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Inequalities in total fertility rate in Sierra Leone, 2008–2019

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Abstract

Background Total fertility rate measures the average number of children a woman is expected to have during her reproductive age (typically 15–49 years). Despite the national decline in Sierra Leone, significant disparities in total fertility rates persist across socioeconomic and geographic lines. This study investigated the inequalities in total fertility rate among women in Sierra Leone between 2008 and 2019.

Methods We utilized data from the three rounds of the Sierra Leone Demographic Health Survey conducted in 2008, 2013, and 2019. The World Health Organization's Health Equity Assessment Toolkit was employed to calculate various inequality measures, including simple difference, ratio, population attributable risk, and population attributable fraction. The assessment focused on inequality across four stratifiers: economic status, level of education, place of residence, and sub-national province.

Results The total fertility rate declined in Sierra Leone throughout the period, dropping from 5.0 births per woman in 2008 to 4.3 births per woman in 2019. Economic disparity among women in the richest quintile compared with those in the poorest quintile increased from 3.0 births per woman in 2008 to 3.1 births per woman in 2019. The ratio between women in the richest quintile compared with those in the poorest quintile also increased from 1.9 in 2008 to 2.1 in 2019; the confidence interval suggest inequality, with women in the poorest quintile disproportionately affected. Inequality in education among women with secondary education or higher compared with those with no education decreased from 2.7 births per woman in 2008 to 1.9 births per woman in 2019. The ratio between women with secondary education or higher compared with those with no education decreased from 1.9 in 2008 to 1.6 in 2019, and the confidence interval suggest an inequality with women with no education disproportionately affected. Provincial inequality among women who resided in Western area compared with those in Eastern province decreased slightly from 2.3 births per woman in 2008 to 2.2 births per woman in 2019. The ratio between women who resided in Western province compared with those in Eastern province increased from 1.6 in 2008 to 1.7 in 2019 and indicate an inequality among women in the provinces.

Conclusion The results indicate substantial socioeconomic and geographical disparities in total fertility rate among women in Sierra Leone that require targeted policy interventions. The persistent and widening economic gap between women in the richest and poorest quintiles suggests that poverty reduction strategies and economic empowerment programs for low-income women need strengthening. While the decreasing educational inequality is encouraging, the continued disadvantage faced by women with no education indicates a need for enhanced

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educational access and adult literacy programs. The provincial disparities between Western and Eastern provinces point to a need for balanced provincial development policies and improved resource distribution, particularly in the Eastern province, where women face greater disadvantages. These implications collectively suggest that policymakers should adopt an integrated approach that combines economic empowerment, educational initiatives, and provincial development strategies to address these intersecting inequalities in TFR effectively.

Keywords Fertility, Trend, Inequality, Public health, Sierra Leone

Introduction

Total Fertility Rate (TFR), measured as the average number of children a woman has in her lifetime [1], is an essential indicator for tracking population growth [2]. TFR faces a complex interplay of socioeconomic factors and geographic location, particularly in developing countries like Sierra Leone. The main drivers of TFR are high child mortality, which causes parents to have more children to enhance replacement, and parents' reliance on children to assist with family responsibilities during old age [3].

Recently, studies have reported a significant decline in the trend of TFR globally, although slow progress is reported in Sub-Saharan Africa (SSA), a region with the highest TFR [3–5]. According to the United Nations [5], the global TFR has declined from 3.2 in 1990 to 2.5 in 2019, with variations across countries. The smallest decline was reported among women residing in New Zealand, Australia, North America, and Europe (0.1 births per woman) and the largest in SSA (4.4 births per woman) [5]. In the latter (SSA), special attention is required to foster progress in reducing TFR, as it is a key predictor of high infant, maternal, and child mortality, increasing environmental degradation, and slowing economic growth [6]. The minimal use of modern contraceptives among women in SSA (29%) [5] also contributes to the high TFR in the region. A multi-country study that assessed the socioeconomic and residence-based inequalities in adolescent fertility in 39 African countries revealed high adolescent fertility among women with no education, residing in rural areas, and being poor [7]. Sierra Leone, a fragile health country, has one of the worst maternal and child health indicators globally [8]. Between 1960 and 2022, the TFR in Sierra Leone declined from 6.2 to 3.9 [9]. With a TFR of 3.9 in 2022, it is nearly twice as high as the 2.1 acceptable replacement level [10]. Like in many low-resource countries, limited access to contraceptives, high rates of mortality [11], cultural preference to have more children and low level of education [12] are drivers of high TFR in Sierra Leone.

Sierra Leone has implemented several interventions and strategies to reduce high TFR in past decades. For instance, in 1988, Sierra Leone formulated the National Population Policy (NPP), which was implemented four years later, although its implementation was severely hampered by the prolonged civil war (1991 to 2002)

[13]. In 2018, this policy (NPP) was revised and is now fully operational [13]. In 2010, Sierra Leone launched a free healthcare policy (FHP) that provided free access to pregnant women, lactating mothers, and under-five children [14]. Though implementing FHP was disrupted by the Ebola outbreak [15], it reduced inequality in several maternal and child indicators, including TFR [14]. In 2016, Sierra Leone launched the family planning cost implementation plan, 2018 to 2022, aimed at increasing modern contraceptive use among women from 15.6% in 2013 to 33% in 2022 among all women [16]. Despite these interventions [16], approximately 17% of women had their first sexual intercourse before 15 years, and 14% of women between 15 and 19 years had unmet needs of modern contraceptive methods [17]. These proportions are even higher among women residing in rural settings [17], posing a significant threat to achieving the sustainable development goals by 2030 [18]. Although studies have reported inequality in several maternal and child health indicators in Sierra Leone [19, 20] and the sub-region [21–23], no study has assessed the socioeconomic and geographic inequalities in TFR in Sierra Leone. This is important as inequality in TFR varies from country to country. Understanding the socioeconomic and geographic inequalities in TFR in Sierra Leone is crucial to informing policymakers on developing targeted strategies and interventions to reduce TFR. This study examines the socioeconomic and geographical inequalities in TFR in Sierra Leone.

Methods

Study setting and data source

We utilized data from the 2008, 2013, and 2019 Sierra Leone Demographic Health Survey (SLDHS). The SLDHS is a comprehensive survey conducted across the entire country to identify persistent patterns and fluctuations in demographic indicators, health indicators, and social issues among individuals of all genders and age groups. The study employed a cross-sectional design, wherein participants were selected through a stratified multi-stage cluster sampling technique. This method ensures that the sample is representative of the national population, capturing variations across different subnational regions, urban and rural areas, and specific demographic groups. The SLDHS aims to provide nationally representative estimates for key demographic

and health indicators, allowing for generalizations about the entire population of Sierra Leone. The survey is designed to reflect the diversity of the country by including various regions. Each region is sampled to ensure that regional differences in health and demographic indicators are adequately captured. The sampling framework accounts for both urban and rural populations, ensuring that the unique characteristics and health needs of these groups are represented in the data. The survey includes all households within the selected clusters, allowing for a comprehensive overview of health and demographic indicators across different living conditions. Specifically, the SLDHS focuses on women of reproductive age (15–49 years), providing targeted insights into maternal and child health issues, which are critical for policy and program development. The SLDHS report (19) comprehensively explains the sampling process and its methodology, reinforcing the credibility of the findings derived from this data. The 2008, 2013, and 2019 SLDHS data were accessible for immediate utilization through the WHO HEAT online platform (26). This study was carefully designed, considering the standards outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (27).

Inequality measures

The outcome variable was total fertility rate. The variable is derived by calculating the average number of births per woman. The TFR was classified based on four equality parameters: economic status, level of education, sub-national province, and residence. The wealth index was categorized into five distinct groups: the poorest, poorer, middle, richer, and richest. The woman's educational status was classified into three categories: no education, women who had primary education, and those who had secondary/higher education. Likewise, the place of residence was categorized as either urban or rural. The sub-national provinces were classified into Eastern, Northern, Northwestern, Southern, and Western.

Statistical analysis

All analyses were performed utilizing the WHO HEAT online software (26). The WHO HEAT is a web-based statistical software designed to analyze health disparities within and between countries, employing various health and social indicators (26). The literature (28,29) comprehensively explains the statistics package WHO HEAT. The study examined the prevalence of TFR across four factors indicative of disparity: place of residence, economic status, educational attainment, and sub-national province. Four measures were utilized to assess this inequality: difference (D), ratio (R), population-attributable fraction (PAF), and population-attributable risk (PAR).

Difference (D).

Difference is an absolute measure indicating the disparity in total fertility rate between the most and least disadvantaged groups. A higher D value signifies increased absolute inequality in TFR.

$$D = TFR_{advantaged} - TFR_{disadvantaged}$$

Ratio (R)

The ratio serves as a relative measure, indicating the total fertility rate in the most disadvantaged group compared to that in the most advantaged group. A value exceeding 1 signifies elevated TFR in the most disadvantaged group relative to the most advantaged group.

$$R = \frac{TFR_{in\ most\ advantaged}}{TFR_{in\ most\ disadvantaged}}$$

Population-attributable risk (PAR)

Population-attributable risk is an absolute measure indicating the disparity in TFR between the general population and the subgroup with the lowest fertility rate. This measure assumes that the entire population achieved the same level of TFR as the subgroup with the lowest fertility rate. A higher PAR signifies a more substantial effect of inequalities on overall TFR.

$$PAR = TFR_{in\ most\ advantaged} - \mu$$

where μ is the average TFR of the general population

Population-Attributable Fraction (PAF)

Population-attributable fraction is a relative measure that quantifies the proportion of TFR in the overall population that can be attributed to inequalities. A positive PAF indicates that addressing inequalities would reduce overall TFR.

$$PAF = \frac{PAR}{\mu} * 100$$

The TFR is defined as the average number of children a woman is expected to have over her lifetime, measured in whole numbers rather than percentages. The use of percentages in the context of PAF and PAR is appropriate as these indicators reflect the proportion of health outcomes attributable to specific risk factors, which can be expressed as a percentage of the total population.

Results

Table 1 shows the trends in TFR (average number of children a woman has in her lifetime) across various inequality dimensions in Sierra Leone between 2008 and 2019.

Table 1 Trends in the prevalence of total fertility rate (births per woman) by different inequality dimensions in Sierra Leone, 2008–2019

Dimension	2008			2013			2019		
	5.0			5.1			4.3		
	N	births per woman	LB	UB	N	births per woman	LB	UB	N
Economic status									
Quintile 1 (poorest)	6443	6.2	5.0	7.6	13,689	6.3	6.0	6.7	12,417
Quintile 2	6380	5.6	4.7	6.6	13,516	5.9	5.2	6.7	12,708
Quintile 3	6607	5.7	4.7	6.9	13,833	5.6	4.9	6.6	12,930
Quintile 4	6680	4.8	4.1	5.6	14,490	4.8	4.4	5.3	14,579
Quintile 5 (richest)	7683	3.1	2.7	3.5	17,147	3.1	2.5	3.8	16,037
Level of education									
No education	23,365	5.6	4.9	6.4	44,577	5.8	5.6	6.0	34,281
Primary education	3861	4.9	4.1	5.9	9027	5.3	4.5	6.2	8413
Secondary or higher education	6568	2.8	2.4	3.4	19,072	3.1	2.4	3.9	25,978
Residence									
Rural	21,936	5.7	5.4	6.0	47,263	5.8	5.6	6.0	37,637
Urban	11,860	3.7	3.4	4.0	25,414	3.6	3.3	4.0	31,035
Subnational province									
Eastern	6065	5.5	5.1	5.9	15,858	5.7	5.3	6.1	13,529
Northern	13,880	5.7	5.3	6.1	27,344	5.3	5.1	5.6	14,407
Northwestern	NA	NA	NA	NA	NA	NA	NA	NA	11,085
Southern	7028	4.8	4.4	5.3	15,375	5.6	5.3	6.0	12,871
Western	6822	3.3	3.0	3.7	14,099	3.2	2.8	3.8	16,779

NA-Not available as between 2008 and 2013, Sierra Leone had four regions. LB: Lower Boundary; UB: Upper Boundary

Overall, the total fertility rate has declined in Sierra Leone across the entire period, dropping from 5.0 births per woman in 2008 to 4.3 births per woman in 2019. Women in Quintile 1 (poorest) consistently had the highest TFR, while Quintile 5 (richest) had the lowest. This gap has narrowed slightly over time. Women with no education have the highest TFR, followed by those with primary education. Women with secondary or higher education have the lowest and relatively stable TFR. Urban women consistently have a lower TFR compared to rural women. The gap has narrowed slightly over time. There are regional differences in TFR. The Eastern and Northern provinces generally had higher TFRs compared to the Western Area. The Southern province shows a decline similar to the national trend. Data for the Northwestern province was only available for 2019. This province was created in 2017 after the 2013 survey; and the were part of the Northern province.

Provincial prevalence of total fertility rate (births per woman) in Sierra Leone in 2019

Figure 1 shows the provincial prevalence of total fertility rate (births per woman) in Sierra Leone in 2019. The northwestern province had the highest prevalence of 5.1 births per woman in Sierra Leone, while the western

area had the lowest prevalence of 2.9 births per woman in Sierra Leone.

Table 2 shows inequality measures for TFR in Sierra Leone from 2008 to 2019. Economic disparity among women in richest quintile compared with those in the poorest quintile increased from 3.0 births per woman in 2008 to 3.1 births per woman in 2019. The confidence interval indicate the differences between the two groups were statistically significant. The ratio between mothers in the richest quintile compared with those in the poorest quintile increased from 1.9 in 2008 to 2.1 in 2019; the confidence interval between the two groups indicate inequality, with women in the poorest quintile disproportionately affected.

Inequality in education among women with secondary education or higher compared with those with no education decreased from 2.7 births per woman in 2008 to 1.9 births per woman in 2019; the confidence interval indicates the difference between the groups was statistically significant. The ratio between women with secondary education or higher compared with those with no education decreased from 1.9 in 2008 to 1.6 in 2019; however, the confidence interval between the two groups suggest inequality, with women with no education disproportionately affected.

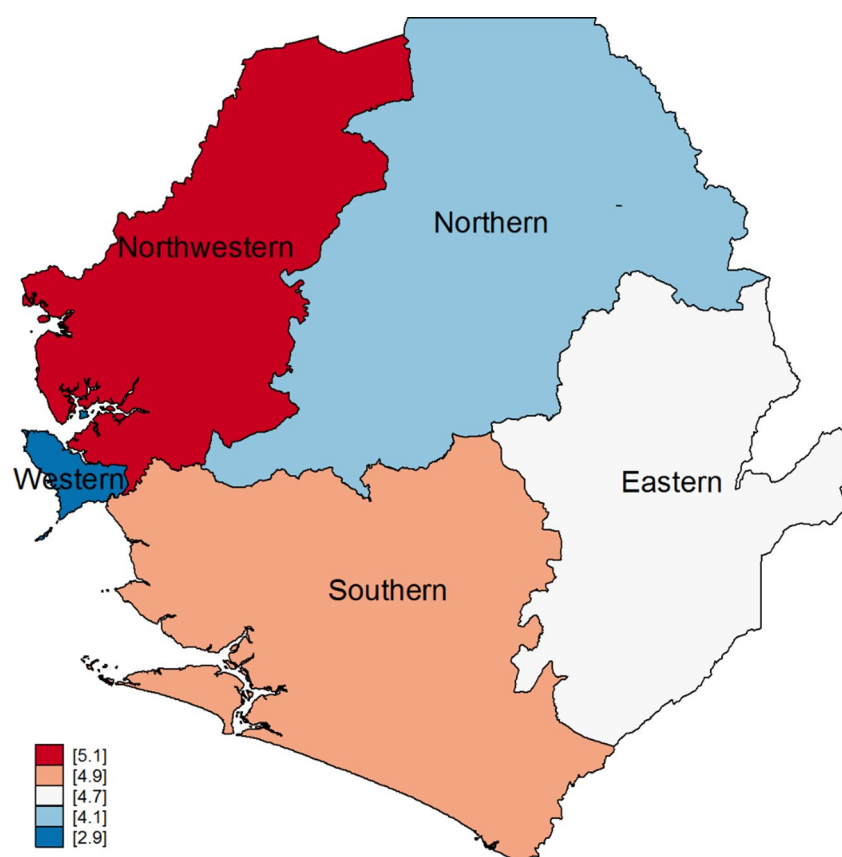


Fig. 1 Provincial prevalence of total fertility rate (births per woman) in Sierra Leone in 2019

Table 2 Inequality measures of estimates of factors associated with total fertility rate (births per woman) in Sierra Leone, 2008–2019

Dimension	2008			2013			2019		
	Est.	LB	UB	Est.	LB	UB	Est.	LB	UB
Economic status									
D	3.0	1.7	4.4	3.2	2.4	3.9	3.1	2.7	3.4
PAF	-38.0	NA	NA	-38.2	NA	NA	-38.7	NA	NA
PAR	-1.9	NA	NA	-1.9	NA	NA	-1.6	NA	NA
R	1.9	1.5	2.5	2.0	1.6	2.5	2.1	1.9	2.3
Level of education									
D	2.7	1.8	3.6	2.7	1.9	3.4	1.9	1.6	2.2
PAF	-42.7	NA	NA	-38.7	NA	NA	-27.5	NA	NA
PAR	-2.1	NA	NA	-1.9	NA	NA	-1.1	NA	NA
R	1.9	1.5	2.4	1.8	1.4	2.3	1.6	1.5	1.7
Subnational province									
D	1.9	1.5	2.4	2.1	1.8	2.5	1.9	1.7	2.2
PAF	-25.7	NA	NA	-27.9	NA	NA	-25.2	NA	NA
PAR	-1.2	NA	NA	-1.4	NA	NA	-1.0	NA	NA
R	1.5	1.3	1.6	1.5	1.4	1.7	1.6	1.5	1.7
Province									
D	2.3	1.7	2.8	2.4	1.8	3.1	2.2	1.8	2.5
PAF	-33.1	NA	NA	-35.8	NA	NA	-30.9	NA	NA
PAR	-1.6	NA	NA	-1.8	NA	NA	-1.3	NA	NA
R	1.6	1.4	1.9	1.7	1.4	2.0	1.7	1.5	1.9

Est: Estimates; UB: Upper-class boundary; LB: Lower class boundary; D: Difference; PAR: Population Attributed Fraction; PAR: Population Attributable Risk; R: Ration

For the place of residence, the difference in inequality among women who resided in urban settings compared with those in rural settings decreased slightly from 2.3 births per woman in 2008 to 2.2 births per woman in 2019; the confidence indicate the difference between the two groups was statistically significant. The ratio between mothers who resided in urban settings compared with those in rural settings increased slightly from 1.5 in 2008 to 1.6 in 2019; the confidence between the two groups suggest inequality, with women in the rural settings disproportionately affected.

Geographically, the difference in TFR among women who resided in Western area compared with those in Eastern province decreased slightly from 2.3 births per woman in 2008 to 2.2 births per woman in 2019. The confidence between the two groups indicate the difference was statistically significant. The ratio between women who resided in Western province compared with those in Southern province increased slightly from 1.6 in 2008 to 1.7 in 2019; and the confidence interval suggest inequality, disproportionately affecting women in Eastern province.

Discussion

This study investigates inequalities in TFR in Sierra Leone between 2008 and 2019. This study found a decline in TFR in Sierra Leone from 5.0 births per woman in 2008 to 4.3 births per woman in 2019. Economic disparity increased from 3.0 births per woman in 2008 to 3.1 births per woman in 2019. Inequality in education decreased

from 2.7 births per woman in 2008 to 1.9 births per woman in 2019. There was no change in inequality for a place of residents, which stood at 1.9 births per woman between 2008 and 2019. Provincial inequality decreased slightly from 2.3 births per woman in 2008 to 2.2 births per woman in 2019.

The decline in TFR from 2008 to 2019 observed in this study is similar with the UNFPA report published in 2017, which reported a decline in TFR from 6.5 births per woman in 1974 to 5.2 births per woman in 2015 in Sierra Leone [11]. Similar findings were also reported in Ghana [4], where TFR decreased from 5.5 births per woman in 1993 to 4.1 births per woman in 2008. A cross-sectional study comparing the trend and determinants of TFR in Guinea and Nigeria reported a decrease in total fatality in both countries, from 6.43 births per woman (1978–1982) to 5.7 births per woman (2003) in Nigeria, and in Guinea from 5.8 births per woman (1983) to 5.7 births per woman (2005) [24]. Recently, a study on global fertility among 204 countries revealed that the global fertility rate declined in all countries from 4.84 births per woman to 2.23 births per woman between 1950 and 2021 [25]. This decline is projected to continue to 1.83 births per woman in 2050 and 1.59 births per woman in 2100 [25]. The authors reported that human civilization interms of improve awareness on utilization of maternal and child health services as the main reason for the decline in the total fatality rate worldwide, even though low-income countries, especially in West and Eastern sub-Saharan Africa, will continue to face significant challenges with

high fertility rates in the future [25]. In the Middle East and North Africa [2], increased male participation in reproductive/sexual health practices, women empowerment, and government direct support policies for family planning, were a few strategies implemented that decreased TFR.

In Sierra Leone, the Government integrated a comprehensive sexuality education into the Ministry of Basic and Senior Secondary School curriculum in 2019 [26] and trained socio-workers in case management and child protection information management systems [27]. These strategies were implemented to reduce TFR and other maternal and child health indicators. The implementation of these strategies could have potentially led to a decrease in TFR observed in this study. For example, the implementation of these policies together with other interventions such as the free healthcare initiative led to an improvement in key maternal health indicators such as maternal mortality rate, reducing from 1165 per 100,000 live births in 2013 to 717 per 100,000 live births in 2019 [28]. However, stakeholders are recommended to heighten efforts by providing additional funding for maternal health interventions including TFR to foster progress in achieving the SDG targets by 2030 [18]. Some of these interventions should include: developing a policy discouraging early marriage, and defaulters should be penalized; providing funding support to community structures such as community healthcare workers to enhance the distribution of contraceptives and intensify awareness raising activities on TFR and maternal health programs, especially in deprived communities; and provide loan support for young women.

This study also indicated that education inequality had a relatively stable difference from 2008 to 2013 at 2.7 births per woman; however, it decreased to 1.9 births per woman, in 2019. The decrease in TFR between 2013 and 2019 observed in this study could be partly attributed to the implementation of clinical and public health interventions aimed at enhancing health service delivery and uptake, including maternal health services [29]. Some of these interventions included strengthening healthcare facilities by ensuring compliance with infectious disease prevention and control standards and leveraging existing foreign medical workers to address immediate health needs targeting vulnerable populations such as lactating mothers [29]. The prevalence of TFR among women with no education was consistently higher than among women with secondary or higher education. In Ghana [4], Ebenezer Agbaglo and colleagues also reported similar findings. Knowledge of the benefits and use of family planning methods in favour of educated women relative to uneducated women were the likely reasons for the low TFR reported by the authors [4]. Since Sierra Leone and Ghana share similar educational systems, cultures,

and health system structures, the reasons above might apply to Sierra Leone as the likely reason for the high TFR among uneducated women compared to educated women. Furthermore, even though economic disparity increased from 3.0 births per woman in 2008 to 3.1 births per woman in 2019, women in the poorest quintile had a consistently higher TFR than those in the richest quintile. Wealth-related inequality is crucial in determining inequality in TFR in Sub-Saharan African countries [30]. Multiple studies have reported that women in the poorest quintile had a consistently higher TFR than those in the richest quintile [30, 31]. Delays in marriage and financial strength to purchase family planning contraceptives were stated as the main reasons for the inequality in favour of women in the richest quintile. Coupled with the stated reasons, difficulty in healthcare utilization exacerbates inequality in favour of women in the richest quintile in Sierra Leone (poorest) [19].

This study also found no change in inequality for a place of residents, at 1.9 births per woman between 2008 and 2019. However, the prevalence of TFR among women residing in rural areas was consistently higher than among women living in urban areas. This finding is consistent with a study conducted using a pooled estimate of TFR for 33 Sub-Saharan African countries, including Sierra Leone, where the authors reported a higher TFR for women residing in rural areas (5.5 births per woman) than women living in urban areas (3.9 births per woman) [6]. The authors reported that economic, social, health, and demographic characteristics factors favouring women residing in urban areas as the likely reasons for the variation [6]. Considering Sierra Leone's fragile healthcare system, the stated factors are eminent as women residing in rural areas are disproportionately challenged with access to specialized medical services, including family planning, among others [32]. This could have likely led to the high TFR among women in rural settings, as observed in this study. Finally, this study found regional inequality decreased slightly from 2.3 births per woman in 2008 to 2.2 births per woman in 2019. However, women residing in the northwestern region had the highest TFR (5.1), and those in the Western region had the lowest TFR (2.9). The Western area, home to the country's capital city, Freetown [33], is the primary center for reproductive and child health resources and contains nearly half of the nation's health workforce [34]. Adjacent to this province is the Northern Region. Residents of the Western Province had easier access to resources such as up-to-date information in reducing the Total Fertility Rate (TFR), likely contributing to a decrease in inequality, followed by those in the Northern Region, as observed in this study.

Policy and practice implications

Our study on Sierra Leone's TFR inequalities highlights the need for multi-pronged approaches to achieve a more equitable decline in fertility rates. The government and policymakers should empower women economically through microfinance programs or initiatives supporting income-generation activities to help them make informed choices about family planning. Providing financial incentives tied to using family planning services or keeping girls in school could encourage desired behaviours. Through these strategies indicating economic disparities disproportionately affecting women in the poorest quintile will be addressed aptly. Invest in expanding access to quality education, particularly for girls in rural areas. This can empower them to delay childbearing and make informed choices about family planning. Integrate comprehensive sexuality education into school curriculums to improve knowledge about reproductive health and family planning methods. Organize community outreach programs to raise awareness about family planning options and dispel myths and misconceptions. Analyze the specific reasons behind provincial variations in TFR [35]. Additionally, interventions aiming at improving access to and utilization of contraceptive methods should be reinforced, with a focus on prioritizing women living in deprived communities [36, 37]. The provincial disparities, particularly provinces located distance away from the main distribution centers such as Eastern and Southern provinces, are concerning. Therefore, targeted interventions designed to improve access to healthcare or raise awareness to enhance cultural acceptance of contraceptive use should focus on regions such as Northern and Southern provinces, which experienced increased disparities over time [38]. Invest in infrastructure development to improve access to healthcare facilities, especially in rural areas [39]. This can ensure wider availability of family planning services. Train and deploy more healthcare workers, especially female providers, to geographically disadvantaged areas to improve access to reproductive health services [36]. Engage with religious and community leaders to address cultural norms that might influence family planning decisions [38]. Promote male involvement in family planning discussions and encourage responsible fatherhood. Regularly monitor and evaluate the effectiveness of implemented policies and programs [40]. By implementing these policy and practice changes, Sierra Leone can work towards a more equitable decline in TFR and empower women to make informed choices about their reproductive health.

Strengths and limitations

SLDHS provides a wealth of demographic and health data collected through nationally representative surveys. This allows for robust analysis of TFR variations across

socioeconomic and geographic groups. The availability of data from multiple surveys (2008, 2013, 2019), in our case, enables us to track trends in inequalities over time. SLDHS follows standardized methodologies, ensuring data comparability across surveys and facilitating analysis of changes over time. HEAT is specifically designed to analyze inequalities in health outcomes, making it a valuable tool for examining TFR disparities across different groups. Reliance on self-reported data can introduce bias, such as underreporting births or forgetting exact dates. While SLDHS collects extensive data, it may not capture all factors influencing TFR, such as deep-rooted cultural norms.

Conclusion

There's a positive trend of national decline in TFR in Sierra Leone between 2008 and 2019. Despite the national decline in TFR, inequality persisted in all subgroups, disproportionately affecting women in the poorest quintile, no education, in rural settings, and those who resided in Eastern, Northwestern and Southern provinces. As Sierra Leone continues to struggle in reducing its high maternal morbidity and mortality, ranked among countries with one of the worst health indicators worldwide, reducing TFR will contribute significantly in reducing the burden of other maternal health indicators, thereby improving the well-being of women. Therefore, the government should promote policy interventions to address economic disparities, crucial for achieving a more equitable decline in TFR. Programs fostering economic empowerment, particularly for women, could be implemented. Additionally, continued investment in education is essential to enhance sustained efforts in reducing gaps and inequalities among the disadvantaged group. Educated women are more likely to make informed choices about family planning and have lower TFRs. Develop and implement targeted programs for geographically disadvantaged areas and those with lower socioeconomic status. This could include expanding access to family planning services and reproductive health education in these areas.

Abbreviations

D	Difference
HEAT	Health Equity Assessment Toolkit
PAF	Population Attributable Fraction
PAR	Population Attributable Risk
R	Ratio
SDG	Sustainable Development Goal
SLDHS	Sierra Leone Demographic and Health Survey
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TFR	Total Fertility Rate
WHO	World Health Organization

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Author contributions

AO, US, MSB, CB, and BOA conceived the study, performed the data analysis, and wrote the initial draft of the manuscript. All the authors reviewed and approved the final version of the manuscript.

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Data availability

The dataset used can be accessed at <https://whoequity.shinyapps.io/heat/>

Declarations

Ethics approval and consent to participate

This study did not seek ethical clearance since the WHO HEAT software and the dataset are freely available in the public domain.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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