Impact of the free healthcare initiative on wealth-related inequity in the utilization of maternal & child health services in Sierra Leone

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Abstract

Background: As a result of financial barriers to the utilization of Maternal and Child Health (MCH) services, the Government of Sierra Leone launched the Free Health Care Initiative (FHCI) in 2010. This study aimed to examine the impact of the FHCI on wealth related inequity in the utilization of three MCH services.

Methods: We analysed data from 2008 to 2013 Sierra Leone Demographic Health Surveys (SLDHS) using 2008 SLDHS as a baseline. Seven thousand three hundred seventy-four and 16,658 women of reproductive age were interviewed in the 2008 and 2013 SLDHS respectively. We employed a binomial logistic regression to evaluate wealth related inequity in the utilization of institutional delivery. Concentration curves and indices were used to measure the inequity in the utilization of antenatal care (ANC) visits and postnatal care (PNC) reviews. Test of significance was performed for the difference in odds and concentration indexes obtained for the 2008 and 2013 SLDHS.

Results: There was an overall improvement in the utilization of MCH services following the FHCI with a 30% increase in institutional delivery rate, 24% increment in more than four focused ANC visits and 33% increment in complete PNC reviews. Wealth related inequity in institutional delivery has increased but to the advantage of the rich, highly educated, and urban residents. Results of the inequity statistics demonstrate that PNC reviews were more equally distributed in 2008 than ANC visits, and, in 2013, the poorest respondents ranked by wealth index utilized more PNC reviews than their richest counterparts. For ANC visits, the change in concentration index was from 0.008331 [95% CI (0.008188, 0.008474)] in 2008 to −0.002263 [95% CI (−0.002322, −0.002204)] in 2013. The change in concentration index for PNC reviews was from −0.001732 [95% CI (−0.001746, −0.001718)] in 2008 to −0.001771 [95% CI (−0.001779, −0.001763)] in 2013. All changes were significant (p value < 0.001).

Conclusion: The FHCI appears to be improving access to and utilization of MCH services, narrowing the inequity in ANC visits and PNC reviews, but is insufficient in addressing wealth-related inequity that exists for institutional deliveries. If Sierra Leone is to realize a significant reduction in maternal and child mortality rates, it needs to strengthen the effective implementation of FHCI considering incorporating a sector wide approach (SWAp) or a “Health in all Policy” framework to reach the less educated, rural residents and ensuring culturally sensitive quality services.

Keywords: Antenatal care, Postnatal care, Inequity, Institutional delivery, Concentration index, Maternal health, Sierra Leone

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Background

Despite the gains in improving the health status of vulnerable segments of the society over the century, inequity in health and healthcare continue to persist globally [1] and obeying the inverse care law – the availability of good quality healthcare seems to be inversely related to the need for it [2]. Such gap in health status between the rich and the poor is prevalent in many developing countries. In recognising the need to bridge the equity gap, most governments and international organisations have included key provisions in their primary healthcare delivery policy initiative to address such disparities [1, 3–5]. Notwithstanding such commitments, the health status among the poor in sub-Saharan Africa is suboptimal [6].

Monitoring trends in equity in health and access to essential health interventions is important in order to tailor scarce public resources to those who are most in need, particularly poor and underserved communities. While low income countries in sub-Saharan Africa face many challenges in collecting and analysing relevant information for observing trends in equity, such challenges which should not be an excuse for inaction [7].

The 2008 Sierra Leone Demographic and Health Survey (SLDHS) identified cost as the main barrier to utilization of maternal and child health (MCH) services and a key contributing factor for the high maternal and infant mortality rates [8]. In order to address the high maternal and infant mortality rates, the government launched the free healthcare initiative (FHCI) for pregnant women, lactating mothers and children under the age of five in April 2010, which eliminates medical fees and provides drugs and treatments at no cost in every public health facility in the country [9, 10]. However, the FHCI remains challenged by increasing demand, low staffing, and stock-outs of essential laboratory equipment (86–97%), other equipment (13–47%) and drugs (12%), resulting in patients being required to pay out of pocket for services falling under the FHCI [11–13]. Although an increasing number of women and children are reportedly utilizing healthcare services, the FHCI may not have eradicated differential distribution of services among the different wealth quintiles [11, 14].

Despite the FHCI, Sierra Leone was unable to meet its target of the millennium development goals 4 and 5 (MDG4 and MDG5) – reducing maternal mortality ratio to 450 per 100,000 births and child mortality to 95 per 1000 live births. The FHCI has since entered into the sustainable development goals (SDG) era with significant gaps in the health sector remaining to achieve SDG 3 – health and wellbeing for all [15, 16]. In Sierra Leone, the current neonatal and under-five mortality rates are at 39 and 156 deaths per 1000 live births respectively and the maternal mortality ratio is 1165 death per 10,000 live births [17]. These infant and maternal mortality indices are far short of the 70 deaths per 100,000 live births target set out in the 2030 sustainable development goal agenda [18]. Even though the FHCI has made MCH services free, indirect costs, among other factors, may still contribute to the disparity in the utilization of MCH services. However, little is known on the impact of the FHCI in narrowing the wealth-related inequity in the utilization of MCH services. For instance, studies have reported that despite the FHCI, women in rural communities, many of which are poor, still experience difficulty in accessing health services [10, 11].

Inequity studies are urgently needed to understand the FHCI’s ability to close the gap between wealth quintiles, which will provide evidence to guide policies aiming to reduce inequalities in access to such services in order to achieve universal health coverage in Sierra Leone. Therefore, we aimed to evaluate the change in the utilization of MCH services among wealth quintiles before (2008) and after FHCI (2013) implementation in Sierra Leone. Further analysis is aimed at demonstrating the impact of secondary factors that affect utilization of MCH services such as education level, residence, ethnicity, age, occupation, religion and number of children of respondents.

Methods

Settings

Sierra Leone, which is a low-income country, is approximately 71,740 km² land area divided into four administrative regions namely Northern, Southern, Eastern provinces and the Western area where the capital Freetown is located. The country has a long historical and geopolitical context of poverty, high illiteracy rate. Sierra Leone is also a country that is recovering from disasters including the prolonged 11-year civil war that ended in 2002, followed by the 2012 Cholera outbreak [19] and of recent the 2014–2016 Ebola Virus disease epidemic [20].

Sierra Leone is a low-income country with a reported Gross National Income (GNI) per capita (current dollar, purchasing power parity (PPP) of $1690 while the gross domestic product (GDP) growth rate was 6% in 2013 and the Human Development Index rank for Sierra Leone is 177 out of 187 countries [21]. It has an estimated 2015 population of 7075,64 [22] and the nature of its geography poses significant challenges for the delivery of health services to the population in some of these districts. Sierra Leone currently faces a triple burden of diseases (communicable diseases, 70%; NCDs, 22% and injuries, 7%) [23] common to a growing number of LINCs with life expectancy for both male and female at 50 years [24].

Data source and sample size

This study was based on the secondary analysis of data obtained from two nationally representative household surveys that interviewed a total of 7374 and 16,658...
women of reproductive age (15–49 years) in 2008 [8] and 2013 [25]. Response rates among eligible individuals in the target samples were 94% [8] and 97.2% [25] in 2008 and 2013 respectively.

**Sampling method of SLDHS**

All the two Sierra Leone Demographic and Health Surveys (SLDHS) used a multi-stage cluster sampling technique [8, 25]. Initially, the Enumeration Areas (EA) — a cluster that conventionally encompasses 85 adjacent households each were selected as primary sampling units from the sampling frame developed based on the 2004 Census [26]. In each of the selected EAs, a complete listing of households was carried out from which secondary sampling units were drawn using systematic random sampling technique. In the two surveys, 353 EAs were sampled of which 145 were urban and 208 were rural, with each EA having 85 households from which 22 were selected in the second stage of the two-stage sampling [8, 25]. For this study, all data collected from women who gave birth in the preceding 5 years of the survey were included. In cases, where women had more than one birth in the reference period, the most recent one was considered. An algorithm of the number of women interviewed in each of the SLDHS and the women included in the final analysis of antenatal care (ANC) & postnatal care (PNC) (Additional file 1).

**Data analysis**

Data analysis were done using Excel Microsoft Corporation and SPSS Package version 22 (SPSS, Inc. Chicago). This study first explored the background characteristics of study participants and then the analysis of MCH utilization by wealth quintile and other individual characteristics. An unadjusted and adjusted binary logistic regression was run for institutional delivery and a concentration curve with subsequent concentration indices generated for ANC visits and PNC reviews for 2008 and 2013 SLDHS.

For MCH utilization variables, we defined the number of antenatal visits (ANC) and postnatal reviews made (PNC) as discrete variables; we considered the number of visits to be complete if it reached the recommended number of visits as per the WHO guidelines [27, 28] (four or more for ANC and four or more for PNC). For ease of analysis, ANC was transformed into three subcategories (none, up to four and more than four visits) and PNC into two subcategories (incomplete and complete). Complete includes all four reviews: post-delivery, prior to discharge, a week after discharge, and 6 weeks post-delivery. If any of these visits were missed, then that constitutes an incomplete PNC. We defined Institutional delivery as the use of a healthcare institution for delivery for the pregnancy under review, regardless of the package of care provided as a binary categorical variable (Yes vs No). We defined wealth quintiles as poorest (1st quintile); poorer (2nd quintile); middle (3rd quintile); richer (4th quintile); and richest (5th quintile). Additional covariates were defined as categorical i.e. education level, occupation, residence (rural/urban), ethnicity, religion, and mother’s age as well as discreet (number of children) variables. All the independent variables were categorical variables except for number of children, which was a quantitative variable.

The undermentioned operational definitions of the dependent and independent variables (see Additional files 2 and 3) were the same as defined in the DHS data-set except for PNC (a composite variable) ethnicity and religion, which were redefined to suit the study design.

The concentration curves were built using two key variables: the independent wealth index variable on the one hand and maternal & child health services utilization outcome variables on the other hand (ANC& PNC). The concentration indices estimated the magnitude of wealth related inequality in the selected MCH services utilization.

During analysis, the cases were grouped according to wealth quintiles into: Poorest: 1st quintile; Poorer: 2nd quintile; Middle: 3rd quintile; Richer: 4th quintile; Richest: 5th quintile. The sum of each outcome variable noted for the five wealth quintiles and then expressed as a percentage of the total outcome variable of interest. Each curve, therefore, represents the cumulative percent of the outcome variable of interest against the cumulative percent of the wealth quintile of the sample analyzed. If ANC visits or PNC reviews utilization were equally distributed across the different wealth quintiles, a 45-degree line representing perfect equality would be generated. This line known as the line of equality (LOE) runs from the bottom left corner of the graph (0,0) to the upper right corner of the graph (100, 100) [29]. If these services were however utilized more by the rich than the poor, the curve falls below the LOE and the further it is away from the LOE the more the wealth-related inequality in the distribution of the MCH services utilization. Since the aim was to compare the wealth related inequality in ANC visits or PNC reviews utilization across a period using the 2008 and 2013 SLDHS, the concentration curves for each outcome variable were plotted on the same graph. Thus, if the curve of one of the time periods (2008 vs 2013) lies above the other (closer to the LOE), then the former is said to dominate the latter, but the extent is unknown. In order to get an exact measure of the degree of inequality, a concentration index is built from each curve and it is defined as double the area between the curve and the LOE [29]. The concentration indexes obtained were then used to rank these two-time periods by the degree of inequality. If the two curves cross each other, a case of non-dominance may be demonstrated.
In this study, the concentration index was calculated first as twice the area between the curve and the line of equality. However, since the area under-the-curve approach to calculating the confidence interval (CI) does not give the standard error of the curve and hence the CI, the CIs were therefore computed using the convenient regression method. The CI was computed in the convenient regression method as twice the weighted variance of fractional living standard variable squared \((\delta^2)\) and the health variable \((h_i = \text{ANC or PNC})\) divided by the mean of the health variable \((\mu)\) based on the left hand of eq. 1 below:

\[
2\delta^2(h_i/\mu) = \alpha + \beta r_i + \varepsilon_i
\] (1)

The computation of the fractional rank of wealth index \((r_i)\) was based on equation below for the weighted data.

\[
r_i = \sum (W_j + W_i/2)
\] (2)

\(r_i\) was then sorted in ascending order and its variance calculated. \(\beta\) produced during the convenient regression of the CI variable against the fractional rank variable represents the unadjusted estimate of the concentration index generated on the right hand of eq. 1.

The standardized or adjusted estimate of the concentration index was computed using SPSS statistical software using the generated model to predict the health variable (ANC or PNC) based on eq. 3 below:

\[
Y_i = b_0 + b_1x_1 + b_2x_2 + b_3x_3
\] (3)

\(Y_i\) represents the predicted health variable. During the adjustment or standardization of the wealth variable for the other covariates, the adjusted values were predicted using eq. 3 while keeping all covariates at their mean values.

In order to calculate the standard error of the standardized estimate of the concentration index, the sampling variability was taken into account, and thus the convenient regressions were run without transforming the dependent health variable but instead using the transformed living standard variable (i.e. \(R\text{Wealthi}\)). The standard error of the adjusted concentration index was estimated as the coefficient of the transformed living standard variable \((R\text{Wealthi})\). The variance of the fractional rank, which was also used in the transformation, depended only on the sample size and so has no sampling variability. It can be treated as a constant. This way the sampling variability was considered because the estimate and its standard error were written as a function of regression coefficients based on eqs. 4, 5, and 6 below.

\[
h_i = \alpha_1 + \beta_1 r_i + \varepsilon_i
\] (4)

\[
\delta = \left(\frac{2\delta^2}{\mu}\right)_{\beta}
\] (5)

An unadjusted and adjusted binary logistic regression were run to identify how wealth in relation to the other independent variables serves as a predictor of utilization of healthcare institutions for delivery. The generated model predicts whether a pregnant woman will deliver in a health facility or at home based on her wealth index and other independent variables. Logistic regression models were used to obtain unadjusted and adjusted odds ratios with 95% confidence interval for the associations between the different independent variables and institutional delivery. The significant standardized contribution of each covariate was assessed using the adjusted Wald test to obtain the \(p\)-value. All \(p\)-values < 0.05 were considered statistically significant.

### Ethical considerations

The DHS program-ICF International, (Rockville, USA), granted access to the data after a submission of a written request through their online platform. The Sierra Leone Ethics and Scientific Review Committee granted a waiver since this is a secondary analysis of de-identified data.

### Results

#### Sociodemographic characteristics

The results in Table 1 show that of the women included in the analysis, 75 and 66% had no formal education in 2008 and 2013 respectively; about 70% were rural residents in both 2008 and 2013; about 80% were Muslims in both 2008 and 2013; and 55 and 50% of children had one to four siblings in 2008 and 2013 respectively.

#### MCH services utilization rates

Table 2 highlights MCH services (ANC, Institutional Delivery and & PNC reviews) utilization rates in 2008 and 2013. Although more than 50% of women attended the four ANC visits recommended by WHO focus antenatal care guideline in 2008, this number increased to 75% in 2013. Institutional delivery among women respondents increased from 27% in 2008 to 57% in 2013. There was also a reduction in the number of incomplete postnatal visits from 92% in 2008 to 59% in 2013.

#### Inequality analysis of ANC visits

The curves in Fig. 1(a and b) show the unadjusted and adjusted concentration curves respectively for ANC visits in both 2008 and 2013 SLDHS.

The ANC concentration curve for 2013 lies slightly above the line of equality indicating that the poor made more ANC visits than the rich. On the other hand, the 2008 ANC concentration curve lies below and above the
| Background characteristics | Weighted number of study participants by sociodemographic characteristics 2008 |  | Weighted number of study participants by sociodemographic characteristics 2013 |  |
|-----------------------------|--------------------------------------------------------------------------|---|--------------------------------------------------------------------------|---|
|                             | ANC 2008 Freq (n = 3346) | Percent (%) | PLOD 2008 Freq (n = 4053) | Percent (%) | ANC 2013 Freq (n = 7478) | Percent (%) | PLOD 2013 Freq (n = 8625) | Percent (%) | PNC 2013 Freq (n = 7971) | Percent (%) |
| **Wealth Index**            |                           |             |                            |             |                           |             |                            |             |                           |             |
| Poorest                     | 721                       | 22          | 885                        | 22          | 1667                      | 22          | 1901                       | 22          | 1663                      | 21          |
| Poorer                      | 707                       | 21          | 849                        | 21          | 1524                      | 20          | 1809                       | 21          | 1550                      | 19          |
| Middle                      | 748                       | 22          | 893                        | 22          | 1556                      | 21          | 1797                       | 20          | 1527                      | 19          |
| Richer                      | 629                       | 19          | 793                        | 19          | 1491                      | 20          | 1694                       | 20          | 1849                      | 23          |
| Richest                     | 541                       | 16          | 683                        | 16          | 1240                      | 17          | 1447                       | 17          | 1382                      | 17          |
| **Education level**         |                           |             |                            |             |                           |             |                            |             |                           |             |
| None                        | 2510                      | 75          | 3051                       | 74          | 4920                      | 66          | 5768                       | 67          | 5233                      | 66          |
| Primary                     | 411                       | 12          | 515                        | 13          | 1079                      | 14          | 1203                       | 14          | 1085                      | 14          |
| Secondary                   | 386                       | 12          | 482                        | 12          | 1374                      | 18          | 1559                       | 18          | 1540                      | 19          |
| Higher                      | 39                        | 01          | 55                         | 01          | 105                       | 01          | 117                        | 01          | 114                       | 01          |
| **Occupation**              |                           |             |                            |             |                           |             |                            |             |                           |             |
| Yes                         | 2577                      | 77          | 3122                       | 77          | 5596                      | 75          | 6476                       | 75          | 5791                      | 73          |
| No                          | 769                       | 23          | 950                        | 23          | 1882                      | 25          | 2148                       | 25          | 2181                      | 27          |
| **Residence**               |                           |             |                            |             |                           |             |                            |             |                           |             |
| Urban                       | 1036                      | 32          | 1183                       | 29          | 2075                      | 28          | 2387                       | 28          | 2586                      | 32          |
| Rural                       | 3238                      | 68          | 2920                       | 71          | 5404                      | 72          | 6260                       | 72          | 5385                      | 68          |
| **Ethnicity**               |                           |             |                            |             |                           |             |                            |             |                           |             |
| Temne, Loko, & Limba        | 1589                      | 48          | 1898                       | 46          | 3283                      | 44          | 3724                       | 43          | 3211                      | 40          |
| Mende, Sherbro & Kono       | 1192                      | 36          | 1512                       | 37          | 3156                      | 42          | 3714                       | 43          | 3460                      | 43          |
| Others Sierra Leonean & Foreign | 565                      | 17          | 687                        | 17          | 1039                      | 14          | 1183                       | 14          | 1300                      | 17          |
| **Religion**                |                           |             |                            |             |                           |             |                            |             |                           |             |
| Christianity                | 636                       | 19          | 794                        | 19          | 1388                      | 19          | 1590                       | 18          | 1581                      | 20          |
| Islam                       | 2667                      | 80          | 3247                       | 79          | 6067                      | 81          | 7005                       | 81          | 6372                      | 80          |
| Others                      | 43                        | 01          | 50                         | 01          | 24                        | 03          | 25                         | 03          | 18                        | 02          |
| **Mother’s age**            |                           |             |                            |             |                           |             |                            |             |                           |             |
| 19–20                       | 270                       | 08          | 330                        | 08          | 751                       | 10          | 859                        | 10          | 824                       | 10          |
| 24–20                       | 664                       | 20          | 804                        | 20          | 1527                      | 20          | 1773                       | 21          | 1683                      | 21          |
| 29–35                       | 953                       | 29          | 1213                       | 30          | 1853                      | 25          | 2142                       | 25          | 1945                      | 24          |
| 34–40                       | 579                       | 17          | 704                        | 17          | 1421                      | 19          | 1644                       | 19          | 1493                      | 19          |
| 39–45                       | 559                       | 17          | 673                        | 16          | 1152                      | 15          | 1354                       | 16          | 1250                      | 16          |
| 40–44                       | 209                       | 06          | 215                        | 06          | 485                       | 07          | 554                        | 06          | 491                       | 06          |
| 45–49                       | 111                       | 03          | 127                        | 03          | 290                       | 04          | 322                        | 04          | 285                       | 04          |
| **Siblings**                |                           |             |                            |             |                           |             |                            |             |                           |             |
| None                        | 707                       | 21          | 871                        | 21          | 1811                      | 24          | 2112                       | 24          | 1948                      | 24          |
| 1–4                         | 1863                      | 56          | 2269                       | 56          | 3631                      | 50          | 4166                       | 49          | 3835                      | 49          |
| >4                          | 776                       | 23          | 96                         | 23          | 2036                      | 26          | 2369                       | 27          | 2188                      | 27          |
line of equality, suggesting that in 2008 there was little wealth related inequality in the number of ANC visits.

Inequality analysis of PNC reviews

Figure 2(a and b) show the unadjusted and adjusted concentration curves respectively for PNC reviews. In comparison with Figs. 1(a and b), unadjusted and adjusted concentration curves in Figs. 2(a and b) demonstrate that PNC reviews were more equally distributed in 2008 than ANC visits and this is evident in the values of concentration indices in 2008 for ANC visits and PNC reviews. Fig. 2(a and b) shows that in 2013, the poorest

| MCH Services          | Distribution | 2008 | 2013 |
|-----------------------|--------------|------|------|
| ANC                   | None         | 8.2% | 2.2% |
|                       | Up to four visits | 41% | 22.6%|
|                       | More than four visits | 51% | 75.2%|
| Institutional delivery| Yes          | 27%  | 57.2%|
|                       | No           | 73%  | 42.8%|
| Postnatal reviews     | Complete     | 8.3% | 41.4%|
|                       | Incomplete   | 91.7%| 58.6%|

Fig. 1a Weighted Unadjusted Concentration Curves for ANC visits in 2008 and 2013 SLDHS. b Weighted adjusted concentration curves for ANC visits in 2008 and 2013 SLDHS
respondents ranked by wealth index utilized more PNC reviews than the richest.

Results of the inequality statistics for ANC visits and PNC reviews in 2008 & 2013 SLDHS are presented in Table 3. The differences in the adjusted concentration indices was statistically significant for ANC (t = 76.80, \( p < 0.001 \)) and PNC (t = 4.84, \( p < 0.001 \)) over the two survey periods.

**Determinants of institutional delivery**

In the 2013 SLDHS, institutional delivery coverage was 57.2% (Table 2), 50.4% among the poorest wealth quintile and 72.2% among the richest wealth quintile (Fig. 3b). Women in the richest wealth quintile were [AOR = 1.75; 95% CI (1.41, 1.78)] more likely to give birth at a health facility compared to women in the poorest wealth quintile (Table 4). The level of inequality in institutional delivery utilization increased, as the overall coverage increased, from a baseline utilization rate of 27% (Table 2). In 2008 SLDHS, the rate of institutional delivery was 18.2% among the poorest wealth quintile and 41.9% among the richest wealth quintile (Fig. 3b). Women in the richer wealth quantile were [AOR = 1.37; 95% CI (1.05, 1.78)] times more likely to birth in a health facility compared to their poorest counterparts (Table 4a).

The proportion of institutional delivery also varied significantly across education levels and residence. In 2008 SLDHS, 69.1% of women with higher than secondary school education had institutional delivery compared to the 22.2% of women with no formal education, representing a 46.9% difference in institutional delivery utilization rate (Fig. 4). Thus, women with higher than secondary school education were [AOR = 3.76; 95% CI (2.04, 6.94)] times more likely to give birth at a health facility compared to women with no formal education (Table 4a). In 2013 SLDHS, the overall coverage for institutional delivery improved for all education levels and the inequality gap narrowed. Women with higher than secondary school
education had 88% institutional delivery rate compared to the 52.1% of those with no formal education, representing a 35.9% difference in institutional delivery utilization rate (Fig. 4). Women with higher than secondary school education in 2013 were [AOR = 3.4; 95% CI (1.89, 6.11)] times more likely to birth at a health facility compared to women with no formal education (Table 4b).

Institutional delivery was lowest among women in rural settings (21.4% & 52.3% in 2008 & 2013 respectively) compared to their counterparts in urban settings (40.9% & 70.3% in 2008 and 2013 respectively) (Fig. 4). Women in rural areas were 32% less likely in 2008 [AOR = 0.68; 95% CI (0.58, 0.80)] and 53% less likely in 2013 [AOR = 0.47 [95% CI (0.37, 0.58)] to give birth at a health facility compared to their counterparts in urban settings (Table 4).

The institutional delivery rate varied significantly across ethnic and religious subgroups of the respondents in both 2008 and 2013 SLDHS. In 2013 SLDHS, women from tribes found predominantly in the North and Western parts of the country (Temne, Loko & Limba). A 13.3% difference in institutional delivery rate in 2008 between tribes in the South and Southeast and those in Northern and Western of the country (Fig. 4b). Women from tribes in the South & South-eastern regions were more likely to birth at a health facility compared to their counterparts from tribes in the Northern & Western parts of the country in 2013 [AOR = 3.08; 95% CI (2.78, 3.42)] and 2008 [AOR = 2.22; 95% CI (1.88, 2.63)] (Table 4).

The percentage point difference between Christian and Muslim women in the utilization rate of institutional delivery was 11.4% in 2008, and this difference increased to 12.8% in 2013 (Fig. 4b). Muslim women in 2013 were 14% less likely [AOR = 0.86; 95% CI (0.76, 0.97)] to deliver at a health facility compared to their Christian counterparts (Table 4a).

We observed a significant difference in the unadjusted (t = 1.80, p = 0.036) and adjusted (t = 1.73, p = 0.042) odds ratios of the richest-poorest subgroups of society with regards to the utilization of institutional delivery in 2008 & 2013 (Table 5). This represents a significant gap in wealth related inequality in institutional delivery utilization between the rich and the poor over the study period.

**Table 3** Test of Significance for Means & Standard Errors Obtained from Convenient Regressions

| Year | Estimate of concentration index | Standard error | Adjusted | Test statistic | P value |
|------|--------------------------------|----------------|----------|----------------|---------|
| 2008 | 0.009612                       | 0.000584       | 10.78    | <0.001         |
| 2013 | 0.002264                       | 0.000351       |          |                |

| Year | Estimate of concentration index | Standard error | Adjusted | Test statistic | P value |
|------|--------------------------------|----------------|----------|----------------|---------|
| 2008 | 0.008331                       | 0.000073       | 76.80    | <0.001         |
| 2013 | -0.002263                      | 0.000030       |          |                |

| Year | Estimate of concentration index | Standard error | Adjusted | Test statistic | P value |
|------|--------------------------------|----------------|----------|----------------|---------|
| 2008 | -0.000386                      | 0.000133       | 6.70     | <0.001         |
| 2013 | -0.001769                      | 0.000158       |          |                |

| Year | Estimate of concentration index | Standard error | Adjusted | Test statistic | P value |
|------|--------------------------------|----------------|----------|----------------|---------|
| 2008 | -0.001732                      | 0.000007       | 4.84     | <0.001         |
| 2013 | -0.001771                      | 0.000004       |          |                |
People tend to utilize the informal healthcare before seeking the formal sector as a form of last resort [40–42] and recent Sierra Leonean studies suggest that pregnant women, lactating mothers and infertile women practice medical pluralism [43–45]. Therefore, that may be the reason why mild to moderate ailments may not warrant PNC reviews utilization within richer households. Our finding is inconsistent with findings in Ghana and other published literature globally [35, 46, 47]. The inconsistency of our finding with the global literature may reflect the unique cultural, political and social context of Sierra Leone. The inconsistency may be due to differences in the data source used and the analytical approaches. For instance, while Ghana shares a similar cultural profile to that of Sierra Leone, the study examining the impact of the free user policy on utilization analyzed data from the Ghana Maternal Health Survey 2007 [48]. The difference in findings may also be reflective of differences in health policy to healthcare delivery design. For example, in Bangladesh [35] user fees were abolished alongside the implementation of a sector wide approach (SWAp), which resulted in the narrowing the gap in wealth-related inequity between the rich and the poor.

We found that wealth-related inequality in the utilization of health facilities for delivery increased over the study period to the disadvantage of the poor. Our
Table 4 Adjusted and Unadjusted Odds Ratios of the Association between Demographic Characteristics of Women Respondents and Institutional Delivery in (a) 2008 SLDHS and (b) 2013 SLDHS

| 2008 SLDHS (a) | 2013 SLDHS (b) |
|----------------|----------------|
| **Background Characteristic** | Adjusted OR (95% CI) | P-value | Unadjusted OR (95% CI) | P-value | Adjusted OR (95% CI) | P-value | Unadjusted OR (95% CI) | P-value |
| **Wealth index** | | | | | | | | |
| Poorest | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Poorer | 1.49 (1.17, 1.89) | 0.001 | 1.44 (1.14, 1.82) | < 0.001 | 1.22 (1.07, 1.40) | 0.004 | 1.07 (0.94, 1.22) | 0.290 |
| Middle | 1.52 (1.19, 1.93) | 0.001 | 1.54 (1.22, 1.94) | < 0.001 | 1.28 (1.11, 1.47) | < 0.001 | 1.07 (0.94, 1.21) | 0.335 |
| Richer | 1.37 (1.05, 1.78) | 0.020 | 1.82 (1.45, 2.30) | < 0.001 | 1.72 (1.47, 2.00) | < 0.001 | 1.68 (1.47, 1.92) | < 0.001 |
| Richest | 1.30 (0.94, 1.80) | 0.115 | 3.24 (2.57, 4.08) | < 0.001 | 1.75 (1.41, 2.17) | < 0.001 | 2.55 (2.20, 2.95) | < 0.001 |
| **Education Level** | | | | | | | | |
| None | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Primary | 1.40 (1.13, 1.75) | 0.002 | 1.78 (1.45, 2.18) | < 0.001 | 1.28 (1.12, 1.47) | < 0.001 | 1.37 (1.21, 1.56) | < 0.001 |
| Secondary | 1.98 (1.56, 2.52) | < 0.001 | 2.90 (2.38, 3.54) | < 0.001 | 1.76 (1.52, 2.03) | < 0.001 | 2.36 (2.09, 2.66) | < 0.001 |
| Higher | 3.76 (2.03, 6.96) | < 0.001 | 7.61 (4.27, 13.55) | < 0.001 | 3.40 (1.89, 6.11) | < 0.001 | 6.80 (3.88, 11.91) | < 0.001 |
| **Occupation** | | | | | | | | |
| No | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Yes | 1.20 (1.00, 1.43) | 0.047 | 0.86 (0.73, 1.01) | 0.066 | 0.72 (0.64, 0.81) | < 0.001 | 0.58 (0.52, 0.64) | < 0.001 |
| **Residence** | | | | | | | | |
| Urban | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Rural | 0.47 (0.38, 0.58) | < 0.001 | 0.39 (0.34, 0.45) | < 0.001 | 0.68 (0.58, 0.80) | < 0.001 | 0.46 (0.42, 0.51) | < 0.001 |
| **Ethnicity** | | | | | | | | |
| Temne, Loko, & Limba | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Mende, Sherbro & Kono | 2.22 (1.88, 2.63) | < 0.001 | 1.98 (1.69, 2.31) | < 0.001 | 3.08 (2.78, 3.41) | < 0.001 | 2.62 (2.39, 2.88) | < 0.001 |
| Others | 1.47 (1.19, 1.82) | < 0.001 | 1.53 (1.25, 1.87) | < 0.001 | 1.62 (1.41, 1.86) | < 0.001 | 1.58 (1.38, 1.80) | < 0.001 |
| **Religion** | | | | | | | | |
| Christianity | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| Islam | 0.87 (0.72, 1.04) | 0.130 | 0.58 (0.49, 0.69) | < 0.001 | 0.86 (0.76, 0.97) | 0.016 | 0.58 (0.52, 0.65) | < 0.001 |
| Others | 0.41 (0.15, 1.11) | 0.079 | 0.17 (0.07, 0.46) | < 0.001 | 0.89 (0.37, 2.12) | 0.791 | 0.56 (0.25, 1.26) | 0.162 |
| **Mother's age** | | | | | | | | |
| 15–19 | 1 | 1 | 1.00 | 0.001 | 1.00 | 0.001 | 1.00 | 0.001 |
| 20–24 | 1.19 (0.88, 1.61) | 0.265 | 1.19 (0.89, 1.58) | 0.249 | 1.09 (0.91, 1.30) | 0.367 | 1.00 (0.84, 1.18) | 0.976 |
| 25–29 | 1.04 (0.77, 1.40) | 0.791 | 0.96 (0.72, 1.26) | 0.749 | 1.25 (1.05, 1.50) | 0.014 | 1.02 (0.87, 1.20) | 0.841 |
| 30–34 | 1.25 (0.91, 1.71) | 0.162 | 1.22 (0.91, 1.64) | 0.179 | 1.03 (0.86, 1.25) | 0.739 | 0.79 (0.67, 0.94) | 0.006 |
| 35–39 | 1.08 (0.78, 1.49) | 0.654 | 0.96 (0.71, 1.29) | 0.775 | 1.06 (0.87, 1.29) | 0.562 | 0.77 (0.64, 0.91) | 0.003 |
finding is consistent with other studies, which reported increasing wealth related inequity in institutional delivery between the poor and the rich. [30–32, 46, 49, 50]. The observed increase in wealth related inequality in utilization of institutional delivery that favors the rich may be a significant pointer to the fact that poor and less educated women view the conventional healthcare setting as a hostile environment that is not culturally sensitive to the needs of women delivering at these institutions. For example, women in rural areas prefer to squat during delivery unlike the lithotomy position promoted in health facilities [51]. Some tribes have specific rituals observed around the time of delivery, such as burial of the placenta by specific family members or its consumption as food, which may not be accommodated in the healthcare setting [52, 53]. Also, women of secret traditional societies do not prefer to be attended to during delivery by women who are not members of these secret societies or worse still by men [54]. The healthcare delivery system may therefore need to re-think its approach and re-evaluate its policies to providing institutional delivery to accommodate the legitimate concerns of women and therefore promote institutional delivery, which is key to reducing the current high maternal and infant mortality in Sierra Leone.

We found that despite an encouraging decrease in home delivery rates from 73% in 2008, the 43% delivery rate in 2013 remains high, which may indicate barriers beyond a policy of free services. Our results showed higher levels of education and urban residence have a relationship to utilization of MCH services, consistent with other evidence [31, 35, 55, 56]. The influence of residence on inequality in the utilization of MCH services may be due to the availability of more health facilities in urban settings than in rural settings [57]. In addition, rural health facilities are usually understaffed and this may serve as a disincentive to seeking MCH services in rural residences [58]. Tackling such inequitable distribution of health facilities and addressing the human resource for health gap is a fundamental goal in the free health care initiative [13]. Residents in rural settings hold strong cultural beliefs that limit their seeking of institutional delivery such as that labor is a normal process that can only requires hospitalization and surgery for weak women or those who have invited a curse upon themselves [59].

### Policy and practice implications

FHCI has been successful at increasing utilization of MCH services over time, but the serious gaps in equity of utilization of services across different wealth quintiles remain problematic. In addition, the increase in inequality of utilization of facility-based delivery services, a factor with strong correlation to maternal mortality [49], among the poorest women, warrants immediate action to ensure that policies are benefitting all levels of society in order to achieve universal health coverage. In order for Sierra Leone to meet its commitment to achieving SDG3, a review of the implementation strategies supporting the FHCI with specific reference to equity is required. Such a review should include consideration of implementation approaches to address specific equity gaps. Bangladesh has shown that a sector-wide approach (SWAp) that harnesses the significant inputs of other sectors such as agriculture, infrastructure, education, and traditional leadership, has promise [35]. Such an adaption of “Health in all Policy” approach allows for developments in the agricultural sector to enhance the rural incomes, thus helping to address indirect costs of accessing free services [60]. Interventions that address quality of care in relation to delivery services, with a specific focus on accommodating social and cultural preferences of the poorest women, should be considered. Similarly, investments in, strategic deployment of, and retention of human resources for health in rural and remote communities is needed to create a more balanced and fair of services. Finally, strategies to understand and target services preferences, health promotion needs, and other barriers to accessing institutional delivery services for the poorest, uneducated, and/or rural women and their families should be reviewed.

### Limitations

Our study has several limitations. Our methods limit our ability to attribute causality in the changes in MCH

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### Table 4 Adjusted and Unadjusted Odds Ratios of the Association between Demographic Characteristics of Women Respondents and Institutional Delivery in (a) 2008 SLDHS and (b) 2013 SLDHS (Continued)

| Background Characteristic | 2008 SLDHS (a) | 2013 SLDHS (b) |
|---------------------------|----------------|----------------|
|                           | Adjusted OR (95% CI) | P-value | Unadjusted OR (95% CI) | P-value |
|                           | 1.02 (0.99, 1.05) | 0.119 | 1.02 (0.99, 1.05) | 0.235 |
|                           | 1.05 (0.83, 1.33) | 0.404 | 0.71 (0.57, 0.88) | 0.002 |
|                           | 0.80 (0.60, 1.06) | 0.116 | 0.60 (0.46, 0.78) | < 0.001 |
| Number of children        | 0.99 (0.66, 1.49) | 0.950 | 0.85 (0.58, 1.25) | 0.040 |
|                           | 0.96 (0.57, 1.64) | 0.883 | 0.67 (0.40, 1.11) | 0.116 |
|                           | 0.702 | 1.02 (0.99, 1.05) | 0.235 |
utilization and distribution across wealth quintiles over time to FHCI. The lack of a comparison group means that this study cannot rule out the contribution of other factors to the recorded incremental changes in the utilization of MCH services. Recall bias on events that happened within the 5 years prior to each survey is another limitation. The inclusion of only women who gave birth to their last child in the 5 years prior to each survey may have reduced the number of eligible women from the richest wealth quintile who are known to be less willing to give birth to more kids. This effect is however expected to be minimal and is counteracted by the exclusion of women whose children died within the first 2 months.

Table 5 Test of Equality of the Odds Ratios obtained from Binomial Logistic Regression

| Institutional Delivery* | Unadjusted | | Adjusted | |
|-------------------------|------------|--------|----------|--------|
| Year                    | 2008       | 2013   | Test statistic | P value |
| Rich-poor odds ratio    | 3.24       | 2.55   | 1.80     | 0.03593 |
| Standard error of the odds ratio | 0.340 | 0.177 | |
| Year                    | 2008       | 2013   | Test statistic | P value |
| Rich-poor odds ratio    | 1.3        | 1.75   | 1.73     | 0.04182 |
| Standard error of the odds ratio | 0.186 | 0.173 | |

*aAll values were obtained at a 95% confidence interval

Fig. 4 a Weight adjusted proportion of institutional delivery in 2008 and 2013 by Education level and Residence. b Weight adjusted proportion of institutional delivery in 2008 and 2013 by Ethnicity and Religion
for PNC reviews since infant mortality is more common among the poor. However, this study may be one of the first in Sierra Leone to utilize the DHS in the evaluation of the impact of FHCI on inequity of MCH services across wealth quintiles.

**Conclusion**

Although it is difficult to draw a conclusive causal link between the increase in the utilization rate of the selected MCH services and the free healthcare initiative, it appears that the initiative is at the least not pro-rich for ANC visits and PNC reviews. Steps need to be taken to address the growing wealth related inequality to the disadvantage of the poor that accompanies the overall increase in institutional delivery rate. Pronounced level of inequality in institutional delivery was also linked with women level of education and residence, revealing that women with no formal education or residents in rural settings were the most underserved subpopulations. It is obvious that in addition to wealth differences, other sociodemographic characteristics like education level, residence, ethnicity, and religion contribute to the existing inequities. Promoting the education level of women and increasing the number of qualified staff at health facilities in rural settings, and ensuring culturally sensitive, quality care should be prioritized to improve the odds against socioeconomically disadvantaged women.

**Additional files**

Additional file 1: Number of women interviewed and included in the final analysis in the 2008 and 2013 SLDHS. An algorithm of the number of women interviewed and included in the final analysis for antenatal care (ANC), postnatal care (PNC) and place of delivery (PLOD) in the 2008 and 2013 SLDHS. (DOCX 42 kb)

Additional file 2: Dependent variables. Operational definitions of the dependent variables. (DOCX 14 kb)

Additional file 3: Independent variables. Operational definitions of the independent variables. (DOCX 15 kb)

**Abbreviations**

ANC: Antenatal care; FHCI: Free healthcare initiative; MCH: Maternal child health; MDG: Millennium development goals; PLOD: Place of delivery; PNC: Postnatal care; SDG: Sustainable development goals; SLDHS: Sierra Leone Demography Health survey; SWAp: Sector wide approach.

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**Authors’ contributions**

MBJ and AS contributed to the study conceptualization, MBI, AS, AJB & PBJ contributed in developing the study design. MBI analysed the data and wrote the first draft of the manuscript. AJB, PBJ, KH, SS and AS contributed to the intellectual content of the manuscript. All authors read and approved the final version of the manuscript.

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**Availability of data and materials**

The dataset for this study can be access from the DHS program-ICF International, Rockville, data after the submission of a written request. It is available at https://dhsprogram.com/data/available-datasets.cfm.

**Ethics approval and consent to participate**

Access to the dataset was granted by the DHS program-ICF International, Rockville, the USA after the submission of a written request through their online platform and a waiver was granted by the Sierra Leone Ethics and Scientific Review Committee since this is a secondary data analysis study. Written informed consent was obtained from all participants at the time the two surveys were conducted.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

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