South East Asia Journal of Public Health

Vol. 11, No. 2 (2026)
pISSN: 2220-9476 · eISSN: 2313-531X

ORIGINAL RESEARCH

Socioeconomic and Geographical Inequalities in Caesarean Section Births among Women in Ghana, 2014–2022

Kh Shafiur Rahaman[1,2,3,5*], **Anjlee Sawlani**[4], **Nana Ama Asi Danso**[1,5]

[1] *School of Health Sciences, Western Sydney University, NSW 2751, Australia*

[2] *Health Equity across Lifespan Research Laboratory, Campbelltown, NSW 2560, Australia*

[3] *Bangladesh Academy of Dietetics & Nutrition (BADN), Bangladesh*

[4] *Dow Medical College, Karachi, Pakistan*

[5] *Translational Health Research Institute, Western Sydney University, Campbelltown, NSW, 2560, Australia*

*Correspondence: Kh Shafiur Rahaman <rahamanpt@gmail.com>

ABSTRACT

Objective: To analyse the socioeconomic and geographic inequalities in births by cesarean section (CS) among women in Ghana between 2014 and 2022. **Methods:** We analysed data from the Ghana Demographic and Health Surveys (GDHS) (2014, 2017, and 2022) using the WHO's Health Equity Assessment Toolkit (HEAT). To assess inequalities, two simple unweighted measures: Difference (D) and Ratio (R), and two complex weighted measures: Population Attributable Risk (PAR) and Population Attributable Fraction (PAF) were selected. Socioeconomic inequalities were evaluated based on household wealth and education level, while geographical inequalities were examined by place of residence and subnational regions. Statistical significance was reported using 95% confidence intervals for all point estimates. **Results:** Between 2014 and 2022, the rate of CS among women increased drastically, rising from just 12.8% to 20.3%. The highest CS rates were observed in 2022 among women from the richest wealth quintile (37.7%), those with higher education (43.4%), and living in urban areas (26.5%). Regional differences were also evident, with women in the Greater Accra Region persistently showing higher CS rates. The PAR for the region rose from 8.7 (95% CI: 5.6–11.8) in 2014 to 10.9 (95% CI: 7.6–14.2) by 2022. **Conclusion:** Our analysis revealed persistent socioeconomic and regional disparities in CS rates between 2014 and 2022 in Ghana. To effectively address the inequity gaps, it is crucial to design and implement targeted interventions and health policies. Ensuring equitable access to medically necessary CS procedures, regardless of socioeconomic status or geographic location, should be a national health priority.

Keywords: Cesarean section, CS, Inequality, Ghana, Births, Delivery.

Introduction

Cesarean section (CS) is a traditional surgical procedure performed in obstetric care, which involves delivering the fetus through surgical incisions in the skin and uterus (1, 2). It has been evident that properly performed CS improves outcomes for both infant and maternal health (3, 4). According to the WHO, the CS is equally vital in obstetrical procedures(5). The potential risk, however, may outweigh the benefits if used inappropriately (3, 4).

In recent years, the prevalence of CS has been on the rise in both developed and developing countries(6-8). This global increase in CS rates has become a significant public health concern, given its potential risks to maternal and perinatal health, as well as the inequality in access to and financial resources (9-11). WHO guidelines recommend that the rate of CS be between 10% and 15% in any region (12). However, the rate of CS in developed countries was reported to be between 12 and 86% (13, 14), while in developing countries, this figure ranges from 2 to 39%(5, 13-15) . In recent years, elective CS has become more common as an alternative to natural birth, which is rather unnecessary (16), and unlike any other surgery, it has short and long-term complications(17).

The global increase in the CS rates is also reflected in Ghana. The 2014 Ghana Demographic and Health Survey (GDHS) reported that 13% of mothers have given birth by CS, rising from 7% in 2005(18). Highest CS rates have been observed

among mothers aged between 35-49 years (17%), lived in urban areas (19%), with secondary education and higher (27%), from the wealthiest socioeconomic strata (28%) and in the Greater Accra region (23%)(18). However, a recent report revealed that the CS rate in Ghana is remarkably lower than the global average (19). These low CS rates at the population level indicate that women requiring CS delivery in a country lack access (20, 21). While inequality in birth by CS was experienced by every country globally, this is more profound in low-and middle-income countries (LMICs), ranging from 3% to 58%(22, 23). Inequality in the prevalence of births by CS not only exists between nations but also within countries (23).

A recent study reported that a majority (87%) of Ghanaian women favoured traditional birth, even though the prevalence of CS is on the rise(24). In addition to certain maternal health factors (e.g., age, parity) (17, 25), multiple socio-demographic characteristics such as maternal age (17, 25), place of residence (9), socioeconomic status(25, 26), maternal education(25, 26), and income(25, 26) are attributable to increased CS rates. These factors also differ across other populations(10). Understanding these factors contributing to the increased rates of CS is essential.

Many studies have examined the prevalence, risk factors, and associated hazards of CS; however, there is a paucity of research that examines the socioeconomic and geographic trends and inequalities of CS rates within the Ghanaian population. The objective of this study is to examine the socioeconomic and geographical distribution of CS trends and inequalities from 2014 to 2022 using a countrywide representative dataset.

Methods

To assess disparities in caesarean section (CS) use among women in Ghana over the past nine years, we utilised publicly available data from the Health Equity Assessment Toolkit (HEAT)(27), which covers the period from 2014 to 2022. HEAT is a specialised software developed by the World Health Organisation (WHO) to explore, analyse, and report health inequalities. This study used data from the Ghana Demographic and Health Surveys (GDHS) conducted in 2014, 2017, and 2022. These surveys are part of the global Measure DHS program, which collects health and population data from approximately 85 low- and middle-income countries. The primary aim of the GDHS is to collect comprehensive information on health indicators for children, women, and men, including the use of CS, fertility, and family planning.

The 2022 GDHS(28) employed a stratified, two-stage cluster sampling method to ensure national representativeness. In the first stage, 618 clusters were selected from the sampling frame using probability proportional to size, stratified by urban and rural areas across Ghana's 16 regions. In the second stage, 30 households were systematically selected from each cluster, resulting in a total sample of 18,540 households. This sampling design enabled reliable estimates at the national, urban-rural, and regional levels(28). Additionally, the surveys collected detailed socioeconomic data, including household wealth, education, and employment status, allowing for an in-depth analysis of health disparities across different socioeconomic groups and their impact on CS use.

2.1 Outcome Variable

In this study, we examined whether women had a caesarean section (CS) for their most recent birth within two or three years before the survey. This was the main outcome that we were interested in. The responses to this question were easy to understand: "yes" or "no." Women who received a CS for their most recent birth were recorded as "yes," whereas those who did not were designated as "no." We then allocated a '1' for "yes" and a '0' for "no" to the data.

2.2 Equity Dimensions

To explore inequalities in CS births, four key factors were considered: economic status, education, residence, and subnational regions. Economic status was measured using wealth quintiles (from 1 to 5), which were calculated using Principal Component Analysis (PCA). Education was classified by the highest level of formal education completed, ranging from no education to primary, secondary, or higher. The place of residence was categorised as either rural or urban, and subnational regions were divided into 19 areas: Savannah, North East, Northern, Oti, Upper West, Western North, Central, Upper East, Western, West, Ahafo, Brong Ahafo, Bono, Bono East, East, Eastern, Ashanti, Volta, and Greater Accra.

2.3 Statistical Analysis

The latest version of the HEAT software, developed by the WHO, was used to assess disparities in caesarean section (CS) usage among women over the past 9 years (27). The CS prevalence was calculated based on demographic variables for each year, along with their 95% confidence intervals. To measure the level of inequality, four indicators were used: Difference (D), Population Attributable Fraction (PAF), Population Attributable Risk (PAR), and Ratio (R). D and R were unweighted, while PAF and PAR were weighted measures. Additionally, D and PAR were considered absolute measures, whereas R and PAF were regarded as relative measures. These four measures (D, R, PAF, and PAR) were chosen because they applied to both ordered and unordered variables (29). WHO recommendations guided the selection of these metrics (30), which emphasized the importance of both absolute and relative measures in producing policy-relevant insights (31). Complex measures, unlike simple ones, were weighted to reflect the circumstances of each population subgroup, including the population share of each subgroup (29). Detailed descriptions of the methods used to generate these summary measures can be found in other WHO publications(31), with further calculation specifics outlined in WHO's technical notes(32). For all four inequality measures, higher values indicated greater inequality. Positive values indicated inequality favouring the advantaged group, while negative values indicated inequality favouring the disadvantaged group(31).

To measure inequalities for ordered variables, such as wealth quintiles or education levels, two metrics—D and R—were used. D represented the absolute difference between the highest and lowest categories. For example, when calculating D for wealth quintiles, the prevalence of CS in the wealthiest group was subtracted from the prevalence in the poorest group. R represented the ratio between the highest and lowest categories. For instance, to calculate R for education level, the prevalence of CS in individuals with secondary or higher education was divided by the prevalence in individuals with no formal education. For non-ordered variables, such as place of residence or region, the group with the highest prevalence was treated as the reference group. In these cases, D was the difference between the highest and lowest prevalence groups, while R was calculated by dividing the prevalence of the highest group by that of the lowest group(32)

Results

3.1 Trends in CS Rates by Socioeconomic and Demographic Inequality Factors in Ghana, 2014–2022

Between 2014 and 2022, cesarean section (CS) rates in Ghana rose significantly across nearly all socioeconomic and demographic groups, increasing from 12.8% to 20.3%. This upward trend was especially evident across various equity sub-groups. Analysis by wealth quintile revealed that CS rates among women in the poorest quintile increased from 4.7% in 2014 to 11.1% in 2022, while rates among the wealthiest rose from 25.9% to 37.7%, highlighting a widening disparity over time.

Educational levels also displayed distinct patterns of variation. Women without a formal education had just a small increase in CS rates, from 6.4% in 2014 to 9.4% in 2022. In comparison, women with higher education experienced an increase from 37.5% to 43.4% during the same time period. Urban-rural disparities were also significant; by 2022, the prevalence of CS among urban women had risen to 26.5%, more than twice the rate observed among rural women, which was at 14.6%.

A rising pattern of inequality was noted in all subnational regions between 2006 and 2012. Greater Accra and Ashanti consistently exhibited some of the highest CS rates—31.2% and 24.3%, respectively, in 2022—while the Northern and North East regions remained among the lowest. However, even these lower-rate regions experienced significant growth; for instance, Northern increased from 2.9% in 2014 to 10.4% in 2022. Additionally, regions such as Volta (29.2%) and Bono East (23.1%) had significant rises, illustrating a larger but inconsistent national trend in rising CS delivery.

Table 1. Prevalence Estimates according to wealth, education, place of residence, and subnational region

Inequality Dimension	Year					
	2014		2017		2022	
	n	Estimate (95% CI)	n	Estimate (95% CI)	n	Estimate (95% CI)
Wealth Quintiles						
Quintile 1 (Poorest)	1,263	4.7 (3.4-6.3)	1,313	4.7 (3.4-6.5)	896	11.1 (8.8-13.9)
Quintile 2	1,196	7.6 (5.0-11.5)	1,684	8.9 (6.3-12.2)	749	14.1 (11.3-17.5)
Quintile 3	1,114	11.9 (9.3-15.2)	1,836	9.8 (7.4-13.0)	730	17.9 (14.9-21.2)
Quintile 4	1,074	16.1 (12.5-20.5)	1,951	16.2 (12.3-21.2)	668	26.0 (22.1-30.4)
Quintile 5 (Richest)	1,048	25.9 (21.3-31.1)	1,830	26.5 (21.0-32.9)	595	37.7 (32.9-42.8)
Level Of Education						
No Education	1,561	6.4 (4.7-8.8)	1,592	6.2 (4.4-8.6)	761	9.4 (7.6-11.5)
Primary Education	1,141	11.1 (6.9-17.4)	1,413	7.9 (5.7-11.0)	562	18.2 (15.2-21.6)
Secondary Education	2,208	14.6 (12.7-16.6)	1,264	15.2 (12.7-18.0)	1,979	21.5 (19.2-24.0)
Higher Education	785	37.5 (28.2-47.8)	662	38.6 (25.7-53.3)	336	43.4 (37.3-49.7)
Place of Residence						
Rural	3,132	8.6 (6.4-11.7)	3,855	7.7 (6.4-9.2)	1,938	14.6 (12.9-16.5)
Urban	2,563	17.7 (15.4-20.3)	4,758	20.1 (17.0-23.5)	1,700	26.5 (23.8-29.3)
Subnational Region						
Savannah	–	–	–	–	111	7.4 (5.1-10.6)
North East	–	–	–	–	116	9.0 (5.8-13.8)
Northern	709	2.9 (1.7-5.0)	625	4.3 (2.6-7.0)	406	10.4 (7.5-14.1)
Oti	–	–	–	–	128	12.2 (9.2-16.0)
Upper West	152	5.7 (3.3-9.4)	243	7.3 (4.8-10.9)	109	15.5 (11.3-20.9)
Western North	–	–	–	–	101	17.6 (12.7-23.8)
Central	622	16.5 (10.1-25.8)	753	10.8 (7.4-15.6)	380	18.1 (14.1-22.9)
Upper East	227	8.0 (5.8-11.1)	386	9.5 (6.1-14.5)	196	19.0 (15.5-23.2)
Western	574	–	1,098	14.5 (10.6-19.6)	212	19.1 (14.2-25.1)
West	–	15.5 (11.1-21.4)	–	–	–	–
Ahafo	–	–	–	–	81	19.3 (14.8-24.8)
Brong Ahafo	497	9.8 (7.3-13.1)	906	12.3 (8.6-17.3)	–	–
Bono	–	–	–	–	117	21.7 (16.7-27.7)
Bono East	–	–	–	–	202	23.1 (17.7-29.6)
East	–	10.4 (7.3-14.6)	–	–	–	–
Eastern	532	–	840	15.0 (10.5-20.9)	252	23.2 (19.0-28.0)
Ashanti	1,065	14.9 (11.7-18.8)	1,714	18.0 (13.6-23.5)	666	24.3 (19.2-30.2)
Volta	436	9.4 (6.3-13.8)	567	8.4 (6.0-11.6)	135	29.2 (24.3-34.6)
Greater Accra	880	21.5 (16.7-27.2)	1,483	15.8 (10.9-22.3)	427	31.2 (24.6-38.7)
Overall Trend						
Overall Prevalence	5,695	12.8	8,614	12.9	3,638	20.3

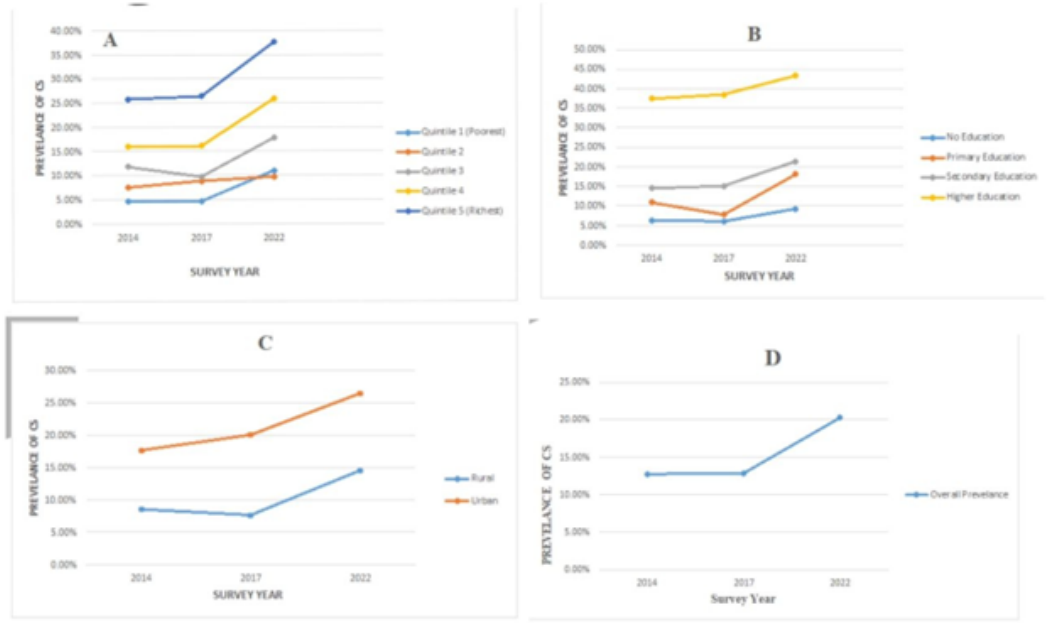

Figure 1. *Trends and Prevalence of Caesarean Sections in Ghana from 2014 to 2022.*

Figure A shows CS coverage by wealth quintile. Figure B shows CS coverage by education level. Figure C shows CS coverage by place of residence. Figure D shows CS coverage by subnational region.

3.2 Inequities in caesarean section rates based on socioeconomic and geographical disparities in Pakistan, 2014–2022

From 2014 to 2022, socioeconomic and geographical disparities in cesarean section rates (CSR) were evident across multiple dimensions, including socioeconomic status, education level, place of residence, and regional divisions. Both absolute (D, PAR) and relative (R, PAF) measures consistently highlighted greater access among women from wealthier households, those with higher education, urban residents, and individuals living in more developed regions. In 2014, the wealthiest had significantly greater access to CS than the poorest (R = 5.6, 95% CI: 3.9–8.0), a ratio that remained unchanged in 2017 but declined by 2022 (R=3.4, 95% CI: 2.6–4.4). The difference (D) increased from 21.2 in 2014 to 26.6 in 2022, showing a widening gap in coverage. The population attributable fraction (PAF) dropped from 102.4% to 85.8% within the same time period, indicating a reduction in relative inequality. However, the population attributable risk (PAR) increased from 13.1 to 17.4, indicating a higher absolute burden of inequality in the population.

Educational inequalities followed a comparable pattern, with women holding higher education qualifications being 5.6 times more likely to access CS in 2014 (R= 5.6, 95% CI: 3.8–8.8), reducing to 4.6 times in 2022 (R=4.6, 95% CI: 3.6–6.0). The D also increased over time, from 31.0 in 2014 to 34.1 in 2022, indicating a persistent and widening gap. The PAF dropped substantially from 192.8% to 114.0%, suggesting some reduction in relative inequality, possibly due to improved access among women with lower education. Despite this, the PAR remained high at 23.1 in 2022, reflecting sustained absolute disparities.

Urban-rural differences also persisted throughout the period. Urban women were twice as likely to have a CS in 2014 (R=2.0), rising in 2017(R=2.6, 95% CI: 2.0-3.3) before falling in 2022 (R =1.8, 95% CI: 1.5-2.1), suggesting some improvement in rural access but continued disparity. The difference (D) increased from 9.1 in 2014 to 12.4 in 2017, slightly falling to 11.9 in 2022. The PAF followed a similar trend, increasing from 38.6% in 2014 to 55.5% in 2017, then dropping to 30.5% in 2022. Despite the drop in relative inequality, the PAR remained relatively high at 6.2 in 2022, indicating continued urban advantage in absolute terms.

Regional disparities were also striking in 2014, women in some regions had cesarean section rates 6.8 times higher than those in the least advantaged areas (R = 6.8, 95% CI: 3.0–15.8); this gap widened in 2017 (R = 20.1, 95% CI: 9.1–44.1), before narrowing to in 2022 (R = 10.2, 95% CI: 5.0–20.9). The D dropped from 18.6 in 2014 to 13.7 in 2017 but rose

sharply to 23.8 in 2022. The PAF followed a U-shaped curve, decreasing to 39.3% in 2017, then rising to 53.6% in 2022. The PAR also increased from 8.7 to 10.9 during the same period, indicating a growing absolute impact of regional inequality.

Table 2. Summary measures of inequality in birth by c-section in Ghana

Inequality Dimension (Summary Measure)	Year					
	2014		2017		2022	
	Estimate	(95% CI)	Estimate	(95% CI)	Estimate	(95% CI)
Wealth Quintile						
D	21.2	16.1-26.3	21.8	15.7-28.0	26.6	21.1-32.2
R	5.6	3.9-8.0	5.6	3.8-8.4	3.4	2.6-4.4
PAF	102.4	102.1-102.6	105.3	105.0-105.5	85.8	85.6-85.9
PAR	13.1	10.3-15.9	13.6	10.8-16.4	17.4	14.6-20.2
Level of Education (4 groups)						
D	31.0	20.9-41.1	32.4	18.1-46.7	34.1	27.6-40.6
R	5.8	3.8-8.8	6.2	3.8-10.3	4.6	3.6-6.0
PAF	192.8	192.3-193.4	198.7	198.2-199.2	114.0	113.8-114.2
PAR	24.7	17.5-31.8	25.7	19.1-32.2	23.1	18.9-27.3
Place of Residence						
D	9.1	5.5-12.6	12.4	8.9-15.9	11.9	8.6-15.1
R	2.0	1.5-2.9	2.6	2.0-3.3	1.8	1.5-2.1
PAF	38.6	38.5-38.7	55.5	55.4-55.6	30.5	30.5-30.6
PAR	4.9	3.7-6.1	7.2	5.9-8.5	6.2	5.1-7.3
Sub-National Region						
D	18.6	13.1-24.1	13.7	8.3-19.1	23.8	16.2-31.4
R	7.4	4.0-13.5	4.2	2.4-7.4	4.2	2.7-6.5
PAF	68.2	68.0-68.4	39.3	39.1-39.5	53.6	53.5-53.8
PAR	8.7	5.6-11.8	5.1	2.8-7.3	10.9	7.6-14.2

4. Discussion

Evidence suggests that cesarean sections (CS) are predominantly utilised by affluent urban residents, raising significant concerns about equitable access to these surgical interventions across different demographics. In sub-Saharan Africa (SSA), this disparity underscores the challenge of ensuring that all women, particularly those in rural and underprivileged communities, can access timely and necessary cesarean deliveries(19, 20). Factors such as socioeconomic status, geographical location, and the availability of medical facilities contribute to this inequity, resulting in many women facing barriers to receiving appropriate maternal care during childbirth. These disparities not only affect health outcomes for mothers and infants but also underscore the need for systemic reforms to improve access to safe surgical options for all women in the region (33).

The percentage of women delivering via cesarean section (CS) increased significantly from 12.8% in 2014 to 20.3% in 2022, representing a rise of 7.5 percentage points. While a greater number of women may have gained advantages from CS in 2014 compared to 2022, research indicates that cesarean rates exceeding 10% do not automatically reduce maternal and perinatal mortality rates (19, 34). A study assessing maternal fatalities related to cesarean sections indicated that the likelihood of a woman dying post-cesarean was nearly three times greater than the risk of maternal death following a vaginal birth(35).

Our research reveals that the incidence of cesarean sections (CS) is significantly higher among women in the wealthiest quintile compared to those in the lowest quintile, and this disparity has been widening over time. This finding is supported by a multitude of other studies(17, 36, 37). Cesarean deliveries are financially advantageous for physicians, primarily because they require less time than vaginal deliveries, allowing doctors to perform more procedures within a similar timeframe (38). Furthermore, unofficial fees imposed by healthcare providers, along with indirect costs such as transportation and other expenses not covered by the National Health Insurance Scheme (NHIS) or the Free Maternal Healthcare Policy, present obstacles for women in lower wealth brackets (39). Women from higher-income families are better equipped to handle the additional costs associated with cesarean deliveries, which makes them more likely to opt for elective CS over spontaneous birth (38), without adequate medical justification.

In our study, the prevalence of CS was higher among women with higher education and increased over time, favouring highly educated women. Previous research conducted in Tanzania (40) and Ghana(41) suggests that the likelihood of CS is lower among women with at least a secondary education. One possible explanation for this trend is that educated women may mistakenly perceive CS as a safer childbirth option, partly because they believe it allows them to minimise disruptions to their work and leisure activities compared to vaginal delivery (42, 43). Additionally, the increased likelihood of CS among educated women may be attributed to their greater autonomy and decision-making power, which enables them to recognise the importance of CS when it is medically necessary (44). Conversely, women with limited or no formal education may hesitate or decline a cesarean delivery due to fears of pain and potential infection risks, even when CS is warranted. They often prefer to seek spiritual remedies, such as prayer, in hopes of achieving a vaginal birth(45, 46).

The higher prevalence of cesarean sections among women in urban areas between 2014 and 2022 was expected, as urban settings typically offer better access to advanced healthcare facilities and skilled birth attendants. In contrast, rural women often face challenges due to less-equipped and more remote health facilities, where skilled birth attendants may be scarce. This reliance on traditional birth attendants, who lack the necessary training and credentials to perform cesarean sections, limits access to modern surgical options. Additionally, religious beliefs and community influences shape patients' views on cesarean sections, particularly in rural regions where women prefer traditional practices they associate with home deliveries, which discourages them from seeking care at medical facilities(46). Moreover, the high expenses related to facility-based deliveries (47), along with experiences of mistreatment, abuse, and neglect by healthcare providers, have led to feelings of dissatisfaction, distrust, and a tendency to avoid seeking care in such facilities, as they perceive discrimination based on their social status (48). Policies and programs must address this disparity to ensure that rural women receive equitable access to contemporary maternity care. A robust referral system within the healthcare framework is essential to achieve this.

Variations in the prevalence of cesarean sections (CS) were most noticeable in urban-centred areas with high economic activity, such as the Greater Accra and Ashanti Regions, in contrast to the less urbanised Northern, Bono, and Volta Regions, which demonstrated lower rates of CS. Regions exhibiting elevated rates of Cesarean section (CS) procedures tend to have a higher concentration of private hospitals, alongside multiple facilities that possess the necessary staffing and resources to manage these surgical interventions effectively. In contrast, regions characterised by a singular regional hospital and fewer adequately equipped private facilities often report lower CS rates. This disparity highlights the crucial role that healthcare infrastructure and resource availability play in shaping medical practice patterns. Women delivering in private facilities had a two-fold increased likelihood of having a CS compared to those who gave birth in public institutions (49). However, between 2014 and 2022, the gap in CS prevalence between urban and rural areas narrowed following the introduction of the National Health Insurance Scheme (NHIS) and the Free Maternal Health Policy in Ghana. Nevertheless, attributing this shift solely to the implementation of the NHIS would be premature. Future research could further explore this relationship to enrich the existing literature.

The observed persistent inequalities in access to cesarean sections (CS) among women in Ghana reflect a broader global issue. Although we advocate for reducing disparities in cesarean births, it's essential to acknowledge that CS can lead to complications. Women should only undergo CS when there is a legitimate medical reason. While elective cesarean sections (CS) are becoming increasingly popular, it remains crucial to discuss the potential risks with expectant mothers to ensure they can make informed choices. Despite the associated risks, we believe that women who genuinely need a

cesarean should receive adequate support for a safe procedure without systemic inequalities linked to socioeconomic status.

4.1 Strengths and Limitations

The strength of this study lies in its use of the HEAT, which provides a systematic approach for assessing inequality in CS, thereby enhancing the robustness of the analysis. By analysing a nationally representative sample from the GDHS, HEAT improves the generalizability of the findings. These findings can guide targeted interventions aimed at reducing unnecessary CS in advantageous groups while improving access for disadvantaged populations, ultimately shaping more equitable healthcare policies. However, the study does have limitations. Due to our reliance on existing data from the HEAT software, we were unable to differentiate between singleton and multiple births. Although there has been a noticeable increase in cesarean births (CS) over the years, this trend reveals significant inequalities that underscore the necessity for continued policy action. Additionally, variations in healthcare infrastructure, policies, and cultural factors across countries may complicate direct comparisons. The reliance on observational outputs from HEAT means that causal inferences cannot be drawn. Furthermore, the data from DHS is based on self-reported information regarding CS deliveries, which introduces the possibility of bias in the findings.

5. Conclusion

Significant inequality in births by cesarean section (CS) has been revealed in both socioeconomic and geographical dimensions in Pakistan. Over the last few decades, women from the affluent quintile, who had a higher level of education and lived in urban areas, were found to be at an advantage. The Greater Accra region was identified as having the highest prevalence of CS. This pattern highlights the disparities in access to healthcare services and the impact of socioeconomic factors on the rates of cesarean section (CS) deliveries. Addressing these inequalities is crucial for improving maternal health outcomes and ensuring equitable access to safe childbirth options across different regions and socioeconomic groups. Minimising regional disparities while improving overall maternal health outcomes requires increasing access to high-quality maternal healthcare in impoverished rural areas. To ensure that the procedure is only carried out when medically necessary, policymakers should impose strict guidelines regarding CS indications. This will help prevent misuse and overuse of the procedure in high-income groups and underuse in marginalized populations. Finally, more thorough qualitative and longitudinal research should be carried out to investigate the underlying socioeconomic and geographic patterns causing differences in CSR, thereby enabling more successful interventions to address these disparities.

Declaration of conflicting interest

The authors report no conflicts of interest.

Funding: The authors did not obtain any funding for this study.

Ethics Approval and Consent to Participate:

We utilized de-identified data from the Health Equity Assessment Toolkit, which had already obtained ethical approval from the involved countries, so no additional ethical permission was necessary for this study. The data was gathered from an online source (https://whoequity.shinyapps.io/heat). Since the dataset is publicly accessible to all researchers, no further approval was required.

Consent for publication

Not applicable.

Data availability statement

The study used data from HEAT. This data is available at

Author contributions:

Conceptualization: KSR, AS; Data curation: KSR, AS; Formal analysis: AS: Funding acquisition: N/A; Investigation: KSR, AS; Methodology: KSR, AS; Project administration: KSR; Resources: KSR, AS; Software: KSR, AS; Supervision: KSR, Validation: KSR; Visualization: AS; Writing – original draft: AS, NAAD, Writing – review and editing: KSR, NAAD.

References

1. Arulkumaran S. Malpresentation, malposition, cephalopelvic disproportion and obstetric procedures. Dewhurst's Textbook of Obstetrics & Gynaecology. 2012:311-25.
2. Kwawukume EY. Caesarean Section in Comprehensive Obstetrics in the Tropics. 2002:321-9.
3. Savage W. The caesarean section epidemic. Journal of Obstetrics and Gynaecology. 2000;20(3):223-5.
4. Panditrao S. Intra-operative difficulties in repeat cesarean sections. J Obstet Gynecol India. 2008;58(6):507-10.
5. Organization WH. Monitoring emergency obstetric care: a handbook: World Health Organization; 2009.
6. Gomes UA, Silva AA, Bettiol H, Barbieri MA. Risk factors for the increasing caesarean section rate in Southeast Brazil: a comparison of two birth cohorts, 1978-1979 and 1994. International Journal of Epidemiology. 1999;28(4):687-94.
7. Leone T, Padmadas SS, Matthews Z. Community factors affecting rising caesarean section rates in developing countries: an analysis of six countries. Social science & medicine. 2008;67(8):1236-46.
8. Leung GM, Lam TH, Thach TQ, Wan S, Ho LM. Rates of cesarean births in Hong Kong: 1987–1999. Birth. 2001;28(3):166-72.
9. Stanton CK, Holtz SA. Levels and trends in cesarean birth in the developing world. Studies in family planning. 2006;37(1):41-8.
10. Abebe FE, Gebeyehu AW, Kidane AN, Eyassu GA. Factors leading to cesarean section delivery at Felegehiwot referral hospital, Northwest Ethiopia: a retrospective record review. Reprod Health. 2016;13:6.
11. Villar J, Carroli G, Zavaleta N, Donner A, Wojdyla D, Faundes A, et al. Maternal and neonatal individual risks and benefits associated with caesarean delivery: multicentre prospective study. Bmj. 2007;335(7628):1025.
12. Organization WH. Appropriate technology for birth. Lancet. 1985;2:436-7.
13. Adnan A AO, Suleiman H AA. Frequency rate and indications of cesarean sections at Prince Zaid bin Al Hussein Hospital-Jordan. 2012.
14. Lauer JA, Betrán AP. Decision aids for women with a previous caesarean section. Bmj. 2007;334(7607):1281-2.
15. Shamshad B. Factors leading to increased cesarean section rate. Gomal J Med Sci. 2008;6(1):1-5.
16. Belizán JM, Minckas N, McClure EM, Saleem S, Moore JL, Goudar SS, et al. An approach to identify a minimum and rational proportion of caesarean sections in resource-poor settings: a global network study. The Lancet Global Health. 2018;6(8):e894-e901.
17. Manyeh AK, Amu A, Akpakli DE, Williams J, Gyapong M. Socioeconomic and demographic factors associated with caesarean section delivery in Southern Ghana: evidence from INDEPTH Network member site. BMC pregnancy and childbirth. 2018;18(1):405.
18. Ghana Statistical Service GSS, Ghana Health Service GHS, International ICF. Ghana Demographic and Health Survey 2014. Rockville, Maryland, USA: GSS, GHS, and ICF International; 2015.
19. Organization WH. WHO statement on caesarean section rates. World Health Organization; 2015.
20. Betrán AP, Ye J, Moller A-B, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990-2014. PloS one. 2016;11(2):e0148343.
21. Lauer JA, Betrán AP, Merialdi M, Wojdyla D, editors. Determinants of caesarean section rates in developed countries: supply, demand and opportunities for control2010.
22. Boerma T, Ronsmans C, Melesse DY, Barros AJ, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. The Lancet. 2018;392(10155):1341-8.
23. Boatin AA, Schlotheuber A, Betran AP, Moller A-B, Barros AJ, Boerma T, et al. Within country inequalities in caesarean section rates: observational study of 72 low and middle income countries. bmj. 2018;360.
24. Banchani E, Tenkorang EY. Risk factors for caesarean sections in Ghana: evidence from the Ghana maternal health survey. Journal of Biosocial Science. 2022;54(1):21-38.
25. Huang K, Tao F, Faragher B, Raven J, Tolhurst R, Tang S, et al. A mixed-method study of factors associated with differences in caesarean section rates at community level: the case of rural China. Midwifery. 2013;29(8):911-20.

26. Tatar M, Günalp S, Somunoğlu S, Demirol A. Women's perceptions of caesarean section: reflections from a Turkish teaching hospital. Social Science & Medicine. 2000;50(9):1227-33.

27. Hosseinpoor AR, Nambiar D, Schlotheuber A, Reidpath D, Ross Z. Health Equity Assessment Toolkit (HEAT): software for exploring and comparing health inequalities in countries. BMC medical research methodology. 2016;16(1):141.

28. GHS G, Demographic IG. Health Survey 2022: Key Indicattors Report. Accra, Ghana, Rockville, Maryland, USA: GSS ICF. 2023:5-24.

29. Schlotheuber A, Hosseinpoor AR. Summary measures of health inequality: a review of existing measures and their application. International journal of environmental research and public health. 2022;19(6):3697.

30. Zwecker P, Azoulay L, Abenhaim HA. Effect of fear of litigation on obstetric care: a nationwide analysis on obstetric practice. American journal of perinatology. 2011;28(04):277-84.

31. Organization WH. Handbook on health inequality monitoring: with a special focus on low-and middle-income countries: World Health Organization; 2013.

32. Ahinkorah BO, Budu E, Duah HO, Okyere J, Seidu A-A. Socio-economic and geographical inequalities in adolescent fertility rate in Ghana, 1993–2014. Archives of Public Health. 2021;79(1):124.

33. Chu K, Cortier H, Maldonado F, Mashant T, Ford N, Trelles M. Cesarean section rates and indications in sub-Saharan Africa: a multi-country study from Medecins sans Frontieres. 2012.

34. Ye J, Zhang J, Mikolajczyk R, Torloni MR, Gülmezoglu A, Betran A. Association between rates of caesarean section and maternal and neonatal mortality in the 21st century: a worldwide population-based ecological study with longitudinal data. BJOG: An International Journal of Obstetrics & Gynaecology. 2016;123(5):745-53.

35. Gebhardt GS, Fawcus S, Moodley J, Farina Z. Maternal death and caesarean section in South Africa: results from the 2011-2013 saving mothers report of the national committee for confidential enquiries into maternal deaths. South African Medical Journal. 2015;105(4):287-91.

36. Long Q, Kempas T, Madede T, Klemetti R, Hemminki E. Caesarean section rates in Mozambique. BMC pregnancy and childbirth. 2015;15(1):253.

37. McKinnon B, Harper S, Kaufman JS, Bergevin Y. Removing user fees for facility-based delivery services: a difference-in-differences evaluation from ten sub-Saharan African countries. Health policy and planning. 2015;30(4):432-41.

38. Obed J, Bako B, Agida T, Nwobodo E. CAESAREAN DELIVERY ON MATERNAL REQUEST: CONSULTANTS'VIEW AND PRACTICE IN THE WEST AFRICAN SUB REGION. Journal of the West African College of Surgeons. 2013;3(1):72.

39. Asante F, Chikwama C, Daniels A, Armar-Klemesu M. Evaluating the economic outcomes of the policy of fee exemption for maternal delivery care in Ghana. Ghana medical journal. 2007;41(3).

40. Nilsen C, Østbye T, Daltveit AK, Mmbaga BT, Sandøy IF. Trends in and socio-demographic factors associated with caesarean section at a Tanzanian referral hospital, 2000 to 2013. International journal for equity in health. 2014;13(1):87.

41. Apanga PA, Awoonor-Williams JK. Predictors of caesarean section in northern Ghana: a case-control study. Pan African Medical Journal. 2018;29(1):1-11.

42. Dickson KS, Darteh EKM, Kumi-Kyereme A. Providers of antenatal care services in Ghana: evidence from Ghana demographic and health surveys 1988–2014. BMC health services research. 2017;17(1):203.

43. Litorp H, Mgaya A, Kidanto HL, Johnsdotter S, Essén B. 'What about the mother?'Women′ s and caregivers′ perspectives on caesarean birth in a low-resource setting with rising caesarean section rates. Midwifery. 2015;31(7):713-20.

44. Yaya S, Bishwajit G, Shah V. Wealth, education and urban–rural inequality and maternal healthcare service usage in Malawi. BMJ global health. 2016;1(2):e000085.

45. Sunday-Adeoye I, Kalu C. Pregnant Nigerian women's view of cesarean section. Nigerian journal of clinical practice. 2011;14(3):276-9.

46. Ugwu NU, De Kok B. Socio-cultural factors, gender roles and religious ideologies contributing to Caesarian-section refusal in Nigeria. Reproductive health. 2015;12(1):70.

47. Arsenault C, Fournier P, Philibert A, Sissoko K, Coulibaly A, Tourigny C, et al. Emergency obstetric care in Mali: catastrophic spending and its impoverishing effects on households. Bulletin of the World Health Organization. 2013;91:207-16.

48. Bohren MA, Hunter EC, Munthe-Kaas HM, Souza JP, Vogel JP, Gülmezoglu AM. Facilitators and barriers to facility-based delivery in low-and middle-income countries: a qualitative evidence synthesis. Reproductive health. 2014;11(1):71.

49. Gebremedhin S. Trend and socio-demographic differentials of Caesarean section rate in Addis Ababa, Ethiopia: analysis based on Ethiopia demographic and health surveys data. Reproductive health. 2014;11(1):14.

