Use of maternal and reproductive health interventions in Sierra Leone

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Abstract

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Abstract

Access to, and use of, maternal and reproductive health services is crucial for human development, especially in developing regions. However, inequality remains a persistent problem for many developing countries. Study used Sierra Leone Demographic and Health Surveys data in 2008-2013. Five maternal and reproductive health indicators were selected for this study, including: four or more antenatal care visits, skilled antenatal care provider, births delivered in a facility, births assisted by a skilled birth attendant, and any method of contraception. The study measured differentials over the two periods, and decomposed it to measure the contribution of the selected circumstance variables to inequality. Inequalities declined over time, as shown by the decrease in the dissimilarity index. Due to the drop in the dissimilarity index, the Human Opportunity Index (HOI) increased for all the selected maternal and reproductive health indicators. Overall, study found that household wealth status, maternal education, and place of residence, are the most important factors contributing to the inequality in the use of maternal and reproductive health services. Even though there are improvements in inequalities over time, there are variations in the way in which inequality within the different indicators has improved. In order to improve the use of maternal and reproductive health services, and to reduce inequalities in these services, the government will have to invest in: (i) increasing the educational levels of women, (ii) improving the standard of living, as well (iii) bringing maternal and reproductive health services closer to rural populations.

Keywords: Maternal and reproductive health services, inequality of opportunity, human opportunity index, dissimilarity index, Shapley decomposition

Background

Poor countries (such as Sierra Leone) tend to have poor health outcomes, whereby the majority of the population, such as the poorest populations (often in rural areas),

cannot access lifesaving health services (Peters et al., 2008). Sierra Leone is among the countries with very high maternal mortality ratios (MMR) in the world (Statistics Sierra Leone and ICF International, 2014). The high MMR does not come as a surprise since this country has faced many political conflicts over the years. These conflicts have worsened the socioeconomic and demographic outlook of all citizens in the country. It is well-known that poor countries, particularly those countries with a tense political climate, tend to have negative health outcomes, where the majority of the population cannot access lifesaving health services (Peters et al., 2008). Therefore, the advancement of women's maternal and reproductive health rights remains crucial in the fight against high MMR in developing countries. Furthermore, over the last few decades, many researchers have delved into research aimed at unearthing factors that determine health inequalities in many societies. Health inequality is a common phrase used to label disparities in health among populations (Kawachi et al., 2002). Evidence-based research into many aspects of health inequalities has provided policy-makers and other relevant stakeholders with means of understanding and placing measures that seek to reduce such inequalities.

Sierra Leone faces various developmental challenges, which can exacerbate the current healthcare situation. Access to, and use of, maternal and reproductive health services is crucial for human development (Axelson et al., 2012). Studies have found that investing in Reproductive, Maternal, Newborn, and Child Health (RMNCH) drastically improves maternal mortality rates (Regassa, 2011; Susuman, 2012; Pell et al, 2013). In Sierra Leone, there are variations in the uptake of maternal and reproductive health interventions; findings from the 2008 and 2013 suggest that the use of these health interventions has been on the rise, but with varying levels. For instance, the use of four or more antenatal visits increased by 19.9 percentage points (from 56.1% to 76.0%, in 2008 and 2013 respectively), and the use of facility-based delivery services increased by 29.6 percentage points, from 25.3% to 59.7%, in 2008 and 2013 respectively (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014).

These variations may be due to some levels of inequality across health interventions. Inequality remains a persistent problem for many developing countries. Therefore, studying inequalities in access to, and use of, maternal and reproductive health interventions is important, especially with regard to uncovering the main drivers of such inequalities. However, we have not found empirical studies, which have examined inequalities in maternal and reproductive health in Sierra Leone. In order to address this gap, we examined the extent to which inequalities are related to the socio-economic factors.

There are various measures of health inequalities, which have been brought forward. The various measures of health inequalities allow researchers to make certain conclusions based on the chosen measure as well as the study's research questions and objectives. For this study, we adopt the health opportunity approach, specifically the Human Opportunity Index (HOI). This approach takes into consideration the correlates of inequalities, the life circumstances of individuals as well as the efforts in examining and explaining health inequalities (de Barros et al. 2009; Ersado and Aran, 2014). The literature suggests that the health opportunity approach provides informative findings, which are good when it comes to informing health policies geared towards reducing health inequalities (Sanoussi, 2017). Therefore, using the HOI, this study has two objectives: (a) to examine the prevalence of maternal reproductive health services as well as the share of inequality of opportunity among these services, taking into consideration the selected circumstances, and (b) to estimate the contribution of the selected circumstances to unequal opportunities. With this study, we aim to contribute to the literature by closing the gap with regard to inequality of opportunity studies in Sierra Leone.

Data and methods

Data sources

We used data collected from the Sierra Leone Demographic and Health Surveys (DHS) in 2008 and 2013. The Demographic and Health Surveys collect comparable

and nationally representative data on various health and socio-demographic factors. Literature related to studies that have used secondary data from various Demographic and Health Surveys to analyse trends, determinants, and inequalities in maternal, child, and reproductive health interventions as well as service coverage exists (Boutayeb and Helmert, 2011; Sanoussi, 2017). The Sierra Leone Demographic and Health Surveys used nationally representative sampling techniques to sample 7 758 households in 2008 and 13 006 households in 2013, with response rates of 98% and 99% respectively (Statistics Sierra Leone and ICF Macro, 2009; Statistics Sierra Leone and ICF International, 2014). For both data collection periods, women of reproductive age (15-49 years) who were present in the household on the night before the survey were eligible to be interviewed.

Selected indicators

The following indicators were selected for this study, use of: (i) four or more antenatal care visits (*percentage of women with four or more antenatal care visits for their most recent pregnancy*), (ii) skilled antenatal care provider (*percentage of women whose antenatal visits were attended by a skilled provider*), (iii) births delivered in a facility (*percentage of births that were delivered in a facility*), (iv) births assisted by a skilled birth attendant, (*percentage of births that were assisted by a skilled birth attendant, such as doctor/nurse/midwife and MCH Aide*), and (v) any method of contraception, (*percentage of women, in union, using any method of contraception*). We dichotomised all the selected indicators, where zero represented non-use and one represented use of the indicator. In order to examine inequalities in family planning, we considered the use of contraceptive services by women who are in union (married or cohabiting). We considered these indicators as opportunities in the analysis of the Human Opportunity Index. We removed 'missing' and/or 'do not know' cases from all of the selected indicators.

Human Opportunity Index

We selected nine circumstance variables to examine inequality of opportunity in the use of maternal and reproductive health interventions in Sierra Leone. These

variables include: (i) maternal age, (ii) marital status, (iii) maternal education, (iv) media saturation (access radio, television, and newspaper at least once a week), (v) household wealth, (vi) number of living children, (vii) number of household members, (viii) place of residence, and (ix) region. As part of our analyses, using each of our indicators, we calculated the human opportunity as well as the dissimilarity indices in order to measure inequality of opportunity based on methodologies applied by previous studies (de Barros et al., 2009; Yalonetzky, 2009). The Human Opportunity Index calculates the coverage rate of a certain indicator and adjusts it by how equally distributed this indicator is across the selected circumstances (Ersado and Aran, 2014). The formula for the Human Opportunity Index is as follows:

$$HOI = \overline{p}(1 - D)$$

Where D denotes the dissimilarity index, which measures the inequality in the rates of maternal and reproductive health services use defined by the selected circumstances, and compared with the average use rate to the same service for the population as a whole (de Barros et al. 2009; Ersado and Aran, 2014). The coverage rate, denoted by $\overline{p}$, allows for computation using household survey data (Ersado and Aran, 2014). Moreover, Ersado and Aran (2014) state that if the use of health services is independent of the circumstances, then $(1 - D)$ will be equal to one, and HOI will have the same value as $\overline{p}$. Therefore, the dissimilarity index is computed as follows:

$$D = \frac{1}{2p}\left(\sum_{k=1}^{m}\alpha_k \mid \overline{p} - p_k \mid \right)$$

where k denotes the group of circumstances; p_k denotes the average coverage rate of group k; α_k denotes the share of group k in total population of children; and

m denotes the numbers of disjoint groups defined by circumstances (Ersado and Aran, 2014). When the coverage rate is the same as the average coverage rate for all circumstance groups, the dissimilarity index is equal to zero (Ersado and Aran, 2014). The dissimilarity index is the proportions of the opportunities which needs to be shifted, based on the selected circumstances, to ensure equality in the use of such opportunities (Sanoussi, 2017). Therefore, the dissimilarity index ranges from 0 to 1 (when considering a percentage, the 0 to 100), and it is equal to zero when there is perfect equality (Ersado and Aran, 2014).

Changes in HOI

We also examined changes in inequality of opportunity between the two data points (2008 and 2013). We decomposed the changes in the human opportunity index, between 2008 and 2013, by scale and distribution effects in order to understand the drivers of the estimated change over time (de Barros et al., 2009; Sanoussi, 2017). Therefore, a change in the human opportunity index can be seen either as a characteristic of a difference in the coverage rate (scale effect), or difference in the index of inequality of opportunity (distribution effect):

Variation of HOI: $HOI^{final} - HOI^{initial} = \Delta \bar{p} + \Delta D$

Scale effect: $Scale_n = C_A \left(1 - Đ_B\right) - C_B \left(1 - Đ_B\right)$

Distribution effect: $Distribution_n = C_A \left(1 - Đ_A\right) - C_A \left(1 - Đ_B\right)$

where C_A is the coverage rate in 2013 and C_B is the coverage rate in 2008. $Đ_A$ denotes the dissimilarity index in 2013 and $Đ_B$ denotes the dissimilarity index in 2008.

Decomposition of the dissimilarity index

We decompose the contribution of each circumstance variable to inequality of opportunity using the Shapley decomposition procedure (Ersado and Aran, 2014). This procedure examines the marginal contribution of each circumstance to inequality in the uptake of maternal and reproductive health services (Amara and Jemmali, 2017). The assumption is that the human opportunity index relies on a set of circumstances, and adding other circumstances to these tends to increase the value of the dissimilarity index (Amara and Jemmali, 2017; Sanoussi, 2017). The formula used to compute the impact of adding a circumstance (A) is given by the following formula:

$$D_A = \sum_{S \subseteq N \backslash \{N\}} \frac{|s|!(n-|s|-1)!}{n!} \Big[D\big(S \cup \{A\}\big) - D(S) \Big]$$

where N denotes the overall number of circumstances, and n denotes the number of selected circumstances in N (Amara and Jemmali, 2017; Sanoussi, 2017). Moreover, s denotes the subset of N circumstances without A (Amara and Jemmali, 2017; Sanoussi, 2017). $D(S)$ denotes the dissimilarity index estimated using a set of circumstances S and $D\big(S \cup \{A\}\big)$ denotes the estimated dissimilarity index based on a set of circumstances S as well as circumstance A (Amara and Jemmali, 2017). We then used the Shapley decomposition procedure, to examine the contribution of the omitted circumstance (A) to the dissimilarity index by using the following formula:

$$M_A = \frac{D_A}{D(N)}, \text{ where } \sum_{i \in N} M_i = 1$$

Using the Shapley decomposition, the sum of contributions of all the selected circumstances adds up to 100%. We used the *hoi* and *hoishapley* commands in Stata to examine and decompose health inequalities in maternal and reproductive

health services (Azevedo et al, 2010; Suarez, 2013). We analysed the data using Stata version 14 and Microsoft Excel.

Ethical considerations

We conducted all analyses using publicly available data from the Sierra Leone Demographic and Health Surveys. The Institutional Review Board of Macro International, Inc. reviewed and approved the collection of data for both periods of the Sierra Leone Demographic and Health Surveys. The authors submitted a request for the use of this data to the DHS Program and permission was granted to download and use the data as per the request.

Results

Table 1 presents findings based on the coverage, dissimilarity index, and HOI by selected maternal and reproductive health indicators. The coverage rates show an increase in the use of all selected maternal and reproductive health services. Use of delivery services (births delivered in a facility and births assisted by a skilled birth attendant) and contraception remains low in the country, even though births delivered in a health facility had the highest percentage point increase between 2008 and 2013. This is an impressive development over five-year period. Moreover, the dissimilarity index (D-Index) dropped across all selected maternal and reproductive health indicators. For instance, the dissimilarity index among women who attended four or more antenatal care visits decreased from 6.3% to 1.6%, and from 2.8% to 0.7% among women who reported that they used a skilled antenatal care provider during their previous pregnancy in the five years preceding the survey. The low dissimilarity index shows that antenatal services are more equitable compared to the other selected services. Furthermore, relatively higher D-indices were found for the following health services births delivered in a facility, births assisted by a skilled birth attendant, and use of any method of contraception, indicating higher inequalities in the use of these services.

Due to the drop in the D-index, the HOI increased for all the selected maternal and reproductive health indicators. The highest HOI was found among women who attended antenatal services provided by a skilled provider, and the lowest was found among women who reported use of any method of contraception. The low HOI is indicative of the low use of contraception among women in the country. In 2013, 13,3% of the use of contraception in Sierra Leone was distributed inequitably among women of reproductive age. This HOI value was much lower for the same service in 2008. In contrast, the high HOI value for antenatal services indicates high use of these services among women of reproductive age. For instance, in 2013, 96,4% of skilled antenatal care provider use, and 85,9% of four or more antenatal visits, were available and equitably allocated. The use of skilled birth attendants showed the highest penalty, opportunities that were incorrectly allocated, between 7% and 6% in 2008 and 2013 respectively.

Figure 1-3 show changes in the HOI using various measures, as outlined above. Figure 1 particularly shows the variations in the coverage rate of the selected maternal and reproductive health indicators; this variation estimates the number of opportunities present in a given society, which are allocated based on the principle of equal opportunity. As mentioned above, the coverage rates, for all the selected maternal and reproductive health indicators, increased between 2008 and 2013. There was an increase of 29.3 percentage points in the HOI for the use of any method of contraception, and the lowest increase, of 17% percentage points in the HOI was for the use of any method of contraception. Use of four or more antenatal visits also increased by over 20 percentage points in the HOI.

The increase in the use of maternal and reproductive health services is explained by the combined effect (Figure 2) of an increase in the coverage rate and an increase in the HOI. For instance, the scale effect explains 83% of the increase in the use of skilled antenatal services and facility-based deliveries. Moreover, the scale effect explains about 67% (the lowest) of the increase in the use of any method of contraception. Furthermore, 32.8% of the increase in the use of nay method of contraception, and about 17% in the use of skilled antenatal services and facility-

based deliveries, was due to changes in the distribution of circumstances. (Figure 3).

The contribution of each variable of circumstance variable to the inequality opportunity is presented in Table 2. The decomposition of the dissimilarity index indicates that the household wealth status, maternal education, and residence, are most important factors contributing to the inequality in the use of maternal and reproductive health services. The findings show certain variations in the contributions of these variables to inequality. For instance, in 2013, maternal age had the second highest contribution (24.8%) to the inequality in the use of skilled antenatal services, whereas in 2008 maternal age contributed just only 6.0% to inequality in the use of this service. The contribution of maternal education to inequalities in the use of four or more antenatal visits, skilled antenatal services and facility-based deliveries increased between 2008 and 2013. The contribution of household wealth to inequalities in the use of facility-based deliveries increased between 2008 and 2013, whereas it decreased for other indicators. Moreover, the contribution of household wealth to inequalities in the use of any method of increased between 2008 and 2013. Overall, all the selected circumstance variables made an important contribution to maternal and reproductive health inequalities. For instance, the number of living children was seen as an important contributor to inequalities in maternal and reproductive health services.

Discussion

The findings show that inequality of opportunity declined for all the selected maternal and reproductive health services between 2008 and 2013. Generally, the use of maternal and reproductive health services has increased over time, as shown by the higher coverage rates in 2013 compared to 2008 across all the selected maternal and reproductive health interventions. The changes in the coverage rate also brought about changes in the dissimilarity index as well as the HOI. Using the HOI, the findings showed that antenatal services were available and equitably allocated in Sierra Leone. Moreover, antenatal services (four or more antenatal visits and skilled antenatal services) are closer to equality compared to the other

selected services. However, the HOI was low for the use of any method of contraception, indicating that there is a lot that needs to be done to increase the uptake of contraceptive services in the country. With regard to the changes in HOI over time, we found that, in general, there was an increase in the contribution of all the selected circumstance variables over the period between 2008 and 2013. Overall, the scale and distribution effects positively affected the rate of maternal and reproductive health service use.

Furthermore, we found that household wealth status, maternal education, and place of residence, are the most important factors contributing to the inequality in the use of maternal and reproductive health services. From the few studies that have been conducted using the HOI, our findings echoed those studies, which found that geographical location (region and residence), educational level of parents, as well as household wealth status significantly influence health inequality (Collin et al., 2007; Zere et al., 2010; Axelson et al., 2012; Hajizadeh et al., 2014; Bobo et al., 2017). Interestingly, over 60% of the Sierra Leonean population lives in rural areas (Weekes and Bah, 2017), hence place of residence is among the main contributors to inequality. Moreover, the contribution of these factors (or circumstance variables) to inequality increased over time for certain opportunity indicators. Overall, other apart from the circumstance variables mentioned above, all the selected circumstance variables had a particular contribution to the inequality in the use of maternal and reproductive health services.

Limitations

We used cross-sectional data from the Sierra Leone Demographic and Health Surveys. Therefore, this data is subjected to limitations related to cross-sectional surveys, whereby one cannot establish causality among variables. Moreover, the data may also be subjected to recall bias, where respondents have to report of past events (usually up to the five years preceding the survey), especially with regard to

the use maternal and reproductive health services. Furthermore, the selected list of circumstances used in computing the HOI for a given opportunity is important for the measure. Therefore, the limitation is that the HOI is estimated for a specified list of circumstances and if this list changes, then the estimation of inequality and HOI changes. Nonetheless, even though the HOI of a given opportunity is dependent on the number of circumstances used to compute it, it does not necessarily become higher when more circumstances are added to the selected list of circumstances set.

Conclusion

The findings suggest that there has been improvements in the use of maternal and reproductive health services, and a reduction in inequality of these services over time. Even though there are improvements, there are variations in the way in which inequality within these indicators has improved. For instance, antenatal services have had the most considerable improvement in inequalities and have moved closer to equality than the other selected services. There is a need for further improvements in order to reduce inequalities in the use of other services (such as delivery and contraceptive services). The decomposition analysis showed that socioeconomic (maternal education and household wealth) and geographical (place of residence) indicators explained most of the inequalities in maternal and reproductive services in Sierra Leone. Therefore, to improve the use of maternal and reproductive health services, and reduce inequalities in these services, the government will have to invest in maternal education, improving the standard of living, as well bringing maternal and reproductive health services closer to the people, especially those in rural area.

Abbreviations/acronyms

ANC: Antenatal care; DHS: Demographic and Health Survey; D-Index: dissimilarity index; HOI: Human Opportunity Index; SBA: Skilled birth attendant

Acknowledgements

Competing interests

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Table 1: Distribution of the coverage, dissimilarity index and HOI by maternal and reproductive health services

| Health indicator	Survey year	Coverage	D-Index	HOI
Four or more antenatal care visits	2008	68.1	6.3	63.8
	2013	87.3	1.6	85.9
Skilled antenatal care provider	2008	86.9	2.8	84.5
	2013	97.1	0.7	96.4
Births delivered in a facility	2008	25.3	18.0	20.7
	2013	54.9	8.9	50.0
Births assisted by a skilled birth attendant	2008	42.4	17.1	35.2
	2013	59.7	10.2	53.6
Any method of contraception	2008	8.2	36.0	5.3
	2013	16.6	20.1	13.3

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Table 2: Shapley decomposition of the contribution of circumstance variables to indicators of the use of maternal and reproductive health services

| Variable	4+ ANC visits		Skilled ANC		Facility births		SBA		Contraception	
	2008	2013	2008	2013	2008	2013	2008	2013	2008	2013
Age	0.7	6.3	6.0	24.8	1.8	4.9	1.4	5.6	5.1	4.6
Marital status	2.1	2.4	2.0	4.7	1.2	2.7	1.3	2.2	0.1	2.4
Education	21.2	29.3	24.2	32.6	24.9	25.9	22.6	21.1	17.8	15.3
Wealth	24.9	22.4	26.9	15.2	14.4	17.3	21.6	24.3	23.4	21.3
Media	1.3	0.9	1.0	0.7	1.4	1.3	1.0	1.1	1.3	1.2
# of living children	1.4	4.9	1.6	9.4	7.5	8.5	3.8	7.9	13.8	21.4
# of members	5.1	3.3	0.1	1.3	3.9	6.5	2.4	5.2	1.4	0.6
Residence	30.9	26.4	29.1	9.7	36.9	26.8	37.3	30.4	19.4	25.6
Region	12.5	4.2	9.0	1.6	8.0	6.0	8.6	2.4	17.8	7.5

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

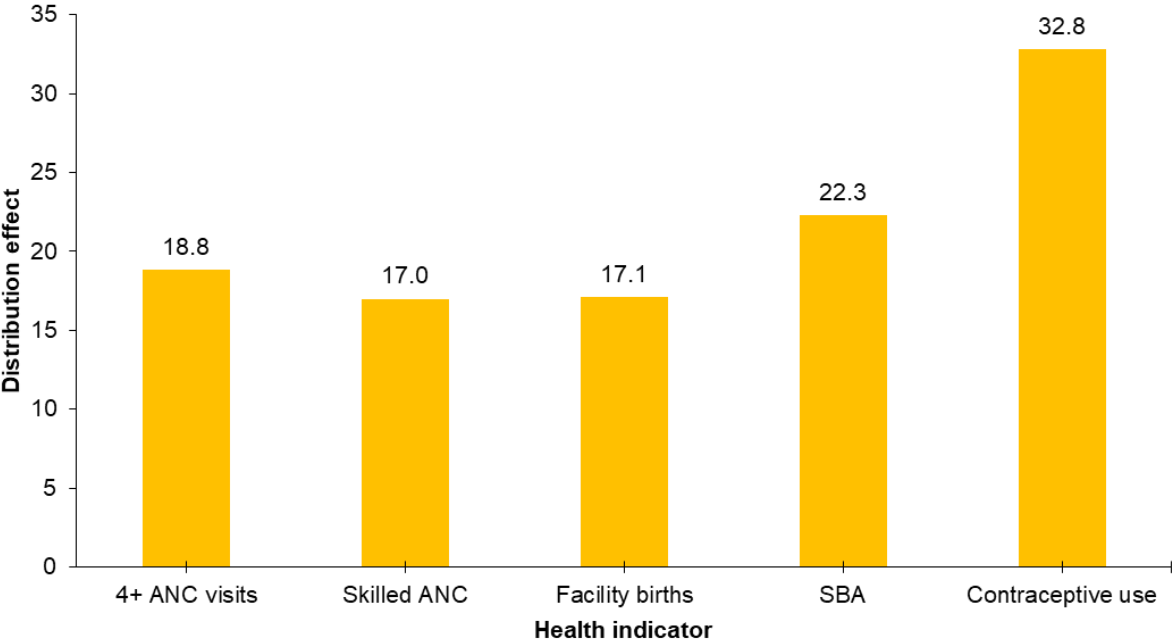Figure 1: Variation of the HOI between 2008 and 2013
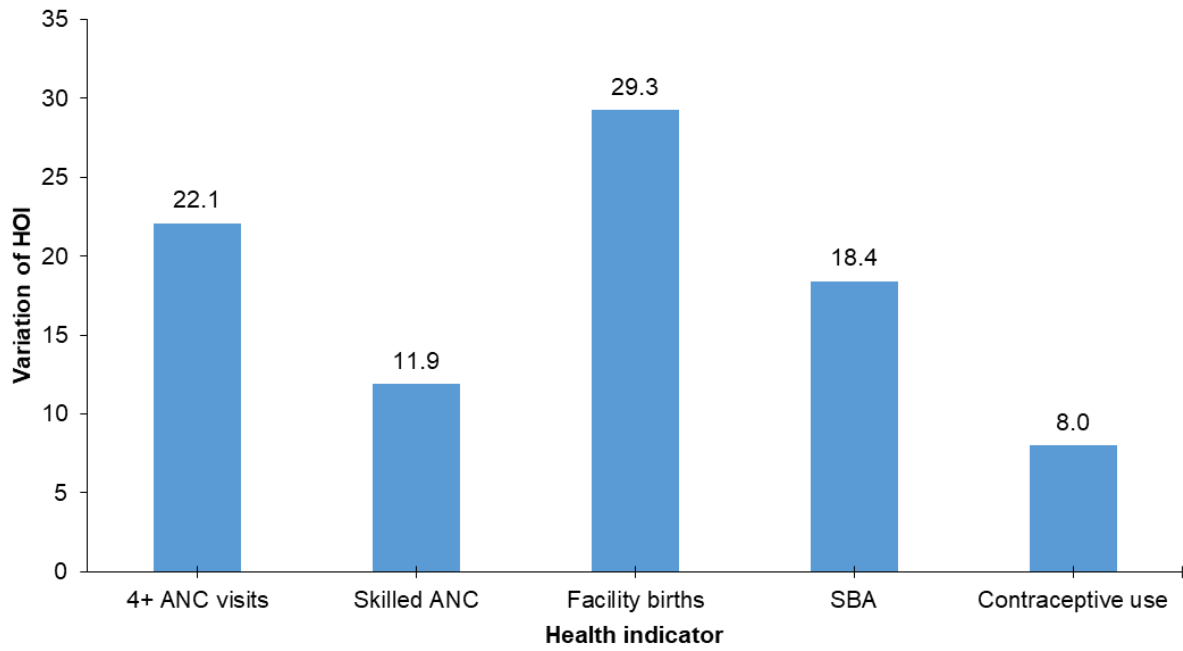
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 2: Decomposition of the HOI in terms of scale effects
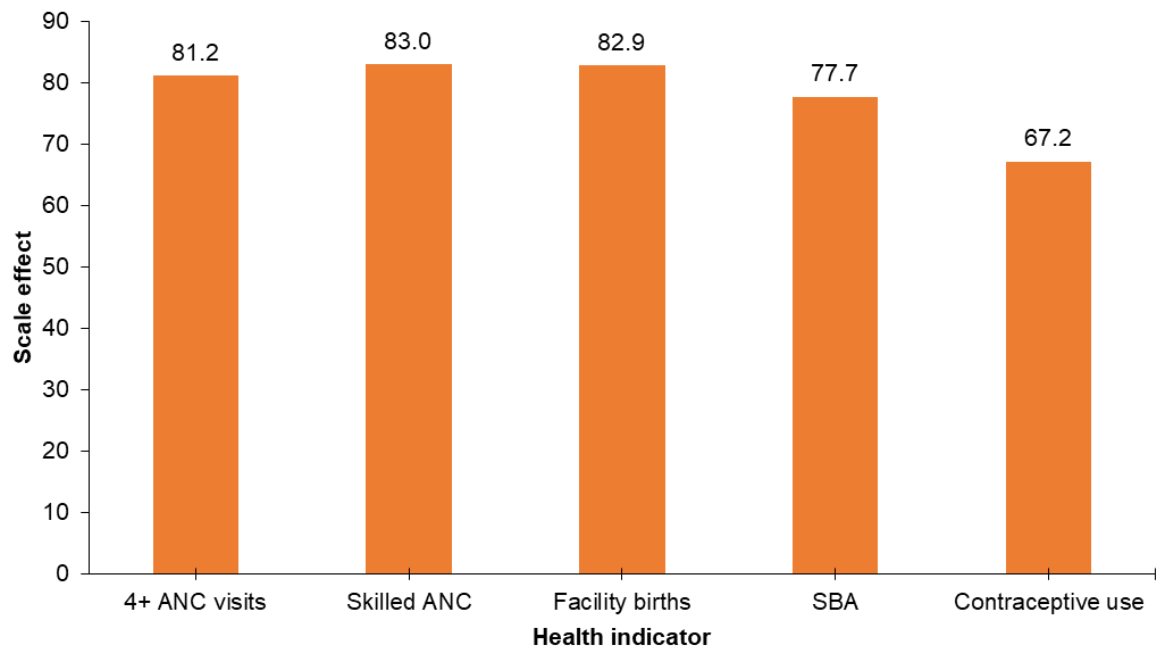
Source: Author's computations from Sierra Leone DHS data, 2008 and 2013

Figure 3: Decomposition of the HOI in terms of distribution effects

Source: Author's computations from Sierra Leone DHS data, 2008 and 2013