees of freedom.

When the calculated F-value exceeds the critical value indicated in the F-distribution table according to the significance level, we reject the null hypothesis. This suggests that there are significant differences between the group means. Otherwise, we fail to reject the null hypothesis, indicating that there is insufficient evidence to say that the group means differ significantly.

Results

The results of the analysis are presented descriptively and inferentially.

Table 1

Summary Descriptive Statistics of Total Fertility Rate Grouped by Regionals (2018).

PARAMETERS	*West*	*North*	*East*	*Central*	*Southern*
Mean	4.8953	2.9953	4.1089	5.0688	3.5634
Standard Error	0.2134	0.3668	0.3444	0.3442	0.2700
Standard Deviation	0.8266	0.8984	1.2888	1.0327	0.8100
Sample Variance	0.6832	0.8072	1.6609	1.0664	0.6560
Kurtosis	2.2663	3.0674	0.9308	-1.6946	-0.9384
Skewness	1.3956	1.6425	-0.2903	0.1839	0.3526
Co-efficient of variation	17%	30%	31%	20%	23%
Number of countries	15	6	14	9	9

The analysis in Table 1 provides a comprehensive comparison of total fertility rates (TFR) across Africa's five regional blocks— West, North, East, Central, and Southern Africa–based on 2018. West Africa has a mean TFR of approximately 4.90, indicating a high fertility rate, second only to Central Africa. With a standard deviation of 0.83, West Africa exhibited fertility variation across 15 countries. The skewness of the region (1.40) and kurtosis (2.27) suggest a distribution with a concentration of countries having lower fertility rates and a few with significantly higher rates, resulting in a right-skewed distribution. The coefficient of variation (17%) indicated relatively low variability compared to the other regions.

North Africa, on the other hand, recorded the lowest mean TFR of 2.995, reflecting its advanced demographic transition. The standard deviation is 0.90, and the kurtosis (3.07) combined with a skewness value of 1.64 points to a highly peaked distribution with a strong right skew, indicating that most North African countries have fertility rates close to the mean, while a few exhibit higher rates. The coefficient of variation is 30%, a notable contrast to other regions, largely influenced by the smaller number of countries (6) in this block.

East Africa displayed a mean TFR of 4.11, placing it in the middle of the regions. However, it has the highest standard deviation of 1.29, reflecting the significant variability in fertility rates across the 14 countries. With a kurtosis of 0.93 and skewness of -0.29, the distribution is relatively flat with a slight left skew, indicating a few countries with very low fertility rates compared to the regional average. The high coefficient of variation of 31% suggests substantial dispersion around the mean.

It is clear from the table that Central Africa has the highest mean Total Fertility Rate (TFR) at 5.07, consistent with the region's high fertility patterns. This mean is accompanied by a standard deviation of 1.03, indicating moderate variation. The fertility rates across the region are more evenly distributed, with a kurtosis of -1.69 and skewness of 0.18. The nine countries in this region exhibit moderate variability relative to the mean, evidenced by a coefficient of variation of 20%. In southern Africa, the mean TFR of 3.56 is the second lowest. The standard deviation of 0.81 indicates relatively low variation within the region, while a kurtosis of -0.94 and a skewness of 0.35 suggest a flatter distribution with a slight right skew. This implies that fertility rates are concentrated around the mean, although some countries report higher rates. The coefficient of variation stands at 23%, reflecting moderate variability.

Table 2

Analysis of Variation in Total Fertility Rate Across Africa (2018).

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	26.21145	4	6.552862	6.422797	0.000319	2.565241
Within Groups	48.97203	48	1.020251			
Total	75.18348	52				

Table 2 presents the results of the ANOVA test for significant differences in fertility rates across regions. The sum of squares between groups is 26.211, with a mean square of 6.553 across the five regions. The within-group variance is represented by a sum of squares of 48.972 and a mean square of 1.020 across 48 countries. The total sum of squares is 75.183, with 52 degrees of freedom. The F-statistic of 6.42 exceeds the critical F value of 2.57 at the 0.05 significance level, indicating a statistically significant difference in total fertility rates between the regions. Furthermore, the P-value of 0.000319 is significantly less than 0.05, confirming that the observed regional differences in fertility rates are highly unlikely to be due to random chance. In conclusion, the ANOVA results demonstrate that total fertility rates vary significantly across Africa's regional blocks. Central and West Africa exhibit the highest fertility rates, while North and Southern Africa have much lower fertility levels. These findings underscore the need for region-specific demographic and policy interventions to address the varying fertility dynamics across the continent.

Table 3

Summary Descriptive Statistics of Total Fertility Rate Grouped by Regional (2022).

Parameters	*west*	*North*	*East*	*Central*	*Southern*
Mean	4.582	2.809	3.832	4.812	3.355
Standard Deviation	0.828	0.833	1.189	1.066	0.738
Kurtosis	2.514	3.292	1.078	-1.815	-0.866
Skewness	1.502	1.710	-0.261	0.261	0.428
Sum	68.726	16.856	53.642	43.307	30.197
Count	15	6	14	9	9

Table 3 summarizes the Total Fertility Rate (TFR) across African regions in 2022, complementing the earlier statistics from Table 1 (2018). A comparison between these two tables reveals both consistency and some shifts in regional fertility trends over time.

In 2022, West Africa continues to exhibit a relatively high fertility rate with a mean of 4.582, slightly lower than its 2018 value of 4.895. The standard deviation remains nearly the same at 0.828, indicating stable variability across countries. Similar to 2018, the skewness (1.502) and kurtosis (2.514) suggest a distribution with a strong right tail, implying a concentration of countries with lower fertility rates and a few outliers with higher rates.

North Africa, still maintaining the lowest fertility levels, shows a further decline in TFR to 2.809 from 2.995 in 2018. The standard deviation (0.833) remains comparable, reflecting consistent fertility variation within the region. The skewness (1.710) and kurtosis (3.292) indicate an even more skewed and peaked distribution than in 2018, showing that most countries cluster around a low TFR while a few experience higher rates.

East Africa's TFR also decreased slightly from 4.1089 in 2018 to 3.832 in 2022, with a reduced standard deviation of 1.189, suggesting somewhat less variability. The distribution remains flat (kurtosis: 1.078) with a slight left skew (-0.261), indicating the persistence of some countries with very low fertility rates.

Central Africa continues to record the highest fertility rates, with a mean total fertility rate (TFR) of 4.812 in 2022, which is slightly lower than the 5.068 recorded in 2018. The standard deviation is 1.066, which is consistent with the earlier period. Kurtosis (-1.815) and skewness (0.261) still indicate a flat distribution with minimal skew, similar to 2018, reflecting a relatively even spread of fertility rates across the region.

Southern Africa shows a slight decline in TFR to 3.355 in 2022, compared to

3.563 in 2018. The standard deviation slightly decreased to 0.738, and skewness (0.428) along with kurtosis (-0.866) suggest a distribution with most countries concentrated around the mean, which is consistent with the earlier period.

In summary, the 2022 data from Table 4 align closely with the 2018 statistics in Table 1, demonstrating a slight decline in fertility rates across most regions. Central Africa had the highest TFR, whereas North and Southern Africa experienced the lowest rates. This trend reflects the ongoing demographic transitions across the continent, with most regions gradually moving toward lower fertility rates.

Table 4

Analysis of Regional Variation in Total Fertility Rate (2022)

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F critical*
Between Groups	23.644	4	5.911	6.320	0.00036	2.565
Within Groups	44.890	48	0.935			
Total	68.53396	52				

The analysis of regional variation in total fertility rates (TFR) for 2022, as shown in Table 4, builds upon the 2018 findings and provides a more updated perspective. In 2022, the sum of squares (SS) between the groups was 23.6436, indicating a significant degree of variation across the five regions. This figure is slightly lower than the 26.211 observed in 2018, suggesting that although regional differences in fertility rates persist, the gap between regions may have narrowed slightly over time.

The F-statistic for 2022 is 6.320, compared to 6.42 in 2018. Although the F-value decreased slightly, it still exceeded the critical F-value of 2.565, indicating that regional differences in fertility rates remained statistically significant at the 5% level. Furthermore, the P-value for 2022 is 0.00036, which is even smaller than the 0.000319 observed in 2018. This indicates a very strong level of significance, reinforcing the conclusion that regional variation in fertility rates across Africa remains substantial and is not due to random chance.

The within-group sum of squares (SS) in 2022 is 44.8904, which is lower than the 48.972 recorded in 2018. This reduction suggests that the variability in fertility rates within individual regions has decreased slightly, possibly indicating a greater convergence in fertility patterns among countries within the same region.

Overall, while the fertility rates across regions remain significantly different in 2022, the slight decline in between-group variation, along with the decrease in within-group variability, suggests a slow and gradual convergence of fertility patterns, both across and within African regions. However, the statistical significance of these regional differences, as evidenced by the F-statistic and P-value, remains high, indicating that the regional blocks continue to exhibit distinct fertility dynamics.

Table 5

Games-Howell Post Hoc Analysis of Variation in Regional 2022 TFR

(I) REGIONS	(J) REGIONS	Mean Difference (I-J)	Std. Error	P-Value	95% Confidence Interval	
					Lower Bound	Upper Bound
West	North	1.77240*	0.4015	0.011	0.4292	3.1156
	East	0.75016	0.38302	0.317	-0.3819	1.8822
	Central	-0.23016	0.41457	0.979	-1.5244	1.0641
	Southern	1.22651*	0.32586	0.01	0.2444	2.2086
North	West	-1.77240*	0.4015	0.011	-3.1156	-0.4292
	East	-1.02224	0.46541	0.238	-2.4786	0.4341
	Central	-2.00256*	0.4917	0.01	-3.5591	-0.446
	Southern	-0.54589	0.41962	0.697	-1.9293	0.8375
East	West	-0.75016	0.38302	0.317	-1.8822	0.3819
	North	1.02224	0.46541	0.238	-0.4341	2.4786
	Central	-0.98032	0.47673	0.279	-2.417	0.4563
	Southern	0.47635	0.40197	0.76	-0.7212	1.6739
Central	West	0.23016	0.41457	0.979	-1.0641	1.5244
	North	2.00256*	0.4917	0.01	0.446	3.5591
	East	0.98032	0.47673	0.279	-0.4563	2.417
	Southern	1.45667*	0.43214	0.031	0.1132	2.8001
Southern	West	-1.22651*	0.32586	0.01	-2.2086	-0.2444
	North	0.54589	0.41962	0.697	-0.8375	1.9293
	East	-0.47635	0.40197	0.76	-1.6739	0.7212
	Central	-1.45667*	0.43214	0.031	-2.8001	-0.1132

The research further investigated which regional blocks are significantly different from the others. This was made possible using the Games-Howell test for post hoc analysis. We observed significant differences in TFR among several regions

One can also observe that West Africa has a significantly higher TFR than North Africa and Southern Africa (mean differences of 1.772, p = 0.011) and (mean difference of 1.227, p = 0.01, respectively). In contrast, there is no statistically significant difference between West Africa, East Africa, and Central Africa, as the p-values exceeded 0.05.

Again, we observed that North Africa had a significantly lower total fertility rate (TFR) compared to Central Africa (mean difference of -2.003, p = 0.01), emphasizing the lower fertility levels in North Africa relative to the central region. However, North Africa is not significantly different from Southern or Eastern Africa. When examining the TFR for Southern Africa (known for its lower fertility rates), we found a significant difference compared with Central Africa (mean difference of 1.457 and p = 0.031).

Discussion

This study revealed significant differences across the five regions of Africa: West, East, Central, Southern, and North Africa. This shows that Central Africa consistently has the highest total fertility rate (TFR), while Northern and Southern Africa exhibit the lowest rates. These findings confirm previous research indicating that sub-Saharan Africa, particularly Central and West Africa, maintains high fertility levels due to limited access to family planning and socio-cultural norms that support larger families (Bongaarts, 2016; Götmark & Andersson, 2023). The decline in fertility rates between 2018 and 2022 also suggests a gradual demographic transition. This aligns with the findings in similar developing regions, where increased access to healthcare and education has begun to lower fertility levels (Canning et al., 2015).

The results of the pairwise analysis highlight a significant fertility gap between regions. The indicator of a reduced fertility rate in North Africa points to the demographic transition that results from improvements in reproductive health services and female education, a claim that is well documented in the area (McDonald, 2013). These findings are consistent with studies showing that Northern African countries are more advanced in their demographic transition compared to the rest of the continent (Visaria, 2019). Bongaarts (2016) emphasized that without targeted interventions, such as improved access to contraception and education, West and Central Africa may struggle to achieve sustainable population growth.

Conclusion

Based on this research, which analyzed regional variations in the Total Fertility Rate (TFR) across Africa, the study concludes that significant differences exist between regions. Central Africa has the highest fertility index value, followed by West Africa. These differences reflect the ongoing demographic trends influenced by sociocultural factors and limited access to reproductive healthcare. In contrast to the high fertility rates in Central and West Africa, North and Southern Africa exhibit much lower fertility rates due to their advanced demographic transition facilitated by improvements in healthcare, education, and family planning services. The study's results align with previous research, emphasizing the need for targeted, region-specific interventions to address the unique fertility dynamics observed across African regional blocks. High fertility rates in Central and West Africa present challenges to sustainable development, including pressure on resources, increased poverty, and slower progress toward achieving the United Nations Sustainable Development Goals (SDGs), particularly regarding maternal health and gender equality. Conversely, the declining fertility rates in North and Southern Africa underscore the effectiveness of policies promoting reproductive health and female empowerment education.

Overall, this study underscores the importance of understanding regional fertility patterns when designing policies that are responsive to local realities. Addressing these disparities through focused policy interventions can accelerate Africa's demographic transition, improve population health outcomes, and promote socioeconomic development across the continent.

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