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Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: a national cross-sectional survey

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3 **1 Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: a national**
4 **2 cross-sectional survey**

5
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56 27 **Abstract**

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4 28 **Introduction:** Understanding the context specific correlates of skilled birth attendance (SBA) in
5 29 urban and rural areas is key to designing relevant strategies and programs. This analysis aimed to
6 30 assess for the rural-urban correlates of SBA in Sierra Leone.

8 31 **Methods:** Using data from the 2019 Sierra Leone Demographic and Health Survey (SLDHS)
9 32 that applied multistage stratified sampling, a total of 7,326 women aged 15–49 who had a live
10 33 birth within five years preceding the survey were eligible for the analysis. Multivariable logistic
11 34 regression was done.

15 35 **Results:** SBA was higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95%
16 36 CI: 83.8-85.9) in rural areas. Rural women resident in the Southern, Northern and Eastern
17 37 regions, with post-primary education (aOR = 1.80; 95% CI 1.30 to 2.48), exposure to mass
18 38 media (aOR = 1.48; 95% CI 1.13 to 1.94), not having difficulties with distance to the nearest
19 39 health facility (aOR = 2.25; 95% CI 1.68 to 3.02) were associated with higher odds of SBA.
20 40 Urban women resident in the Southern, Eastern region, with households having less than seven
21 41 members (aOR = 1.53; 95% CI 1.01 to 2.34), exposure to mass media (aOR = 1.76; 95% CI 1.08
22 42 to 2.86) and not having difficulties with distance to the nearest health facility (aOR = 1.61; 95%
23 43 CI 1.04 to 2.48) were associated with higher odds of SBA.

24 44 **Conclusion:** Region, mass media exposure and distance to the nearest health facility were
25 45 significantly associated with SBA among both rural and urban women. Household size was only
26 46 significantly associated with SBA in urban areas while being visited by a fieldworker, level of
27 47 education and timing of ANC initiation were only significant in rural areas. Given the observed
28 48 differences, improving SBA requires context-specific tailored approaches and strategies
29 49 including targeting mechanisms that have to be designed differently.

30 50

31 51 **Keywords:** Skilled birth attendance, Sierra Leone, Rural-Urban, Women, DHS

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58 **Strengths and limitations of the study**

- 59 ➤ This is the foremost nationwide analysis that explores the rural-urban correlates of skilled
60 birth attendance in Sierra Leone
- 61 ➤ The study used a nationally representative sample using the most recent Sierra Leone
62 Demographic and Health Survey (SLDHS) 2019 data, making the findings of the present
63 study generalisable for women in Sierra Leone.
- 64 ➤ The temporal relationship between the outcome variable and the independent variables
65 could not be established due to the cross-sectional nature of the survey.
- 66 ➤ Since the data was collected from women who had childbirths within five years
67 preceding the survey, we anticipate recall bias in the process of collecting this data
68 among the respondents.
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84 Introduction

85 Globally, over 34% of deliveries are not supervised by a skilled birth attendant, which is over 45
86 million births each year [1]. Sub-Saharan Africa has registered significant progress with skilled
87 birth attendance, but over 50% of births are still supervised by unskilled health personnel [1].
88 About 303,000 maternal deaths are registered annually with ninety-nine percent of these
89 occurring in low- and middle-income countries [2]. Skilled birth attendance (SBA) is a proven
90 evidence based intervention for reducing maternal and neonatal morbidity and mortality [3].
91 Skilled birth attendance can reduce the possibility of death owing to intrapartum-related
92 complications or stillbirth by up to 20% [4]. Therefore, ensuring increased utilisation of SBA can
93 substantially contribute towards achievement of the Sustainable Development Goal (SDG) 3 that
94 aims at reducing MMR to 70 per 100, 000 and neonatal mortality ratio (NMR) of ≤ 12 per 1,000
95 live births by 2030 [4, 5]. A skilled birth attendant is “an accredited health professional such as a
96 midwife, doctor, or nurse who have been trained with adequate skills needed to handle
97 uncomplicated pregnancies, childbirth, and the immediate postnatal period, and in the
98 identification, management, and referral of complications in women and newborns” [4].

99 Besides the women losing their lives, effects of maternal mortality and morbidity are also
100 experienced by their families and communities [6]. Children who lose their mothers have an
101 increased risk of death or other health challenges such as malnutrition and the society loses
102 resources when women die in their most productive years [6]. In Sierra Leone, pregnancy carries
103 an approximate lifetime risk of maternal mortality of 1 in 17 making it among the highest
104 globally [4]. Despite the government’s efforts to improve maternal health with approaches such
105 as Free Health Care Initiative (FHCI) in 2010 that exempted user fees for maternal healthcare
106 services [7], much has not been achieved, as Sierra Leone is among the top three countries with
107 the highest maternal mortality ratio (MMR), globally [4, 8].

108 Although disparities in the levels of utilisation of SBA between urban and rural women in Sierra
109 Leone have been documented [4, 9], information on factors responsible for these differences has
110 not been adequately explored. Therefore, it is important to further understand these factors when
111 stratifying by rural-urban place of residence among women because this may be key to designing
112 effective context-specific interventions tailored to the needs of each setting. We aimed to

1
2
3 113 determine the correlates of skilled birth attendance in Sierra Leone, stratified by rural-urban
4
5 114 place of residence.

6 115 **Methods**

8 9 116 **Data source**

11
12 117 The study used secondary data from the 2019 Sierra Leone Demographic and Health Survey
13
14 118 (SLDHS) accessed from MEASURE DHS database at [http://dhsprogram.com/data/available-](http://dhsprogram.com/data/available-datasets.cfm)
15
16 119 [datasets.cfm](http://dhsprogram.com/data/available-datasets.cfm). SLDHS was a nationally representative cross-sectional survey implemented
17
18 120 between May and August 2019 by Statistics Sierra Leone (Stats SL) with technical assistance
19
20 121 from ICF intern through the DHS Program and funded by the United States Agency for
21
22 122 International Development (USAID). The Demographic and Health Survey datasets are freely
23
24 123 available to the public though researchers must register with MEASURE DHS and submit a
25
26 124 request before accessing them.

27 125 **Study sampling and participants**

28
29
30 126 The 2019 SLDHS samples were selected using a stratified, two-stage cluster sampling design
31
32 127 that resulted in the random selection of 13,872 households [9]. Detailed sampling procedures
33
34 128 were published in the final report [9]. DHS uses different questionnaires. Household
35
36 129 questionnaire collects data on household environment, assets and basic demographic information
37
38 130 of household members while women's questionnaire collects data about women's reproductive
39
40 131 health, domestic violence and nutrition indicators. This secondary analysis included women aged
41
42 132 15 to 49 years who had a live birth within five years preceding the survey and were either
43
44 133 permanent residents or slept in the selected household the night preceding the survey. Out of the
45
46 134 total weighted sample of 15,574 women in the individual women's data set, only 7,326 had given
47
48 135 birth within five years preceding the survey with 4,531 women in rural areas and 2,795 women
49
50 136 in urban areas. Of the 7,326 women, 113 women (32 in rural areas and 81 in urban areas) had
51
52 137 missing data on the timing of ANC first contact leading to a total of 4,499 rural women and
53
54 138 2,714 urban women in the logistic regression analysis as shown in **the supplementary file 1**.

54 139 **Variables**

55 140 **Dependent variables**

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3 141 Skilled birth attendance was defined as delivery conducted by a doctor, nurse or midwife [9] and
4
5 142 was coded as one (1) while un skilled birth attendance was coded as zero (0).
6
7 143

8 9 144 **Independent variables**

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11
12 145 This study included determinants of skilled birth attendance based on evidence from available
13
14 146 literature and data [1, 4, 6]. Sixteen explanatory variables were included and categorized as
15
16 147 shown in **Table1**:
17

18 19 148 **Statistical analysis**

20
21
22 149 In order to account for the multi-stage cluster study design, complex sample package of SPSS
23
24 150 (version 25.0) statistical software was used and the data was adjusted using sampling weight,
25
26 151 primary sampling unit, and strata. Before logistic regression, each exposure/predictor
27
28 152 (independent variable) was assessed separately for its association with the outcome variable
29
30 153 using bivariable logistic regression and we presented the crude odds ratio (COR), 95%
31
32 154 confidence interval (CI) and p-values. Independent variables with a p-value ≤ 0.25 at the
33
34 155 bivariable level, and not strongly collinear with other independent variables were included in the
35
36 156 final multivariable logistic regression model to assess the independent effect of each variable on
37
38 157 skilled birth attendance. Adjusted odds ratios (AOR), 95% confidence intervals (CI) and p-values
39
40 158 were calculated with statistical significance level set at p-value < 0.05 . A STROBE checklist has
41
42 159 been attached as **supplementary file 2**.

43 44 160 **Patient and public involvement**

45
46 161 Patients were not involved. However, local authorities in the different regions were contacted
47
48 162 before data collection. A comprehensive report on the survey results was released and openly
49
50 163 available on the DHS website.

51 52 164 **Ethics approval**

53
54 165 High international ethical standards are ensured during MEASURE DHS surveys and the 2019
55
56 166 SLDHS protocol was reviewed and approved by the Sierra Leone Ethics and Scientific Review
57
58 167 Committee and the ICF Institutional Review Board. Besides, the local authorities before
59
60 168 implementing the survey and well-informed verbal consent are sought from the respondents prior

169 to data collection. However, ethical approval ID was not provided in the SLDHS survey report.
170 This data set was obtained from the MEASURE DHS website (URL:
171 <https://www.dhsprogram.com/data/available-datasets.cfm>) after getting their permission, and no
172 formal ethical clearance was obtained since we conducted a secondary analysis of publicly
173 available data.

174 Results

175 **Table 2** shows a comparison of background characteristics of study participants. Rural areas had
176 more participants (4,531) compared to urban areas (2,795). Remarkable differences were
177 observed in region with 1.1% of rural women residing in Western region compared to 51.1% in
178 urban areas. Furthermore, 63.2% of rural women had no education compared to 35.5% in urban
179 areas, 34.8% in rural areas belonged to the poorest quintile compared to 0.4% in urban areas and
180 36.2% had exposure to mass media in rural areas compared to 69.7% in urban areas. Over 60.3%
181 of rural women had big problems with distance to the nearest health facility compared to 25.8%
182 in urban areas. Overall, 88.3% (6468/7,326, 95% CI: 87.9-89.4) of the women had skilled birth
183 attendance. Skilled birth attendance was higher in urban areas at 94.9% (2,653/2,795, 95% CI:
184 94.1-95.7) compared to 84.2% (3,816/4,531, 95% CI: 83.8-85.9) in rural areas.

185 Factors associated with skilled birth attendance

186 **Table 3** presents the predictors of rural and urban skilled birth attendance in Sierra Leone. Our
187 analysis revealed that region of residence, exposure to mass media and distance to the nearest
188 health facility have significant positive association with skilled birth attendance among women
189 from both regions of residence. In the rural areas, belonging to the Southern (aOR = 3.13; 95%
190 CI 2.10 to 4.68), Northern (aOR = 2.90; 95% CI 1.91 to 4.42) and Eastern regions (aOR = 5.71;
191 95% CI 3.07 to 10.65), being visited a field worker (aOR = 1.37; 95% CI 1.05 to 1.79), post-
192 primary education (aOR = 1.80; 95% CI 1.30 to 2.48), exposure to mass media (aOR = 1.48;
193 95% CI 1.13 to 1.94), not having big problems with distance to the nearest health facility (aOR
194 = 2.25; 95% CI 1.68 to 3.02) were positively associated with skilled birth attendance while
195 initiating ANC after the first trimester (aOR = 0.76; 95% CI 0.60 to 0.95) was negatively
196 associated with skilled birth attendance.
197 In the urban areas, belonging to Southern (aOR = 5.09; 95% CI 1.96 to 13.25), Eastern region
198 (aOR = 11.7; 95% CI 4.56 to 30.21), households with less than seven members (aOR = 1.53; 95%
199 CI 1.01 to 2.34), had exposure to mass media (aOR = 1.76; 95% CI 1.08 to 2.86) and had no big

200 problems with distance to the nearest health facility (aOR = 1.61; 95% CI 1.04 to 2.48) were
201 positively associated with skilled birth attendance. **Wealth index was imprecisely significant**
202 **with urban women belonging to the richest quintile (aOR = 2.53; 95% CI 0.99 to 6.48)**
203 **being more likely to have skilled birth attendance compared to those in the poor quintile.**

204 Discussion

205 In this study, we looked at factors associated with SBA utilisation in Sierra Leone stratified by
206 rural-urban place of residence. Overall, 88.3% (95% CI: 87.9-89.4) of the women had skilled
207 birth attendance. The overall, urban, rural and SBA prevalence in our study shows 28, 15 and 31
208 percentage point increases respectively compared to that of 2013 [4, 10]. This shows a
209 tremendous improvement in the uptake of the SBA between 2013 and 2019 in Sierra Leone
210 which could be attributed to the changes in health-seeking behaviour and transformation of the
211 health systems witnessed after the Ebola epidemic [11, 12]. The introduction of free maternal
212 health care services with the Free Health Care Initiative (FHCI) that exempted pregnant women,
213 breastfeeding mothers and children under 5 years of age from paying fees for services in 2010
214 could also partly have contributed to the observed increase in SBA utilisation [13, 14]. SBA was
215 higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95% CI: 83.8-85.9) in
216 rural areas. Higher SBA utilization among urban women has also been shown by Ameyaw et al
217 [4] and this could be partly explained by factors such as the post-conflict fragility of the rural
218 healthcare system, high concentration of health care facilities and healthcare workers in urban
219 areas enabling easier access to maternal healthcare services [4, 15, 16]. Higher SBA utilization
220 among urban women compared to rural women has been shown in several other studies [17-19].

221 Region of residence, exposure to mass media, and distance to the nearest health facility had
222 significant association with SBA uptake in both rural and urban areas. Household size was only
223 significantly associated with SBA in urban areas while being visited by a fieldworker, level of
224 education and timing of initiation ANC were only significant in rural areas. Being a resident of
225 the South, the Eastern and Northern regions was associated with more odds of SBA utilisation
226 among rural areas compared to those in the Western and North-western regions which was a
227 similar finding for urban women in the Eastern and Southern regions. This is an unexpected
228 finding since the Western region has the largest concentration of health workers and health
229 facilities, the most developed and houses the capital and economic city of the country and hence

230 has higher quality social amenities compared to other regions [13, 15]. However, the Western
231 areas have witnessed increasing numbers of urban poor coupled with high standards of living and
232 inequitable distribution of social amenities including public and private health facilities, which
233 negatively affects access to healthcare [20, 21]. Furthermore, the documented staff challenges in
234 urban areas such as poor delegation, favoritism and a lack of autonomy could partly affect
235 quality of services in public health facilities which further limits utilisation of healthcare [13,
236 15]. The government's efforts to ensure better service delivery in the less developed regions that
237 are far away from the developed Western region could also have contributed to this observation
238 [22]. Region has been shown to be associated with SBA in studies done in similar contexts [23].

239 Exposure to mass media was associated with more odds of SBA utilisation in both rural and
240 urban areas. Mass media help in reducing knowledge gaps by sensitizing the public on the
241 benefits of healthcare seeking and utilisation which leads to positive attitudes, challenges
242 negative social norms and improves health seeking behavior [24, 25]. Furthermore, women who
243 are exposed to mass media are more likely to be educated, have discussions with their peers
244 which interpersonal interactions contribute greatly in challenging negative norms that might
245 affect health seeking and hence lead to positive health seeking behavioral change [26, 27].
246 Hence, enhancing mass media exposure can be used to provide quality healthcare
247 communication that can lead to an improvement in the utilization of SBA [28]. Exposure to
248 media has been shown in previous studies done in similar contexts to have a positive association
249 with SBA [4, 29, 30].

250 Rural and urban women who reported that distance to health facilities was not a major challenge
251 had higher odds of SBA utilization. Our study observed that the mothers in rural areas and urban
252 areas who had no big problem with distance to a health facility had 2.25 and 1.62 higher odds
253 respectively of being attended to by a skilled birth attendant compared to their counterparts who
254 had challenges of distance to the nearest health facility. The strong association between distance
255 to health facility and SBA utilization among the rural mothers compared to urban can be partly
256 explained by the fact that rural areas of Sierra Leone have poor road networks compared to urban
257 areas with most roads being only accessible by off-road vehicles or motorbikes. This is further
258 compounded by the lack of access to affordable transport and health facilities that far apart from
259 each other, which contributes to delays faced by women in rural areas [31, 32]. Distance to

260 health facilities has been shown to impede access to maternal child health services including
261 SBA in several other studies [6, 33, 34].

262 Unlike in urban areas, being visited by a field health worker, such as a community health worker
263 (CHW) among rural women was significantly associated with SBA utilization. The high demand
264 of CHWs in rural areas due to limited accessibility of healthcare because of shortage of health
265 facilities and large distances needed to be covered by rural women [15, 31] compared to easier
266 access of health facilities in urban areas could partly explain the observed difference in
267 association. The increased SBA utilization among rural women who were visited by field health
268 workers could be partly explained by the fact these field health workers equip mothers with
269 knowledge on the dangers of using unskilled birth attendants and complications of pregnancies
270 in addition to encouraging them to seek care within health facilities [35]. Being visited by field
271 health workers has been shown to be associated with SBA in several other studies [36, 37].

272 Level of education was significantly associated with SBA in rural areas but not urban areas.
273 Women with post-primary education had more odds of SBA utilisation compared to women with
274 no education. Educated women are believed to easily understand counseling given from
275 healthcare workers, more health literate hence informed on obstetric danger signs, which enables
276 them to seek early maternal healthcare [28]. Educated women have also been shown to develop
277 greater confidence, be more conscious of their health and better capabilities to make wise
278 decisions about their own health, have more antenatal care visits, and eventually leading to better
279 SBA utilisation [4, 6]. Furthermore, higher levels of education have an influence on women's
280 positive interpretation of mass media messages leading to positive healthcare seeking behavior
281 change [28]. In predominantly patriarchal African societies and mainly in rural areas [38], men
282 are the main sources of household income and have the highest household decision making [39].
283 Women in rural areas tend to be less empowered than their urban counterparts due to the more
284 conservative societies in rural areas hence factors such as education that might increase women's
285 status and decision making are more likely to have an impact on healthcare seeking [40-43]. This
286 might partly explain the significance of education in rural areas and the non-significance in urban
287 areas. Our findings indicate the need for government to strengthen access to quality girl child
288 education among rural areas to at least secondary school level. Level of education has been
289 shown to be associated with SBA utilisation among several other studies [28, 44, 45]. Delayed

1
2
3 290 initiation of ANC among rural women was associated with less odds of SBA utilization. ANC
4
5 291 utilization has been shown to be associated with several other studies [28, 33, 46]. Delayed
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7 292 initiation could partly reflect poor health seeking behaviour which is further observed by reduced
8
9 293 odds of SBA utilization. However, there is need for further studies to explore the association of
10
11 294 ANC utilization and SBA given the fact that ANC frequency was not significantly associated
12
13 295 with SBA but timing of ANC initiation was.

14 296 Besides the three factors that were significant in both rural and urban areas, household size was
15
16 297 the only factor that showed significance in urban areas. Women who belonged to households
17
18 298 with less than seven members had more odds of SBA utilization compared to their counterparts.
19
20 299 This is in agreement with a study done in Nigeria and India [47, 48]. Although wealth index was
21
22 300 marginally significant in urban areas, women belonging to the richest wealth quintile had 2.5
23
24 301 odds of SBA utilisation compared to their counterparts in the poorest households. We
25
26 302 hypothesize that families with smaller sizes tend to have less expenditure which enables savings
27
28 303 that can be used for the direct and indirect costs involved in accessing healthcare [48].
29
30 304 Furthermore, smaller sizes could be attributed to better maternal healthcare seeking such as
31
32 305 modern contraceptives utilization which is further translated into SBA utilisation [48]. Lastly,
33
34 306 having smaller family size might lead to less time spent by women while doing household chores
35
36 307 and providing care to other family members and increase their time to seek healthcare [49].
37
38 308 However, given the dearth of information regarding household size and SBA utilisation, we
39
40 309 recommend further studies to explore this.

39 310 **Strengths and limitations**

41 311 The strength of this study was that we used a nationally representative sample for the analysis
42
43 312 and thus the results can be generalised to all Sierra Leone women. Since the data was extracted
44
45 313 from DHS surveys, we are confident that standardized procedures such as validated
46
47 314 questionnaires were used in data collection to ensure the validity of the results. This being a
48
49 315 cross-sectional study, this creates a limitation in establishing casual relationships from the
50
51 316 established associations. In addition, since most of the data was for women who had childbirths
52
53 317 within five years preceding the survey, we anticipate recall bias in the process of collecting this
54
55 318 data among the respondents.

56 319 **Conclusion and public health implications**

1
2
3 320 In Sierra Leon, SBA utilisation has greatly improved in the last decade. Utilisation is higher in
4 321 the urban compared to the rural areas. Region of residence, exposure to mass media, and distance
5 322 to the nearest health facility had a significant association with SBA uptake in both rural and
6 323 urban areas. Household size was only significantly associated with SBA in urban areas while
7 324 being visited by a fieldworker, level of education and timing of initiation ANC were only
8 325 significant in rural areas. Hence ensuring context specific policies and strategies is crucial to
9 326 ensure effective SBA utilisation. Generally, maternal stakeholders need to focus on Western
10 327 region, use of mass media for awareness and sensitization and ensuring increased availability of
11 328 affordable and accessible health facilities in both rural and urban areas. In addition, urban
12 329 specific programs need to focus on women residing in larger households and rural specific
13 330 programs need to focus on use of field health workers, women educated to primary level and
14 331 below and ensuring timely initiation of ANC services.
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334 We thank the DHS program for making the data available for this study.

335 **Author contributions**

336 QS Conceived the idea, drafted the manuscript, performed analysis and interpreted the results.
337 IM, KK and MWM reviewed and interpreted the results, reviewed the first draft and drafted the
338 subsequent versions of the manuscript. All authors read and approved the final manuscript.

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340 No funding was obtained for this study.

341 **Competing interests**

342 None declared

343 **Patient consent for publication** Not required.

344 **Data availability statement** All data are available from the Demographic and Health Surveys
345 website (URL: <https://www.dhsprogram.com/data/available-datasets.cfm>) upon registration.

346 Ethics statement

347 High international ethical standards are ensured during MEASURE DHS surveys and the 2019
 348 SLDHS protocol was reviewed and approved by the Sierra Leone Ethics and Scientific Review
 349 Committee and the ICF Institutional Review Board. Besides, the local authorities before
 350 implementing the survey and well-informed verbal consent are sought from the respondents prior
 351 to data collection. This data set was obtained from the MEASURE DHS website (URL:
 352 <https://www.dhsprogram.com/data/available-datasets.cfm>) after getting their permission, and no
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25 501 **Table 1: Categorisation of independent variables**

Variable	Categorization	Explanation
Maternal age	15-19 years, 20–34 years and 35–49 years	-
Wealth index	poorest, poorer, middle, richer and richest quintiles	Wealth index is a measure of relative household economic status and was calculated by SLDHS from information on household asset ownership using Principal Component Analysis [50] . Among rural women, only 0.9% and 5.7% belonged to the richest and richer quintiles, hence these were combined into one to have rich, middle, poorer and poorest quintiles in logistic regression. Among urban women, only 0.3% and 3.0% belonged to the poorest and poorer quintiles, hence these were combined

		into one to have poor, middle, richer and richest quintiles in logistic regression.
Region	Northern, Eastern, Southern, Western and Northwestern	Among rural women, only 1.1% belonged to the Western region hence in logistic regression, Western and Northwestern regions were combined.
Education	No education, primary education, secondary and tertiary education	Among rural women, only 0.5% of the women had tertiary education and only 7.1% in urban hence secondary and tertiary were combined to have post-primary in the logistic regression analysis.
Household size	Less than seven members and seven and above members	Based on the dataset average of seven members per household
Sex of household head	Male or female	
Marital status	Married and Not Married	Marriage included those in formal and informal unions while not married included the never married, divorced, separated and widowed.
Religion	Muslims and Christians and others	
Problem seeking permission to access healthcare	Big problem and no big problem	In the questionnaire, seeking permission to access healthcare had three original responses: no problem, no big problem and big problem. However, none of the study participants reported no problem hence we only had two responses.
Difficulties accessing nearest health facility	big problem and no big problem	In the questionnaire, problems with distance to the nearest health facility had three original responses: no problem, no

		big problem and big problem. However, none of the study participants reported no problem hence we only had two responses.
Exposure to media	Yes and No	Yes included women who had exposure to any of the four mass media (radio, television (TV) and newspapers and internet)
Working	Yes and No	-
Visited by fieldworker	Yes and No	-
Parity	5 and above, 2-4 and 1	-
ANC frequency	8 and above ANC contacts and less than 8 ANC contacts	-
ANC timing	Within the first trimester and after first trimester	-

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503 **Table 2: Socio-demographic characteristics of women in Sierra Leone as per the 2019**504 **SLDHS**

Characteristics	Rural		Urban	
	N=4531	%	N=2795	%
Age				
15 to 19	375	8.3	223	8.0
20 to 34	2835	62.6	1995	71.4
35 to 49	1322	29.2	577	20.6
Visited by field worker				
No	3126	69.0	1933	69.2
Yes	1405	31.0	862	30.8
Region				
Western	51	1.1	1428	51.1
Eastern	1059	23.4	483	17.3
Northwestern	1096	24.2	285	10.2
Northern	1082	23.9	351	12.6
Southern	1244	27.5	248	8.9
Religion				
Islam	3729	82.3	2036	72.9

Christianity and others	802	17.7	758	27.1
Sex household head				
Male	3663	80.8	1857	66.4
Female	868	19.2	938	33.6
Household Size				
7 and above	2083	46.0	1236	44.2
Less than 7	2448	54.0	1559	55.8
Working status				
Not working	684	15.1	998	35.7
Working	3847	84.9	1796	64.3
Marital status				
Not married	606	13.4	723	25.9
Married	3925	86.6	2072	74.1
Education Level				
No Education	2866	63.2	992	35.5
Primary Education	729	16.1	304	10.9
Secondary Education	913	20.1	1302	46.6
Tertiary	24	0.5	197	7.1
Wealth Index				
Poorest	1576	34.8	11	0.4
Poorer	1466	32.4	85	3.0
Middle	1192	26.3	296	10.6
Richer	258	5.7	1184	42.4
Richest	40	0.9	1219	43.6
Parity				
1	1011	22.3	977	35.0
2-4	2522	55.7	1493	53.4
5 and above	998	22.0	324	11.6
Exposure to mass media				
No	2890	63.8	846	30.3
Yes	1641	36.2	1948	69.7
Permission to access healthcare				
Big problem	1427	31.5	399	14.3
Not big problem	3104	68.5	2396	85.7
Distance to health facility				
Big problem	2732	60.3	722	25.8
Not big problem	1799	39.7	2073	74.2
ANC timing^a				
First trimester	2048	45.5	1165	42.9
After first trimester	2451	54.5	1549	57.1
ANC attendance				
8 contacts and above	988	21.8	622	22.3
Less than 8 contacts	3543	78.2	2173	77.7

505 ^a = missing 32 (0.7%) respondents in rural and 81 (2.9%) in urban areas

506 **Table 3: Factors associated with skilled birth attendance in Sierra Leone as per the 2019**
507 **SLDHS**

	Rural N=4499			Urban N=2714		
Characteristics	Crude model cOR (95% CI)	P- value	Adjusted model aOR (95% CI)	Crude model cOR (95% CI)	P- value	Adjusted model aOR (95% CI)
Age		0.002			0.825	
15 to 49	1		1	1		
20 to 34	1.32 (1.08-1.60)		1.18 (0.95-1.46)	0.94 (0.56-1.60)		
15 to 19	1.86 (1.26-2.75)		1.45 (0.94-2.25)	0.78 (0.35-1.73)		
Visited by fieldworker		0.004			0.625	
No	1		1	1		
Yes	1.47 (1.13-1.92)		1.37 (1.05-1.79)	1.14 (0.68-1.89)		
Region		<0.001			<0.001	
West and Northwestern	1		1	1		1
Southern	2.74 (1.82-4.13)		3.13 (2.10-4.68)	4.32 (1.64-11.40)		5.09 (1.96-13.22)
Northern	2.96 (1.92-4.57)		2.90 (1.91-4.42)	1.56 (0.74-3.33)		2.03 (0.92-4.49)
Eastern	5.38 (2.95-9.81)		5.71 (3.07-10.65)	6.07 (2.71-13.61)		11.7 (4.56-30.21)
Religion		0.199			0.094	
Christianity and others	1		1	1		1
Islam	0.81 (0.59-1.12)		1.37 (0.98-1.93)	0.61 (0.34-1.09)		0.93 (0.51-1.70)
Sex household head		0.269			0.522	
Male	1			1		
Female	1.15 (0.90-1.47)			0.87 (0.58-1.32)		
Household Size		0.065			0.036	
7 and above	1		1	1		1
Less than 7	1.22 (0.99-1.50)		1.13 (0.91-1.40)	1.63 (1.03-2.58)		1.53 (1.01-2.34)
Working status		0.745			0.080	
Not working	1			1		1
Working	0.95 (0.67-1.33)			0.70 (0.47-1.04)		0.79 (0.49-1.26)
Marital status		<0.001			0.885	
Not married	1		1	1		
Married	0.59 (0.44-0.79)		0.78 (0.57-1.07)	1.03 (0.66-1.62)		
Education Level		<0.001			0.020	
No Education	1		1	1		1
Primary	1.29 (0.96-1.72)		1.06 (0.79-1.42)	1.89 (0.95-3.76)		1.71 (0.81-3.60)
Post-primary	2.34 (1.74-3.15)		1.80 (1.30-2.48)	1.94 (1.18-3.19)		1.38 (0.76-2.51)
Wealth Index					0.200	
Poor				1		1
Middle				1.04 (0.33-3.32)		1.20 (0.41-3.49)
Richer				1.11 (0.40-3.03)		1.46 (0.63-3.36)
Richest				1.96 (0.67-5.72)		;
Wealth Index		0.282				

3 Poorest	1					
4 Poorer	1.01 (0.81-1.26)					
5 Middle	1.19 (0.88-1.61)					
6 Rich	1.61 (0.97-2.67)					
8 Parity		0.018			0.106	
9 5 and above	1		1	1		1
10 2-4	1.09 (0.89-1.34)		0.85 (0.68-1.06)	1.53 (0.80-2.93)		1.04 (0.54-1.20)
11 1	1.43 (1.09-1.88)		0.96 (0.69-1.32)	2.13 (1.05-4.31)		1.27 (0.61-2.68)
12 Exposure to media		0.001			<0.001	
13 No	1		1	1		1
14 Yes	1.56 (1.20-2.03)		1.48 (1.13-1.94)	2.20 (1.43-3.36)		1.76 (1.08-2.86)
15 Permission to access		0.916			0.398	
16 Big problem	1			1		
17 Not big problem	0.99 (0.75-1.29)			0.77 (0.41-1.43)		
18 Distance to health		<0.001			0.104	
19 Big problem	1		1	1		1
20 Not big problem	2.27 (1.67-3.08)		2.25 (1.68-3.02)	1.43 (0.93-2.19)		1.61 (1.04-2.48)
21 ANC timing ^a		0.001			0.041	
22 First trimester	1		1	1		1
23 After first trimester	0.67 (0.53-0.85)		0.76 (0.60-0.95)	0.65 (0.43-0.98)		0.77 (0.49-1.20)
24 ANC attendance		0.615			0.060	
25 8 contacts and above	1			1		1
26 Less than 8	1.07 (0.82-1.39)			0.60 (0.35-1.02)		0.64 (0.38-1.08)

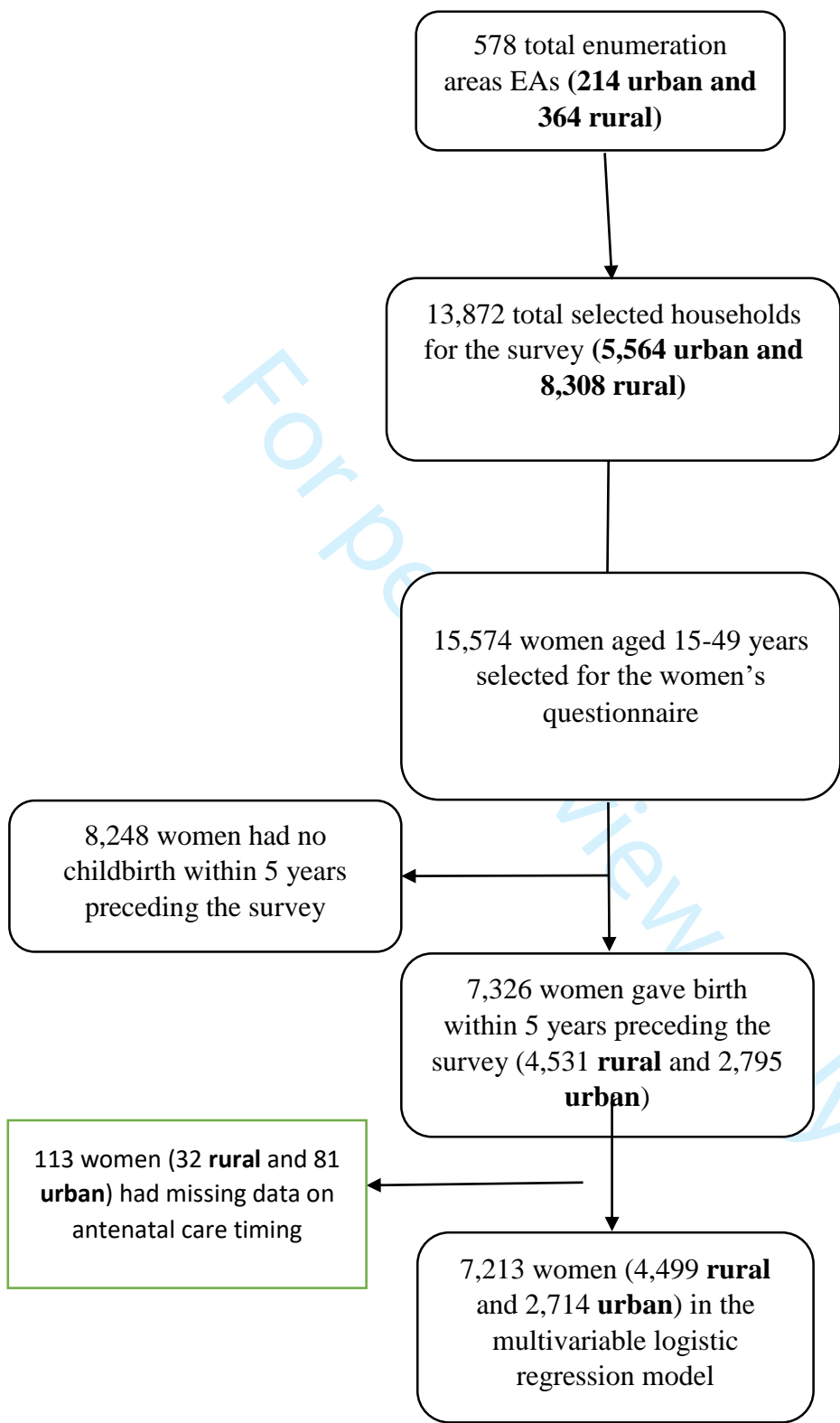
508 ^a = missing 32 in rural and 81 in urban. **bold** = Significant at p-value <0.05, aOR: Adjusted odds

509 ratio. cOR: Crude Odds Ratio

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Additional file Figure 1: flow chat of sampling process

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4,5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	5
		(d) If applicable, describe analytical methods taking account of sampling strategy	5
		(e) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7

		(b) Report category boundaries when continuous variables were categorized	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: evidence from the 2019 Sierra Leone demographic health survey

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3 **1 Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: evidence**
4 **2 from the 2019 Sierra Leone demographic health survey**

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22 Abstract

23 **Objectives** Understanding the context specific correlates of skilled birth attendance (SBA) in
24 urban and rural areas is key to designing relevant strategies and programs. This analysis aimed to
25 assess for the rural-urban correlates of SBA in Sierra Leone.

26 **Setting** Data from the nationally representative 2019 Sierra Leone Demographic and Health
27 Survey (SLDHS) were used.

28 **Participants** The study included a weighted sample of 7,326 women aged 15–49 years who had
29 a live birth within five years preceding the survey (4,531 in rural areas and 2,795 women in
30 urban areas).

31 **Primary and secondary outcome measure** Skilled birth attendance (primary) and predictors of
32 skilled birth attendance (secondary).

33 **Results** SBA was higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95%
34 CI: 83.8-85.9) in rural areas. Rural women resident in the Southern, Northern and Eastern
35 regions, with post-primary education (aOR = 1.8; 95% CI 1.3 to 2.5), exposure to mass media
36 (aOR = 1.5; 95% CI 1.1 to 1.9), not having difficulties with distance to the nearest health facility
37 (aOR = 2.3; 95% CI 1.7 to 3.0) were associated with higher odds of SBA. Urban women resident
38 in the Southern, Eastern region, with households having less than seven members (aOR = 1.5;
39 95% CI 1.1 to 2.3), exposure to mass media (aOR = 1.8; 95% CI 1.1 to 2.9) and not having
40 difficulties with distance to the nearest health facility (aOR = 1.6; 95% CI 1.1 to 2.5) were
41 associated with higher odds of SBA.

42 **Conclusion** Given the observed differences, improving SBA requires context-specific tailored
43 approaches and strategies including targeting mechanisms that have to be designed differently.

44

1
2
3 45 **Keywords:** Skilled birth attendance, Sierra Leone, Rural-Urban, Women, DHS
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5
6 46 **Strengths and limitations of the study**
7

- 8 47 ➤ This is the foremost nationwide analysis that explores the rural-urban correlates of skilled
9
10 48 birth attendance in Sierra Leone
11
12 49 ➤ The study used a nationally representative sample using the most recent Sierra Leone
13
14 50 Demographic and Health Survey (SLDHS) 2019 data, making the findings of the present
15
16 51 study generalisable for women in Sierra Leone.
17
18 52 ➤ The temporal relationship between the outcome variable and the independent variables
19
20 53 could not be established due to the cross-sectional nature of the survey.
21
22 54 ➤ Since the data was collected from women who had childbirths within five years
23
24 55 preceding the survey, we anticipate recall bias in the process of collecting this data
25
26 56 among the respondents.
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63 **Introduction**
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65 Globally, over 34% of deliveries are not supervised by a skilled birth attendant, which is over 45
million births each year [1, 2]. Sub-Saharan Africa has registered significant progress with

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3 66 skilled birth attendance, but over 50% of births are still supervised by unskilled health personnel
4
5 67 [3]. About 303,000 maternal deaths are registered annually with ninety-nine percent of these
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8 68 occurring in low- and middle-income countries [4]. Skilled birth attendance (SBA) is a proven
9
10 69 evidence based intervention for reducing maternal and neonatal morbidity and mortality [5, 6].
11
12 70 Skilled birth attendance can reduce the possibility of death owing to intrapartum-related
13
14 71 complications or stillbirth by up to 20% [7]. Therefore, ensuring increased utilisation of SBA can
15
16 72 substantially contribute towards achievement of the Sustainable Development Goal (SDG) 3 that
17
18 73 aims at reducing the global maternal mortality ratio (MMR) to less than 70 per 100, 000 and
19
20 74 neonatal mortality ratio (NMR) of ≤ 12 per 1,000 live births by 2030 [7-9]. A skilled birth
21
22 75 attendant is “an accredited health professional such as a midwife, doctor, or nurse who have been
23
24 76 trained with adequate skills needed to handle uncomplicated pregnancies, childbirth, and the
25
26 77 immediate postnatal period, and in the identification, management, and referral of complications
27
28 78 in women and newborns” [7].
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34 79 Besides the women losing their lives, effects of maternal mortality and morbidity are also
35
36 80 experienced by their families and communities [10]. Children who lose their mothers have an
37
38 81 increased risk of death or other health challenges such as malnutrition and the society loses
39
40 82 resources when women die in their most productive years [10]. In Sierra Leone, pregnancy
41
42 83 carries an approximate lifetime risk of maternal mortality of 1 in 17 making it among the highest
43
44 84 globally [7]. Despite the efforts by the health stakeholders, utilisation of maternal health services
45
46 85 such as coverage of four or more antenatal (ANC) contacts marginally increased from 76% in
47
48 86 2013 to 79% in 2019 while early initiation in the first trimester declined from 45% in 2013 to
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50 87 44% in 2019 [11], although the Ministry of Health adopted the new WHO ANC model in 2017
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52 88 that aims for at least eight ANC contacts[12]. Although this is indicated in the Sierra Leone
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89 National Reproductive, Maternal, Neonatal, Child and Adolescent Health (RMNCAH) strategy
90 (2017-2021), no data is available about the progress of utilisation of eight or more ANC contacts
91 with the latest SLDHS giving statistics on utilisation of at least four ANC contacts [11].

92 Sierra Leone's long civil war and Ebola epidemic left the health system fragile and overwhelmed
93 with inadequate skilled health personnel having low and irregular remuneration [13]. Despite the
94 government's efforts to improve maternal health with approaches such as Free Health Care
95 Initiative (FHCI) in 2010 that exempted user fees for maternal healthcare services [14], much
96 has not been achieved, as Sierra Leone is among the top three countries with the highest maternal
97 mortality ratio (MMR), globally [7, 15]. Furthermore, the effectiveness of the FHCI is
98 challenged by inadequate skilled health personnel, increasing demand and stock-outs of crucial
99 medical supplies and equipment leading to patients having to pay for services that are meant to
100 be free [16, 17]. Secondary and tertiary care in Sierra Leone is provided by 14 district and
101 regional governmental hospitals and four tertiary referral hospitals which are all located in the
102 Western Area Urban District [18]. The country's nurse density is one of the world's lowest
103 having approximately 0.2 nurses and midwives per 1000 people [13].

104 Although disparities in the levels of utilisation of SBA between urban and rural women in Sierra
105 Leone have been documented [7, 11], information on factors responsible for these differences
106 has not been adequately explored. Therefore, it is important to further understand these factors
107 when stratifying by rural-urban place of residence among women because this may be key to
108 designing effective context-specific interventions tailored to the needs of each setting. We aimed
109 to determine the correlates of skilled birth attendance in Sierra Leone, stratified by rural-urban
110 place of residence.

111 **Methods**

112 **Data source**

113 The study used secondary data from the 2019 Sierra Leone Demographic and Health Survey
114 (SLDHS) accessed from MEASURE DHS database at [http://dhsprogram.com/data/available-](http://dhsprogram.com/data/available-datasets.cfm)
115 [datasets.cfm](http://dhsprogram.com/data/available-datasets.cfm). SLDHS was a nationally representative cross-sectional survey implemented
116 between May and August 2019 by Statistics Sierra Leone (Stats SL) with technical assistance
117 from ICF intern through the DHS Program and funded by the United States Agency for
118 International Development (USAID). The Demographic and Health Survey datasets are freely
119 available to the public though researchers must register with MEASURE DHS and submit a
120 request before accessing them.

121 **Study sampling and participants**

122 The 2019 SLDHS samples were selected using a stratified, two-stage cluster sampling design
123 that resulted in the random selection of 13,872 households [11]. Detailed sampling procedures
124 were published in the final report [11]. DHS uses different questionnaires. Household
125 questionnaire collects data on household environment, assets and basic demographic information
126 of household members while women's questionnaire collects data about women's reproductive
127 health, domestic violence and nutrition indicators. This secondary analysis included women aged
128 15 to 49 years who had a live birth within five years preceding the survey and were either
129 permanent residents or slept in the selected household the night preceding the survey. Out of the
130 total weighted sample of 15,574 women in the individual women's data set, only 7,326 had given
131 birth within five years preceding the survey with 4,531 women in rural areas and 2,795 women

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3 132 in urban areas. Of the 7,326 women, 113 women (32 in rural areas and 81 in urban areas) had
4
5 133 missing data on the timing of ANC first contact leading to a total of 4,499 rural women and
6
7 134 2,714 urban women in the logistic regression analysis as shown in **the supplementary file 1**.
9

11 135 **Variables**

13 136 **Dependent variables**

15
16 137 Skilled birth attendance was defined as delivery conducted by a doctor, nurse or midwife [11]
17
18 138 and was coded as one (1) while un skilled birth attendance was coded as zero (0).
19

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21 139

24 140 **Independent variables**

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27 141 This study included determinants of skilled birth attendance based on evidence from available
28
29 142 literature and data [3, 7, 10]. Sixteen explanatory variables were included and categorized as
30
31 143 shown in **Table1**:
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35 144 **Statistical analysis**

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38
39 145 In order to account for the multi-stage cluster study design, complex sample package of SPSS
40
41 146 (version 25.0) statistical software was used incorporating the following variables in the analysis
42
43 147 plan to account for the multistage sample design inherent in the DHS dataset: individual sample
44
45 148 weight, sample strata for sampling errors/design, and cluster number [19, 20]. Cross tabulation
46
47 149 was conducted and associations between background characteristics and skilled birth attendance
48
49 150 their p-values were presented in **Tables 3 and 4**. Before multivariable logistic regression, each
50
51 151 exposure/predictor (independent variable) was assessed separately for its association with the
52
53 152 outcome variable using bivariable logistic regression and we presented the crude odds ratio
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3 153 (COR), 95% confidence interval (CI) and p-values. Independent variables with a p-value ≤ 0.25
4
5 154 at the bivariable level, and not strongly collinear with other independent variables were included
6
7
8 155 in the final multivariable logistic regression model to assess the independent effect of each
9
10 156 variable on skilled birth attendance [21]. Adjusted odds ratios (AOR), 95% confidence intervals
11
12 157 (CI) and p-values were calculated with adjusted model statistical significance level set at p-value
13
14
15 158 < 0.05 . A STROBE checklist has been attached as **supplementary file 2**. Sensitivity analysis
16
17 159 was done with unskilled birth attendance as the outcome and the results are shown in
18
19 160 **supplementary file 3**.

161 **Patient and public involvement**

22 162 Patients were not involved. However, local authorities in the different regions were contacted
23
24 163 before data collection. A comprehensive report on the survey results was released and openly
25
26 164 available on the DHS website.

165 **Ethics approval**

32
33
34 166 High international ethical standards are ensured during MEASURE DHS surveys and the 2019
35
36 167 SLDHS protocol was reviewed and approved by the Sierra Leone Ethics and Scientific Review
37
38 168 Committee and the ICF Institutional Review Board. Besides, the local authorities before
39
40 169 implementing the survey and well-informed verbal consent are sought from the respondents prior
41
42 170 to data collection. However, ethical approval ID was not provided in the SLDHS survey report.
43
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45 171 This data set was obtained from the MEASURE DHS website (URL:
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47 172 <https://www.dhsprogram.com/data/available-datasets.cfm>) after getting their permission, and no
48
49 173 formal ethical clearance was obtained since we conducted a secondary analysis of publicly
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51 174 available data.

175 **Results**

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3 176 **Table 2** shows a comparison of background characteristics of study participants. Rural areas had
4
5 177 more participants (4,531) compared to urban areas (2,795). Remarkable differences were
6
7 178 observed in region with 1.1% of rural women residing in Western region compared to 51.1% in
8
9 179 urban areas. Furthermore, 63.2% of rural women had no education compared to 35.5% in urban
10
11 180 areas, 34.8% in rural areas belonged to the poorest quintile compared to 0.4% in urban areas and
12
13 181 36.2% had exposure to mass media in rural areas compared to 69.7% in urban areas. Over 60.3%
14
15 182 of rural women had big problems with distance to the nearest health facility compared to 25.8%
16
17 183 in urban areas. Overall, 88.3% (6468/7,326, 95% CI: 87.9-89.4) of the women had skilled birth
18
19 184 attendance. Skilled birth attendance was higher in urban areas at 94.9% (2,653/2,795, 95% CI:
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21 94.1-95.7) compared to 84.2% (3,816/4,531, 95% CI: 83.8-85.9) in rural areas.
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26 186 **Factors associated with skilled birth attendance**

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28 187 **Tables 3 and 4** presents the predictors of rural and urban skilled birth attendance in Sierra
29
30 188 Leone. Our analysis revealed that region of residence, exposure to mass media and distance to
31
32 189 the nearest health facility have significant positive association with skilled birth attendance
33
34 190 among women from both regions of residence. In the rural areas, belonging to the Southern (aOR
35
36 191 = 3.1; 95% CI 2.1 to 4.7), Northern (aOR = 2.9; 95% CI 1.9 to 4.4) and Eastern regions (aOR =
37
38 192 5.7; 95% CI 3.1 to 10.7), being visited a field worker (aOR = 1.4; 95% CI 1.1 to 1.8), post-
39
40 193 primary education (aOR = 1.8; 95% CI 1.3 to 2.5), exposure to mass media (aOR = 1.5; 95% CI
41
42 194 1.1 to 1.9), not having big problems with distance to the nearest health facility (aOR = 2.3; 95%
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44 195 CI 1.7 to 3.0) were positively associated with skilled birth attendance while initiating ANC after
45
46 196 the first trimester (aOR = 0.8; 95% CI 0.6 to 0.9) was negatively associated with skilled birth
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48 197 attendance.
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198 In the urban areas, belonging to Southern (aOR = 5.1; 95% CI 2.0 to 13.3), Eastern region (aOR
199 =11.7; 95% CI 4.6 to 30.2), households with less than seven members (aOR = 1.5; 95% CI 1.1 to
200 2.3), had exposure to mass media (aOR = 1.8; 95% CI 1.1 to 2.9) and had no big problems with
201 distance to the nearest health facility (aOR = 1.6; 95% CI 1.1 to 2.5) were positively associated
202 with skilled birth attendance. Wealth index was imprecisely significant with urban women
203 belonging to the richest quintile (aOR = 2.5; 95% CI 1.0 to 6.5) being more likely to have skilled
204 birth attendance compared to those in the poor quintile.

205 Discussion

206 In this study, we looked at factors associated with SBA utilisation in Sierra Leone stratified by
207 rural-urban place of residence. Overall, 88.3% (95% CI: 87.9-89.4) of the women had skilled
208 birth attendance. The overall, urban, rural and SBA prevalence in our study shows 28, 15 and 31
209 percentage point increases respectively compared to that of 2013 [7, 22]. This shows a
210 tremendous improvement in the uptake of the SBA between 2013 and 2019 in Sierra Leone
211 which could be attributed to the changes in health-seeking behaviour and transformation of the
212 health systems witnessed after the Ebola epidemic [23, 24]. The introduction of free maternal
213 health care services with the Free Health Care Initiative (FHCI) that exempted pregnant women,
214 breastfeeding mothers and children under 5 years of age from paying fees for services in 2010
215 could also partly have contributed to the observed increase in SBA utilisation [25, 26]. SBA was
216 higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95% CI: 83.8-85.9) in
217 rural areas. Higher SBA utilization among urban women has also been shown by Ameyaw et al
218 [7] and this could be partly explained by factors such as the post-conflict fragility of the rural
219 healthcare system, high concentration of health care facilities and healthcare workers in urban
220 areas enabling easier access to maternal healthcare services [7, 27, 28]. Higher SBA utilization

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3 221 among urban women compared to rural women has been shown in several other studies [29-31].
4
5 222 The mismatch between high coverage of SBA and the persistently high rates of maternal and
6
7 223 perinatal mortality is not only unique to Sierra Leon. Available evidence from similar low
8
9 224 resource settings in Sub-Saharan points towards poor quality of services offered [26, 32].
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13 225 Region of residence, exposure to mass media, and distance to the nearest health facility had
14
15 226 significant association with SBA uptake in both rural and urban areas. Household size was only
16
17 227 significantly associated with SBA in urban areas while being visited by a fieldworker, level of
18
19 228 education and timing of initiation ANC were only significant in rural areas. Being a resident of
20
21 229 the South, the Eastern and Northern regions was associated with more odds of SBA utilisation
22
23 230 among rural areas compared to those in the Western and North-western regions which was a
24
25 231 similar finding for urban women in the Eastern and Southern regions. This is an unexpected
26
27 232 finding since the Western region has the largest concentration of health workers and health
28
29 233 facilities, the most developed and houses the capital and economic city of the country and hence
30
31 234 has higher quality social amenities compared to other regions [25, 27]. However, the Western
32
33 235 areas have witnessed increasing numbers of urban poor coupled with high standards of living and
34
35 236 inequitable distribution of social amenities including public and private health facilities, which
36
37 237 negatively affects access to healthcare [33, 34]. Furthermore, the documented staff challenges in
38
39 238 urban areas such as poor delegation, favoritism and a lack of autonomy could partly affect
40
41 239 quality of services in public health facilities which further limits utilisation of healthcare [25,
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43 240 27]. The government's efforts to ensure better service delivery in the less developed regions that
44
45 241 are far away from the developed Western region could also have contributed to this observation
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47 242 [12]. Region has been shown to be associated with SBA in studies done in similar contexts [35].
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3 243 Exposure to mass media was associated with more odds of SBA utilisation in both rural and
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5 244 urban areas. Mass media help in reducing knowledge gaps by sensitizing the public on the
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7 245 benefits of healthcare seeking and utilisation which leads to positive attitudes, challenges
8
9 246 negative social norms and improves health seeking behavior [36, 37]. Furthermore, women who
10
11 247 are exposed to mass media are more likely to be educated, have discussions with their peers
12
13 248 which interpersonal interactions contribute greatly in challenging negative norms that might
14
15 249 affect health seeking and hence lead to positive health seeking behavioral change [38, 39].
16
17 250 Hence, enhancing mass media exposure can be used to provide quality healthcare
18
19 251 communication that can lead to an improvement in the utilization of SBA [40]. Exposure to
20
21 252 media has been shown in previous studies done in similar contexts to have a positive association
22
23 253 with SBA [7, 41, 42].
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28
29 254 Rural and urban women who reported that distance to health facilities was not a major challenge
30
31 255 had higher odds of SBA utilization. Our study observed that the mothers in rural areas and urban
32
33 256 areas who had no big problem with distance to a health facility had 2.25 and 1.62 higher odds
34
35 257 respectively of being attended to by a skilled birth attendant compared to their counterparts who
36
37 258 had challenges of distance to the nearest health facility. The strong association between distance
38
39 259 to health facility and SBA utilization among the rural mothers compared to urban can be partly
40
41 260 explained by the fact that rural areas of Sierra Leone have poor road networks compared to urban
42
43 261 areas with most roads being only accessible by off-road vehicles or motorbikes. This is further
44
45 262 compounded by the lack of access to affordable transport and health facilities that far apart from
46
47 263 each other, which contributes to delays faced by women in rural areas [43, 44]. Distance to
48
49 264 health facilities has been shown to impede access to maternal child health services including
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51 265 SBA in several other studies [10, 45, 46].
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3 266 Unlike in urban areas, being visited by a field health worker, such as a community health worker
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5 267 (CHW) among rural women was significantly associated with SBA utilization. The high demand
6
7 268 of CHWs in rural areas due to limited accessibility of healthcare because of shortage of health
8
9 269 facilities and large distances needed to be covered by rural women [27, 43] compared to easier
10
11 270 access of health facilities in urban areas could partly explain the observed difference in
12
13 271 association. The increased SBA utilization among rural women who were visited by field health
14
15 272 workers could be partly explained by the fact these field health workers equip mothers with
16
17 273 knowledge on the dangers of using unskilled birth attendants and complications of pregnancies
18
19 274 in addition to encouraging them to seek care within health facilities [47]. Being visited by field
20
21 275 health workers has been shown to be associated with SBA in several other studies [48, 49].
22
23
24 276 Level of education was significantly associated with SBA in rural areas but not urban areas.
25
26
27 277 Women with post-primary education had more odds of SBA utilisation compared to women with
28
29 278 no education. Educated women are believed to easily understand counseling given from
30
31 279 healthcare workers, more health literate hence informed on obstetric danger signs, which enables
32
33 280 them to seek early maternal healthcare [40]. Educated women have also been shown to develop
34
35 281 greater confidence, be more conscious of their health and better capabilities to make wise
36
37 282 decisions about their own health, have more antenatal care visits, and eventually leading to better
38
39 283 SBA utilisation [7, 10]. Furthermore, higher levels of education have an influence on women's
40
41 284 positive interpretation of mass media messages leading to positive healthcare seeking behavior
42
43 285 change [40]. In predominantly patriarchal African societies and mainly in rural areas [50], men
44
45 286 are the main sources of household income and have the highest household decision making [51].
46
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48 287 Women in rural areas tend to be less empowered than their urban counterparts due to the more
49
50 288 conservative societies in rural areas hence factors such as education that might increase women's
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3 289 status and decision making are more likely to have an impact on healthcare seeking [52-55]. This
4
5 290 might partly explain the significance of education in rural areas and the non-significance in urban
6
7
8 291 areas. Our findings indicate the need for government to strengthen access to quality girl child
9
10 292 education among rural areas to at least secondary school level. Level of education has been
11
12 293 shown to be associated with SBA utilisation among several other studies [40, 56, 57]. Delayed
13
14 294 initiation of ANC among rural women was associated with less odds of SBA utilization. ANC
15
16 295 utilization has been shown to be associated with several other studies [40, 45, 58]. Delayed
17
18 296 initiation could partly reflect poor health seeking behaviour which is further observed by reduced
19
20 297 odds of SBA utilization. However, there is need for further studies to explore the association of
21
22 298 ANC utilization and SBA given the fact that ANC frequency was not significantly associated
23
24 299 with SBA but timing of ANC initiation was.

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29 300 Besides the three factors that were significant in both rural and urban areas, household size was
30
31 301 the only factor that showed significance in urban areas. Women who belonged to households
32
33 302 with less than seven members had more odds of SBA utilization compared to their counterparts.
34
35 303 This is in agreement with a study done in Nigeria and India [59, 60]. Although wealth index was
36
37 304 marginally significant in urban areas, women belonging to the richest wealth quintile had 2.5
38
39 305 odds of SBA utilisation compared to their counterparts in the poorest households. We
40
41 306 hypothesize that families with smaller sizes tend to have less expenditure which enables savings
42
43 307 that can be used for the direct and indirect costs involved in accessing healthcare [60].
44
45 308 Furthermore, smaller sizes could be attributed to better maternal healthcare seeking such as
46
47 309 modern contraceptives utilization which is further translated into SBA utilisation [60]. Lastly,
48
49 310 having smaller family size might lead to less time spent by women while doing household chores
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51 311 and providing care to other family members and increase their time to seek healthcare [61].
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3 312 However, given the dearth of information regarding household size and SBA utilisation, we
4
5 313 recommend further studies to explore this.
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8 314 **Strengths and limitations**

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10
11 315 The strength of this study was that we used a nationally representative sample for the analysis
12
13 316 and thus the results can be generalised to all Sierra Leone women. Since the data was extracted
14
15 317 from DHS surveys, we are confident that standardized procedures such as validated
16
17 318 questionnaires were used in data collection to ensure the validity of the results. This being a
18
19 319 cross-sectional study, this creates a limitation in establishing casual relationships from the
20
21 320 established associations. In addition, since most of the data was for women who had childbirths
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23 321 within five years preceding the survey, we anticipate recall bias in the process of collecting this
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25 322 data among the respondents.
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29 323 **Conclusion and public health implications**

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33 324 In Sierra Leon, SBA utilisation has greatly improved in the last decade. Utilisation is higher in
34
35 325 the urban compared to the rural areas. Region of residence, exposure to mass media, and distance
36
37 326 to the nearest health facility had a significant association with SBA uptake in both rural and
38
39 327 urban areas. Household size was only significantly associated with SBA in urban areas while
40
41 328 being visited by a fieldworker, level of education and timing of initiation ANC were only
42
43 329 significant in rural areas. Hence ensuring context specific policies and strategies is crucial to
44
45 330 ensure effective SBA utilisation. Generally, maternal stakeholders need to focus on Western
46
47 331 region, use of mass media for awareness and sensitization and ensuring increased availability of
48
49 332 affordable and accessible health facilities in both rural and urban areas. In addition, urban
50
51 333 specific programs need to focus on women residing in larger households and rural specific
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334 programs need to focus on use of field health workers, women educated to primary level and
335 below and ensuring timely initiation of ANC services. Further research is need to explore
336 reasons why maternal mortality is high despite the high SBA focusing on areas such as quality of
337 care provided.

338

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341 **Author contributions**

342 QS Conceived the idea, drafted the manuscript, performed analysis and interpreted the results.

343 IM, KK and MWM reviewed and interpreted the results, reviewed the first draft and drafted the

344 subsequent versions of the manuscript. All authors read and approved the final manuscript.

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347 **Competing interests**

348 None declared

349 **Patient consent for publication** Not required.

350 **Data availability statement** The data that support the finding of this study are available from

351 the Demographic and Health Surveys website (URL:

352 <https://www.dhsprogram.com/data/available-datasets.cfm>) upon registration [11, 62]. Data are

353 available from the authors with the permission of DHS.

354 Ethics statement

355 High international ethical standards are ensured during MEASURE DHS surveys and the 2019
 356 SLDHS protocol was reviewed and approved by the Sierra Leone Ethics and Scientific Review
 357 Committee and the ICF Institutional Review Board. Besides, the local authorities before
 358 implementing the survey and well-informed verbal consent are sought from the respondents prior
 359 to data collection. This data set was obtained from the MEASURE DHS website (URL:
 360 <https://www.dhsprogram.com/data/available-datasets.cfm>) after getting their permission, and no
 361 formal ethical clearance was obtained since we conducted a secondary analysis of publicly
 362 available data.

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545 **Table 1: Categorisation of independent variables**

Variable	Categorization	Explanation
Maternal age	15-19 years, 20–34 years and 35–49 years	-
Wealth index	poorest, poorer, middle, richer and richest quintiles	Wealth index is a measure of relative household economic status and was calculated by SLDHS from information on household asset ownership using Principal Component Analysis [63] . Among rural women, only 0.9% and 5.7% belonged to the richest and richer quintiles, hence these were combined into one to have rich, middle, poorer and poorest quintiles in logistic regression. Among urban women, only 0.3% and 3.0% belonged to the poorest and poorer

		quintiles, hence these were combined into one to have poor, middle, richer and richest quintiles in logistic regression.
Region	Northern, Eastern, Southern, Western and Northwestern	Among rural women, only 1.1% belonged to the Western region hence in logistic regression, Western and Northwestern regions were combined.
Education	No education, primary education, secondary and tertiary education	Among rural women, only 0.5% of the women had tertiary education and only 7.1% in urban hence secondary and tertiary were combined to have post-primary in the logistic regression analysis.
Household size	Less than seven members and seven and above members	Based on the dataset average of seven members per household
Sex of household head	Male or female	
Marital status	Married and Not Married	Marriage included those in formal and informal unions while not married included the never married, divorced, separated and widowed.
Religion	Muslims and Christians and others	

Problem seeking permission to access healthcare	Big problem and no big problem	In the questionnaire, seeking permission to access healthcare had three original responses: no problem, no big problem and big problem. However, none of the study participants reported no problem hence we only had two responses.
Difficulties accessing nearest health facility	big problem and no big problem	In the questionnaire, problems with distance to the nearest health facility had three original responses: no problem, no big problem and big problem. However, none of the study participants reported no problem hence we only had two responses.
Exposure to media	Yes and No	Yes included women who had exposure to any of the four mass media (radio, television (TV) and newspapers and internet)
Working	Yes and No	-
Visited by fieldworker	Yes and No	-
Parity	5 and above, 2-4 and 1	-
ANC frequency	8 and above ANC contacts and less than 8 ANC contacts	-

ANC timing	Within the first trimester and after first trimester	-
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547 **Table 2: Socio-demographic characteristics of women in Sierra Leone as per the 2019**548 **SLDHS**

Characteristics	Rural		Urban	
	N=4531	%	N=2795	%
Age				
15 to 19	375	8.3	223	8.0
20 to 34	2835	62.6	1995	71.4
35 to 49	1322	29.2	577	20.6
Visited by field worker				
No	3126	69.0	1933	69.2
Yes	1405	31.0	862	30.8
Region				
Western	51	1.1	1428	51.1
Eastern	1059	23.4	483	17.3
Northwestern	1096	24.2	285	10.2
Northern	1082	23.9	351	12.6
Southern	1244	27.5	248	8.9
Religion				
Islam	3729	82.3	2036	72.9
Christianity and others	802	17.7	758	27.1
Sex household head				
Male	3663	80.8	1857	66.4
Female	868	19.2	938	33.6
Household Size				
7 and above	2083	46.0	1236	44.2
Less than 7	2448	54.0	1559	55.8
Working status				
Not working	684	15.1	998	35.7
Working	3847	84.9	1796	64.3
Marital status				
Not married	606	13.4	723	25.9
Married	3925	86.6	2072	74.1
Education Level				
No Education	2866	63.2	992	35.5
Primary Education	729	16.1	304	10.9
Secondary Education	913	20.1	1302	46.6
Tertiary	24	0.5	197	7.1

Wealth Index				
Poorest	1576	34.8	11	0.4
Poorer	1466	32.4	85	3.0
Middle	1192	26.3	296	10.6
Richer	258	5.7	1184	42.4
Richest	40	0.9	1219	43.6
Parity				
1	1011	22.3	977	35.0
2-4	2522	55.7	1493	53.4
5 and above	998	22.0	324	11.6
Exposure to mass media				
No	2890	63.8	846	30.3
Yes	1641	36.2	1948	69.7
Permission to access healthcare				
Big problem	1427	31.5	399	14.3
Not big problem	3104	68.5	2396	85.7
Distance to health facility				
Big problem	2732	60.3	722	25.8
Not big problem	1799	39.7	2073	74.2
ANC timing^a				
First trimester	2048	45.5	1165	42.9
After first trimester	2451	54.5	1549	57.1
ANC attendance				
8 contacts and above	988	21.8	622	22.3
Less than 8 contacts	3543	78.2	2173	77.7

^a = missing 32 (0.7%) respondents in rural and 81 (2.9%) in urban areas

550 **Table 3: Factors associated with skilled birth attendance in rural Sierra Leone as per the**
 551 **2019 SLDHS**

Characteristics	Not by SBA n (%)	Delivered by SBA n (%)	Crude model cOR (95% CI)	P-value	Adjusted model aOR (95% CI)
Age				0.002	
15 to 19	42 (5.9)	333 (8.7)	1.9 (1.3-2.8)		1.5 (0.9-2.3)
20 to 34	424 (59.3)	2410 (63.2)	1.3 (1.1-1.6)		1.2 (0.9-1.5)
35 to 49	249 (34.8)	1073 (28.1)	1		1
Visited by fieldworker				0.004	
No	540 (75.6)	2586 (67.8)	1		1
Yes	175 (24.4)	1230 (32.2)	1.5 (1.1-1.9)		1.4 (1.1-1.8)
Region				<0.001	
West and Northwestern	339 (47.4)	808 (21.2)	1		1
Southern	165 (23.1)	1079 (28.3)	2.7 (1.8-4.1)		3.1 (2.1-4.7)

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3 Northern	134 (18.7)	947 (24.8)	3.0 (1.9-4.6)		2.9 (1.9-4.4)
4 Eastern	77 (10.8)	982 (25.7)	5.4 (3.0-9.8)		5.7 (3.1-10.7)
5 Religion				0.199	
6 Christianity and others	109 (15.2)	693 (18.2)	1		1
7 Islam	606 (84.8)	3123 (81.8)	0.8 (0.6-1.1)		1.4 (0.9-1.9)
8 Sex household head				0.269	
9 Male	590 (82.5)	3072 (80.5)	1		
10 Female	125 (17.5)	744 (19.5)	1.2 (0.9-1.5)		
11 Household Size				0.065	
12 7 and above	358 (50.1)	1725 (45.2)	1		1
13 Less than 7	357 (49.9)	2091 (54.8)	1.2 (1.0-1.5)		1.1 (0.9-1.4)
14 Working status				0.745	
15 Not working	104 (14.5)	581 (15.2)	1		
16 Working	611 (85.5)	3235 (84.8)	1.0 (0.7-1.3)		
17 Marital status				<0.001	
18 Not married	64 (8.9)	542 (14.2)	1		1
19 Married	651 (91.1)	3274 (85.8)	0.6 (0.4-0.8)		0.8 (0.6-1.1)
20 Education Level				<0.001	
21 No Education	525 (73.4)	2340 (61.3)	1		1
22 Primary	108 (15.1)	621 (16.3)	1.3 (1.0-1.7)		1.1 (0.8-1.4)
23 Post-primary	82 (11.5)	855 (22.4)	2.3 (1.7-3.2)		1.8 (1.3-2.5)
24 Wealth Index				0.282	
25 Poorest	265 (37.1)	1311 (34.4)	1		
26 Poorer	244 (34.1)	1222 (32.0)	1.0 (0.8-1.3)		
27 Middle	173 (24.2)	1018 (26.7)	1.2 (0.9-1.6)		
28 Rich	33 (4.6)	265 (6.9)	1.6 (1.0-2.7)		
29 Parity				0.018	
30 5 and above	175 (24.4)	823 (21.6)	1		1
31 2-4	409 (57.3)	2112 (55.3)	1.1 (0.9-1.3)		0.9 (0.7-1.1)
32 1	131 (18.3)	881 (23.1)	1.4 (1.1-1.9)		1.0 (0.7-1.3)
33 Exposure to media				0.001	
34 No	514 (71.9)	2378 (62.3)	1		1
35 Yes	201 (28.1)	1440 (37.7)	1.6 (1.2-2.0)		1.5 (1.1-1.9)
36 Permission to access				0.916	
37 Big problem	224 (31.3)	1204 (31.6)	1		
38 Not big problem	491 (68.7)	2612 (68.4)	1.0 (0.8-1.3)		
39 Distance to health				<0.001	
40 Big problem	539 (75.4)	2193 (57.5)	1		1
41 Not big problem	176 (24.6)	1623 (42.5)	2.3 (1.7-3.1)		2.3 (1.7-3.0)
42 ANC timing^a				0.001	
43 First trimester	260 (37.4)	1788 (47.0)	1		1
44 After first trimester	436 (62.6)	2015 (53.0)	0.7 (0.5-0.9)		0.8 (0.6-0.9)
45 ANC attendance				0.615	
46 8 contacts and above	163 (22.8)	825 (21.6)	1		
47 Less than 8	552 (77.2)	2991 (78.4)	1.1 (0.8-1.4)		

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552 **bold**= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds Ratio

553 **Table 4: Factors associated with skilled birth attendance in urban Sierra Leone as per the**
554 **2019 SLDHS**

Characteristics	Not by SBA n (%)	Delivered by SBA n (%)	Crude model cOR (95% CI)	P-value	Adjusted model aOR (95% CI)
Age				0.825	
15 to 49	28 (19.7)	549 (20.7)	1		
20 to 34	101 (71.1)	1894 (71.4)	0.9 (0.6-1.6)		
15 to 19	13 (9.2)	210 (7.9)	0.8 (0.4-1.7)		
Visited by fieldworker				0.625	
No	102 (71.8)	1831 (69.0)	1		
Yes	40 (28.2)	822 (31.0)	1.1 (0.7-1.9)		
Region				<0.001	
West and Northwestern	116 (81.7)	1597 (60.1)	1		1
Southern	4 (2.8)	244 (9.2)	4.3 (1.6-11.4)		5.1 (2.0-13.3)
Northern	16 (11.3)	336 (12.7)	1.6 (0.7-3.3)		2.0 (0.9-4.5)
Eastern	6 (4.2)	477 (18.0)	6.1 (2.7-13.6)		11.7 (4.6-30.2)
Religion				0.094	
Christianity and others	27 (19.0)	732 (27.6)	1		1
Islam	115 (81.0)	1921 (72.4)	0.6 (0.3-1.1)		0.9 (0.5-1.7)
Sex household head				0.522	
Male	90 (63.4)	1767 (66.6)	1		
Female	52 (36.6)	886 (33.4)	0.9 (0.6-1.3)		
Household Size				0.036	
7 and above	79 (55.6)	1157 (43.6)	1		1
Less than 7	63 (44.4)	1496 (56.4)	1.6 (1.1-2.6)		1.5 (1.1-2.3)
Working status				0.080	
Not working	40 (28.2)	958 (36.1)	1		1
Working	102 (71.8)	1695 (63.9)	0.7 (0.5-1.0)		0.8 (0.5-1.3)
Marital status				0.885	
Not married	38 (26.8)	686 (25.8)	1		
Married	104 (73.2)	1967 (74.2)	1.0 (0.7-1.6)		
Education Level				0.020	
No Education	72 (50.7)	920 (34.7)	1		1
Primary	12 (8.5)	292 (11.0)	1.9 (1.0-3.8)		1.7 (0.8-3.6)
Post-primary	58 (40.8)	1441 (54.3)	1.9 (1.2-3.2)		1.4 (0.8-2.5)
Wealth Index				0.200	
Poor	7 (4.3)	90 (3.4)	1		1
Middle	19 (13.5)	277 (10.4)	1.0 (0.3-3.3)		1.2 (0.4-3.5)
Richer	73 (51.8)	1110 (41.9)	1.1 (0.4-3.0)		1.5 (0.6-3.4)
Richest	43 (30.5)	1176 (44.3)	2.0 (0.7-5.7)		2.5 (1.0-6.5)

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3 Parity				0.106	
4 5 and above	25 (17.6)	299 (11.3)	1		1
5 2-4	79 (55.6)	1414 (53.3)	1.5 (0.8-2.9)		1.0 (0.5-1.2)
6 1	38 (26.8)	940 (35.4)	2.1 (1.1-4.3)		1.3 (0.6-2.7)
8 Exposure to media				<0.001	
9 No	68 (47.9)	779 (29.4)	1		1
10 Yes	74 (52.1)	1874 (70.6)	2.2 (1.4-3.4)		1.8 (1.1-2.9)
11 Permission to access				0.398	
12 Big problem	16 (11.3)	383 (14.4)	1		
13 Not big problem	126 (88.7)	2270 (85.6)	0.8 (0.4-1.4)		
14 Distance to health				0.104	
15 Big problem	47 (32.6)	676 (25.5)	1		1
16 Not big problem	95 (67.4)	1977 (74.5)	1.4 (0.9-2.2)		1.6 (1.1-2.5)
17 ANC timing^a				0.041	
18 First trimester	46 (33.3)	1120 (43.5)	1		1
19 After first trimester	92 (66.7)	1457 (56.5)	0.7 (0.4-1.0)		0.8 (0.5-1.2)
20 ANC attendance				0.060	
21 8 contacts and above	21 (14.8)	601 (22.7)	1		1
22 Less than 8	121(85.2)	2052 (77.3)	0.6 (0.4-1.0)		0.6 (0.4-1.1)

26 555 **bold**= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds Ratio

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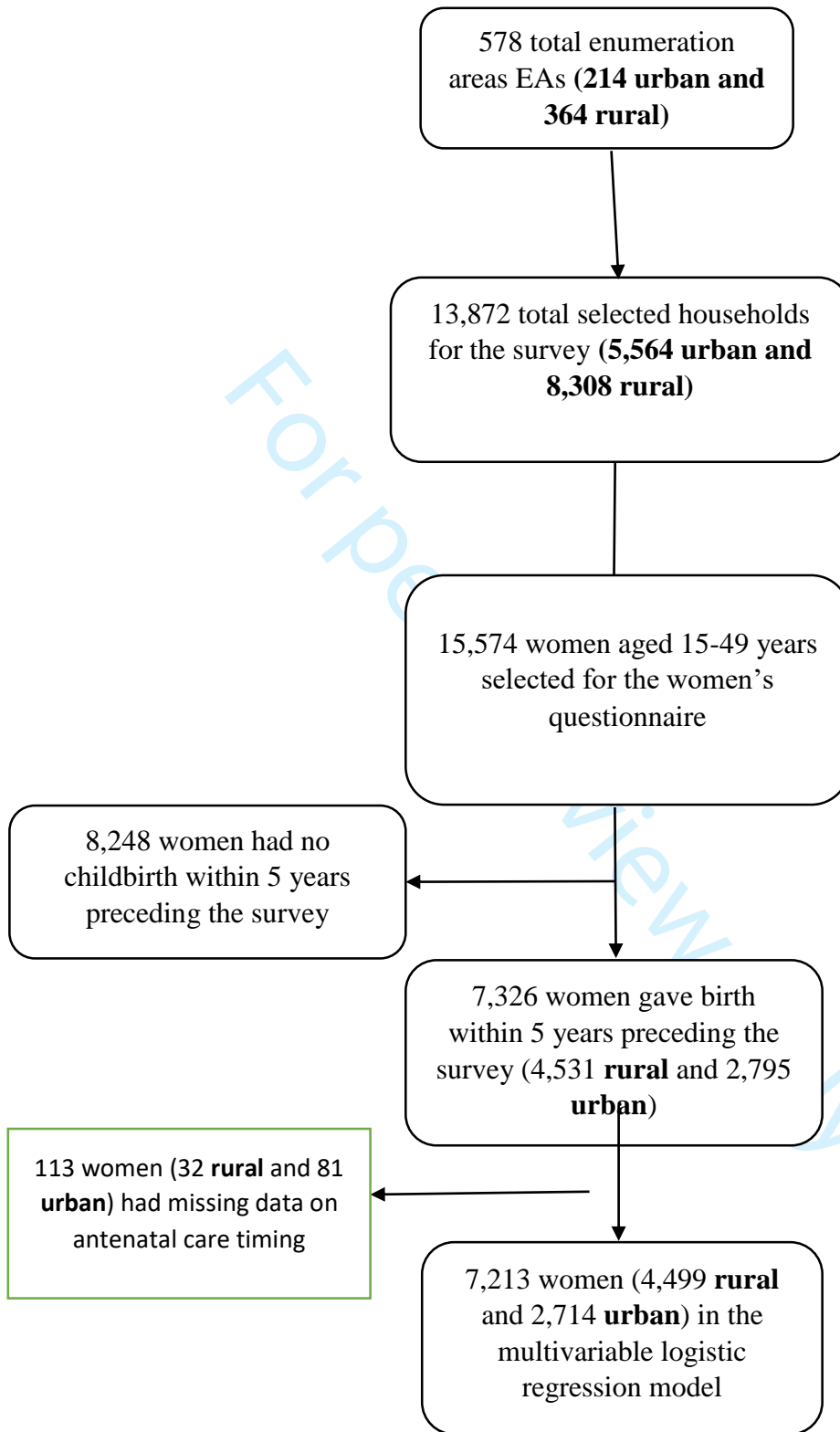
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Additional file Figure 1: flow chat of sampling process

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For peer review only

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4,5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	5
		(d) If applicable, describe analytical methods taking account of sampling strategy	5
		(e) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7

		(b) Report category boundaries when continuous variables were categorized	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

Table 1: Factors associated with non-utilisation of skilled birth attendance in Sierra Leone as per the 2019 SLDHS

Characteristics	Crude model cOR (95% CI)	P-value	Adjusted model aOR (95% CI)
Age		<0.001	
35 to 49	1		1
20 to 34	0.7 (0.6-0.9)		0.9 (0.8-1.2)
15 to 19	0.6 (0.4-0.8)		0.9 (0.6-1.4)
Residence		<0.001	
Urban	1		1
Rural	3.5 (2.6-4.8)		1.8 (1.2-2.7)
Visited by fieldworker		0.006	
Yes	1		1
No	1.4 (1.1-1.8)		1.3 (1.1-1.7)
Region		<0.001	
Western	1		1
Southern	2.3 (1.4-3.8)		0.5 (0.3-0.9)
North-western	6.8 (4.4-10.6)		1.8 (1.2-2.9)
Northern	2.1 (1.3-3.4)		0.6 (0.4-1.0)
Eastern	1.0 (0.5-1.9)		0.3 (0.2-0.5)
Religion			
Islam	1	0.006	1
Christianity and others	0.7 (0.5-0.9)		1.3 (0.9-1.8)
Sex household head		0.012	
Male	1		1
Female	0.8 (0.6-0.9)		1.0 (0.8-1.3)
Household Size		0.006	
7 and above	1		1
Less than 7	0.8 (0.6-0.9)		0.8 (0.7-1.1)
Working status		0.002	
Not working	1		1
Working	1.5 (1.2-2.0)		1.10 (0.8-1.4)
Marital status		<0.001	
Not married	1		1
Married	1.7 (1.4-2.2)		1.10 (0.8-1.4)
Education Level		<0.001	
No Education	1		1
Primary	0.7 (0.6-0.9)		0.9 (0.7-1.1)
Secondary	0.3 (0.3-0.5)		0.6 (0.4-0.8)
Tertiary	0.2 (0.1-0.4)		0.5 (0.2-1.3)
Wealth Index		<0.001	
Richest	1		1
Richer	1.9 (1.2-3.2)		1.5 (0.9-2.4)
Middle	3.8 (2.3-6.3)		1.5 (0.9-2.6)
Poorer	4.9 (3.0-8.2)		1.6 (0.9-2.9)
Poorest	5.1 (3.1-8.4)		1.9 (1.1-3.4)

Parity		<0.001	
5 and above	1		1
2-4	0.8 (0.6-0.9)		1.1 (0.9-1.4)
1	0.5 (0.4-0.7)		0.9 (0.7-1.2)
Exposure to media		<0.001	
Yes	1		1
No	2.2 (1.8-2.8)		1.5 (1.2-1.9)
Permission to access		0.164	
Big problem	1		1
Not big problem	0.8 (0.7-1.1)		1.3 (1.0-1.7)
Distance to health facility		<0.001	
Big problem	1		1
Not big problem	0.4 (0.3-0.5)		0.5 (0.4-0.6)
ANC timing^a		<0.001	
First trimester	1		1
After first trimester	1.4 (1.2-1.8)		1.3 (1.1-1.6)
ANC attendance		0.787	
8 contacts and above	1		-
Less than 8	1.0 (0.8-1.3)		

bold= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds

Ratio

BMJ Open

Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: evidence from the 2019 Sierra Leone demographic health survey

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Manuscript ID	bmjopen-2021-056825.R2
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Date Submitted by the Author:	11-Feb-2022
Complete List of Authors:	Sserwanja, Quraish; GOAL Ireland, Programmes Department, Khartoum, Sudan Mufumba, Ivan; Makerere University; CHILD Research Laboratory Kamara, Kassim; Sierra Leone Ministry of Health and Sanitation Musaba, Milton; Busitema University, Obstetrics and Gynaecology
Primary Subject Heading:	Obstetrics and gynaecology
Secondary Subject Heading:	Public health
Keywords:	Maternal medicine < OBSTETRICS, PUBLIC HEALTH, REPRODUCTIVE MEDICINE

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3 **1 Rural-urban correlates of skilled birth attendance utilisation in Sierra Leone: evidence**
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5 **2 from the 2019 Sierra Leone demographic health survey**
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8 3 Quraish Sserwanja^{1*}, Ivan Mufumba^{2,3}, Kassim Kamara⁴, Milton W. Musaba^{5,6}
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22 Abstract

23 **Objectives** Understanding the rural - urban context specific correlates of skilled birth attendance
24 (SBA) is important to designing relevant strategies and programs. This analysis aimed to assess
25 for the rural-urban correlates of SBA in Sierra Leone.

26 **Setting** The latest nationally representative Sierra Leone Demographic and Health Survey
27 (SLDHS) of 2019.

28 **Participants** The study included a weighted sample of 7,326 women aged 15–49 years. Each of
29 them had a live birth within five years prior to the survey (4,531 in rural areas and 2,795 women
30 in urban areas).

31 **Primary and secondary outcome measure** Skilled birth attendance (primary) and predictors of
32 skilled birth attendance (secondary).

33 **Results** SBA was higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95%
34 CI: 83.8-85.9) in rural areas. Rural women resident in the Southern, Northern and Eastern
35 regions, with post-primary education (aOR = 1.8; 95% CI 1.3 to 2.5), exposure to mass media
36 (aOR = 1.5; 95% CI 1.1 to 1.9), not having difficulties with distance to the nearest health facility
37 (aOR = 2.3; 95% CI 1.7 to 3.0) were associated with higher odds of SBA. Urban women resident
38 in the Southern, Eastern region, with households having less than seven members (aOR = 1.5;
39 95% CI 1.1 to 2.3), exposure to mass media (aOR = 1.8; 95% CI 1.1 to 2.9) and not having
40 difficulties with distance to the nearest health facility (aOR = 1.6; 95% CI 1.1 to 2.5) were
41 associated with higher odds of SBA.

42 **Conclusion** Given the observed differences, improving SBA requires programmes and strategies
43 that are context-specific.

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3 45 **Keywords:** Skilled birth attendance, Sierra Leone, Rural-Urban, Women, DHS
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6 46 **Strengths and limitations of the study**

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8 47 ➤ This is the first nationally representative analysis that explores the rural-urban correlates
9
10 48 of SBA in Sierra Leone
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12 49 ➤ We used the latest nationally representative sample from the 2019 SLDHS, hence
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14 50 findings are generalisable to women in Sierra Leone.
15
16 51 ➤ Given the cross-sectional nature of the data, we could not establish the temporal
17
18 52 relationship between the outcome variable and the independent variables.
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20 53 ➤ Since the data was collected from women who had childbirths within five years prior to
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22 54 data collection, we anticipate recall bias in the process of collecting this data among the
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24 55 respondents.
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29 56 **Introduction**

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32 57 Globally, 83% of births in 2020 occurred with skilled birth attendance (SBA), but coverage
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34 58 continues to be uneven around the world with significant discrepancies between regions with
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36 59 only 64% of births in sub-Saharan Africa (SSA) being attended to by SBA [1]. About 303,000
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38 60 maternal deaths are registered annually with ninety-nine percent being recorded in low- and
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40 61 middle-income countries [2, 3]. SBA has been documented as an effective intervention for
41
42 62 reducing maternal and neonatal deaths [4, 5]. Skilled attendance at birth can reduce
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44 63 intrapartum-related complications by up to 20% [6]. Therefore, ensuring increased utilisation of
45
46 64 SBA can substantially contribute towards achievement of the “*Sustainable Development Goal*
47
48 65 *(SDG) 3 that aims at reducing the global maternal mortality ratio (MMR) to less than 70 per*
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50 66 *100, 000 and neonatal mortality ratio (NMR) of ≤ 12 per 1,000 live births by 2030*” [6-8]. A
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52 67 skilled birth attendant is “an accredited health professional such as a midwife, doctor, or nurse
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3 68 who have been trained with adequate skills needed to handle uncomplicated pregnancies,
4
5 69 childbirth, and the immediate postnatal period, and in the identification, management, and
6
7 70 referral of complications in women and newborns” [6].
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11 71 Besides the women losing their lives, effects of maternal mortality and morbidity are also
12
13 72 experienced at the household and community level [9, 10]. Children left behind after maternal
14
15 73 deaths have increased odds of mortality or other health challenges including undernutrition and
16
17 74 the society loses resources when women die in their most productive years [9]. In Sierra Leone,
18
19 75 pregnancy is associated with a 1 in 17 lifetime risk of maternal death making it among the
20
21 76 highest globally [6]. Despite several measures being implemented in the country, utilisation of
22
23 77 maternal health services such as utilisation of at least four or more antenatal (ANC) contacts
24
25 78 marginally increased by three percent points (76% to 79%) between 2013 and 2019 while
26
27 79 initiation in the first trimester decreased by one percent point (45% to 44%) [11]. In 2017, the
28
29 80 Ministry of Health adopted the latest 2016 WHO guidelines for ANC, recommending eight or
30
31 81 more ANC contacts during pregnancy [12]. To date, there is no data available about the progress
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33 82 made regarding the utilisation of eight or more ANC contacts. The latest SLDHS only reported
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35 83 on the utilisation of at least four ANC contacts [11].
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42 84 Post-civil war and Ebola epidemic Sierra Leone era has witnessed left a fragile health system
43
44 85 having poor infrastructure and inadequate skilled health personnel who are irregularly paid low
45
46 86 salaries [13]. Despite the government’s efforts to improve maternal health with approaches such
47
48 87 as exemption of user fees for maternal healthcare services [14], the country ranks among the
49
50 88 top three countries with the highest MMR, globally [3, 6, 15]. Furthermore, the exemption of
51
52 89 user fees is challenged by inadequate skilled health personnel, increasing workload and
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3 90 inadequate supplies and equipment [16, 17]. Secondary and tertiary care in Sierra Leone is
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5 91 provided by 14 district and regional governmental hospitals [17]. At national level, there are
6
7 92 four tertiary referral hospitals which are all located in the Western Area Urban District [18]. The
8
9 93 country has one of the lowest nurse densities in the world, at approximately 0.2 nurses and
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11 94 midwives per 1000 people [13].
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16 95 Although differences in the levels of utilisation of SBA between Sierra Leone's rural and urban
17
18 96 women have been documented [6, 11], there is a paucity of information on this topic as it is not
19
20 97 adequately explored. Therefore, it is important to further understand these factors when
21
22 98 stratifying by rural-urban place of residence among women because this may be key to designing
23
24 99 effective context-specific strategies and interventions targeting rural and urban areas. We aimed
25
26 100 to determine the correlates of SBA in Sierra Leone, stratified by rural-urban place of residence.
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29 30 101 **Methods**

31 32 33 102 **Data source**

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36 103 Secondary data from the 2019 Sierra Leone Demographic and Health Survey (SLDHS) was
37
38 104 analysed for this study. SLDHS data collection occurred between May and August 2019 by
39
40 105 Statistics Sierra Leone (Stats SL) with technical assistance from ICF international through the
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42 106 DHS Program.
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46 47 107 **Study sampling and participants**

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49
50 108 A stratified, two-stage cluster sampling design was used for the survey leading to 13,872
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52 109 households [11]. The 2019 SLDHS final report contains a detailed description of the sampling
53
54 110 procedures [11, 19]. Women of reproductive age who had a live birth within five years preceding
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3 111 the SLDHS were included in this secondary analysis. Originally, a weighted sample of 15,574
4
5 112 women was included in the individual women's data set of which 7,326 had given birth within
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7 113 five years prior the survey (with 4,531 in rural areas and 2,795 in urban areas) [3], as shown in
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9
10 114 **the supplementary file 1.**

115 **Variables**

116 **Dependent variables**

117 SBA was defined as delivery conducted by a doctor, nurse or midwife [11] and was coded as one
118 (1) while un skilled birth attendance was coded as zero (0).
119

120 **Independent variables**

121 The analysis included independent variables based on evidence from available literature and
122 data [6, 9, 20]. Sixteen explanatory variables were included and categorized as shown in **Table1:**

123 **Statistical analysis**

124 Due to the multi-stage cluster study design used by SLDH, complex sample package of SPSS
125 (version 25.0) statistical software was used with the analysis plan designed to include sample :
126 individual weight, strata for sampling errors/design, and cluster number [21-23]. Associations
127 between independent variables and SBA were assessed by cross tabulation and p-values
128 presented. Before the final adjusted model, each independent variable was assessed individually
129 for its association with SBA using bivariable logistic regression and the crude odds ratio
130 (COR), 95% confidence interval (CI) and p-values are presented and independent variables with
131 a p-value ≤ 0.25 , and not strongly collinear with other independent variables were included in

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2
3 132 the final multivariable logistic regression model [24]. In the final adjusted model, adjusted odds
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5 133 ratios (AOR), 95% CI and p-values were calculated at significance level set at p-value < 0.05.

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8 134 **Supplementary file 2 shows the STROBE checklist.** Sensitivity analysis was done with
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10 135 unskilled birth attendance as the outcome and the results are shown in **supplementary file 3.**

11 136 **Patient and public involvement**

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14 137 Patients were not involved. However, local authorities in the different regions were contacted
15
16 138 before data collection. A comprehensive report on the survey results was released and openly
17
18 139 available on the DHS website.

19 140 **Ethics approval**

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21
22 141 SLDHS ensured that recommended ethical standards are followed. *“The protocol was reviewed*
23
24 142 *and approved by the Sierra Leone Ethics and Scientific Review Committee and the ICF*
25
26 143 *Institutional Review Board” [11].* Furthermore, during data collection, local authorities’
27
28 144 permission and well-informed verbal consent from participants were sought. Ethical approval ID
29
30 145 was not provided in the SLDHS survey report. Authors received written permission from DHS to
31
32 146 access this dataset.

33 147 **Results**

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35
36 148 **Table 2** shows a comparison of background characteristics of study participants. Rural areas had
37
38 149 more participants (4,531) compared to urban areas (2,795). Remarkable differences were
39
40 150 observed in region with 1.1% of rural women residing in Western region compared to 51.1% in
41
42 151 urban areas. Furthermore, 63.2% of rural women had no education compared to 35.5% in urban
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44 152 areas, 34.8% in rural areas belonged to the poorest quintile compared to 0.4% in urban areas and
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46 153 36.2% had exposure to mass media in rural areas compared to 69.7% in urban areas. Over 60.3%
47
48 154 of rural women had big problems with distance to the nearest health facility compared to 25.8%

155 in urban areas. Overall, 88.3% (6468/7,326, 95% CI: 87.9-89.4) of the women had skilled birth
156 attendance. Skilled birth attendance was higher in urban areas at 94.9% (2,653/2,795, 95% CI:
157 94.1-95.7) compared to 84.2% (3,816/4,531, 95% CI: 83.8-85.9) in rural areas.

158 **Factors associated with skilled birth attendance**

159 **Tables 3 and 4** presents the predictors of rural and urban SBA. Our analysis revealed that region
160 of residence, exposure to mass media and distance to the nearest health facility have significant
161 positive association with SBA among women from both regions of residence. In the rural areas,
162 the likelihood of being delivered by a skilled birth attendant was three times higher in the
163 Southern (aOR = 3.1; 95% CI 2.1 to 4.7), Northern (aOR = 2.9; 95% CI 1.9 to 4.4) and six times
164 higher in the Eastern regions (aOR = 5.7; 95% CI 3.1 to 10.7), one and a half times higher
165 among women who had been visited a field worker (aOR = 1.4; 95% CI 1.1 to 1.8), two times
166 higher among women with post-primary education (aOR = 1.8; 95% CI 1.3 to 2.5), one and a
167 half times higher among women with exposure to mass media (aOR = 1.5; 95% CI 1.1 to 1.9),
168 twice higher among women not having big problems with distance to the nearest health facility
169 (aOR = 2.3; 95% CI 1.7 to 3.0) while the likelihood was 0.8 times lower among women who
170 initiated ANC after the first trimester (aOR = 0.8; 95% CI 0.6 to 0.9).

171 In the urban areas, the likelihood of being delivered by a skilled birth attendant was five times
172 higher in the Southern (aOR = 5.1; 95% CI 2.0 to 13.3), 12 times higher in the Eastern region
173 (aOR = 11.7; 95% CI 4.6 to 30.2), one and a half times higher among women from households
174 with less than seven members (aOR = 1.5; 95% CI 1.1 to 2.3), twice among women who had
175 exposure to mass media (aOR = 1.8; 95% CI 1.1 to 2.9) and one and a half times among women
176 who had no big problems with distance to the nearest health facility (aOR = 1.6; 95% CI 1.1 to
177 2.5) compared to those from the western and northwestern regions, households with seven and

178 above household members, with no mass media exposure and those with big problems with
179 distance respectively. Wealth index was imprecisely significant with urban women belonging to
180 the richest quintile (aOR = 2.5; 95% CI 1.0 to 6.5) being more likely to have SBA compared to
181 those in the poor quintile.

182 Discussion

183 In this study, we looked at factors associated with SBA utilisation in Sierra Leone stratified by
184 rural-urban place of residence. Overall, 88.3% (95% CI: 87.9-89.4) of the women had SBA. The
185 overall, urban, rural and SBA prevalence in our study shows 28, 15 and 31 percentage point
186 increases respectively compared to that of 2013 [6, 25]. This shows a tremendous improvement
187 in the uptake of the SBA between 2013 and 2019 in Sierra Leone which could be attributed to
188 the changes in health-seeking behaviour and transformation of the health systems witnessed after
189 the Ebola epidemic [26, 27]. The introduction of free maternal health care services in 2010
190 could also partly have contributed to the observed increase in SBA utilisation [28, 29]. SBA was
191 higher in urban areas at 94.9% (95% CI: 94.1-95.7) compared to 84.2% (95% CI: 83.8-85.9) in
192 rural areas. Higher SBA utilization among urban women has also been shown by Ameyaw et al.
193 [6] and this could be partly explained by factors such as the huge negative effects of the conflict
194 on the rural healthcare system, high concentration of health centres and hospitals and healthcare
195 workers in urban areas enabling easier access to maternal healthcare services [6, 30, 31]. Higher
196 SBA utilization among urban women compared to rural women has been shown in several other
197 studies [32-34]. The mismatch between high coverage of SBA and the persistently high numbers
198 of maternal and perinatal deaths is not only unique to Sierra Leone. This may be partly attributed
199 to delayed seeking of childbirth care and inadequate quality of care provided by skilled birth
200 attendants [35-37]. Available evidence from similar low resource settings in Sub-Saharan points

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3 201 towards poor quality of services offered [29, 38]. The inadequate quality of care may be
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5 202 attributed to factors such as; poor remuneration which demotivates health workers, increased
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7 203 workload on health workers, lack of essential drugs and low quality pre-service and refresher
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9 204 training [36, 37]. In Sierra Leone, pre-service training for SBAs produces three cadres of nursing
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11 205 staff, namely; maternal and child health assistants who train for two years, state enrolled
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13 206 community health nurses spend two and half years in training, and state registered nurses whose
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15 207 training lasts three years. These cadres then have the option to undertake further midwifery
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17 208 training that lasts between 18 – 24 months depending on the nursing qualification and experience
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19 209 [39, 40]. However, the quality of training is affected by factors such as; poor student attendance,
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21 210 delayed and low tutor allowances and poor schools' infrastructure especially for rural training
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23 211 schools [30, 40].

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29 212 Region of residence, exposure to mass media, and distance to the nearest health facility had
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31 213 higher likelihood of SBA uptake in both rural and urban areas. Household size was only
32
33 214 significantly associated with SBA in urban areas while being visited by a fieldworker, level of
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35 215 education and timing of initiation ANC were only significant in rural areas. Being a resident of
36
37 216 the South, the Eastern and Northern regions was associated with more odds of SBA utilisation
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39 217 among rural areas compared to those in the Western and North-western regions which was a
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41 218 similar finding for urban women in the Eastern and Southern regions. This is an unexpected
42
43 219 finding since the Western region has the highest concentration of skilled personnel and health
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45 220 facilities, the most developed and is the most economically vibrant region and therefore has
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47 221 better quality social amenities compared to other regions [28, 30]. However, the Western areas
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49 222 have witnessed increasing numbers of urban poor who are experiencing high standards of living
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51 223 and inequitable distribution of social amenities hence negatively affecting their ability to access
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224 quality healthcare [41, 42]. Furthermore, the documented staff challenges in urban areas such as
225 poor delegation, favoritism and a lack of autonomy could partly affect quality of services in
226 public health facilities which further limits utilisation of healthcare [28, 30]. The government's
227 efforts to ensure better service delivery in the less developed regions that are far away from the
228 developed Western region could also have contributed to this observation [12]. Region has been
229 documented to have an association with SBA in other studies [43].

230 Exposure to mass media was associated with more odds of SBA utilisation in both rural and
231 urban areas. Mass media have been documented to improve health literacy by sensitizing
232 communities on the positive outcomes of timely healthcare seeking and utilisation hence leading
233 to positive attitudes, challenging negative social norms and improving health seeking behavior
234 [44, 45]. Furthermore, women who are exposed to mass media are more likely to be educated,
235 have discussions with their peers which interpersonal interactions contribute greatly in
236 challenging negative norms that might affect health seeking and hence lead to positive health
237 seeking behavioral change [46, 47]. Hence, enhancing mass media exposure can be used to
238 provide targeted maternal health messaging that can lead to increase in the utilisation of SBA
239 [48]. Exposure to media has been shown in previous studies done in similar contexts to have a
240 positive association with SBA [6, 49, 50].

241 Rural and urban women who reported that distance to health facilities was not a major challenge
242 had higher odds of SBA utilization. Our study observed that the mothers in rural areas and urban
243 areas who had no big problem with distance to a health facility had 2.25 and 1.62 higher odds
244 respectively of being attended to by a skilled birth attendant compared to their counterparts who
245 had challenges of distance to the nearest health facility. The strong association between distance
246 to health facility and SBA utilization among the rural mothers compared to urban can be partly

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3 247 explained by the fact that rural areas of Sierra Leone have poor road networks compared to urban
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5 248 areas with most roads being only accessible by off-road vehicles or motorbikes. This is further
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7 249 compounded by the lack of access to affordable transport and health facilities that far apart from
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10 250 each other, which contributes to delays faced by women in rural areas [35, 51]. Distance to
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12 251 health facilities has been shown to impede access to maternal child health services including
13
14 252 SBA in several other studies [9, 52, 53].

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17 253 Unlike in urban areas, being visited by a field health worker, such as a community health worker
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19 254 (CHW) among rural women was significantly associated with SBA utilization. The high demand
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21
22 255 of CHWs in rural areas due to limited accessibility of healthcare because of shortage of health
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24 256 facilities and large distances needed to be covered by rural women [30, 51] compared to easier
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26 257 access of health facilities in urban areas could partly explain the observed difference in
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28 258 association. The increased SBA utilization among rural women who were visited by field health
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31 259 workers could be partly explained by the fact these field health workers equip mothers with
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33 260 knowledge on the dangers of using unskilled birth attendants and complications of pregnancies
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35 261 in addition to encouraging them to seek care within health facilities [54]. Being visited by field
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37 262 health workers has been shown to be associated with SBA in several other studies [55, 56].

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41 263 Level of education was significantly associated with SBA in rural areas but not urban areas.
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43 264 Women with post-primary education had more odds of SBA utilisation compared to women with
44
45 265 no education. Educated women are believed to easily understand counseling given from
46
47 266 healthcare workers, more health literate hence informed on obstetric danger signs, which enables
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49 267 them to seek early maternal healthcare [48]. Educated women have also been shown to develop
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51 268 greater confidence, be more conscious of their health and better abilities to make wise decisions
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53 269 about their own health, hence better SBA utilisation [6, 9]. Furthermore, higher levels of
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3 270 education have an influence on women's positive interpretation of mass media messages leading
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5 271 to positive healthcare seeking behavior change [48]. In predominantly patriarchal African
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7 272 societies and mainly in rural areas [57], men are the main providers with the highest decision
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9 273 making powers [58]. Women in rural areas are usually less empowered due to the more
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11 274 conservative societies in rural areas hence factors such as education that might increase women's
12
13 275 status and decision making are more likely to have an impact on healthcare seeking [59-62]. This
14
15 276 might partly explain the significance of education in rural areas and the non-significance in urban
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17 277 areas. Our findings indicate the need for government to strengthen access to quality girl child
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19 278 education among rural areas to at least secondary school level. Level of education has been
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21 279 shown to be associated with SBA utilisation among several other studies [48, 63, 64]. Delayed
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23 280 initiation of ANC among rural women was associated with less odds of SBA utilization. ANC
24
25 281 utilization has been shown to be associated with several other studies [48, 52, 65]. Delayed
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27 282 initiation could partly reflect poor health seeking behaviour which is further observed by reduced
28
29 283 odds of SBA utilization. However, there is need for further studies to explore the association of
30
31 284 ANC utilization and SBA given the fact that ANC frequency was not significantly associated
32
33 285 with SBA but timing of ANC initiation was.

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35 286 Besides the three factors that were significant in both rural and urban areas, household size was
36
37 287 the only factor that showed significance in urban areas. Women who belonged to households
38
39 288 with less than seven members had more odds of SBA utilization compared to their counterparts.
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41 289 This is in agreement with a study done in Nigeria and India [66, 67]. Although wealth index was
42
43 290 marginally significant in urban areas, women belonging to the richest wealth quintile had 2.5
44
45 291 odds of SBA utilisation compared to their counterparts in the poorest households. We
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47 292 hypothesize that families with smaller sizes tend to have less expenditure which enables savings
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3 293 that can be used for the direct and indirect costs involved in accessing healthcare [67].
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5 294 Furthermore, smaller sizes could be attributed to better maternal healthcare seeking such as
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7 295 modern contraceptives utilization which is further translated into SBA utilisation [67]. Lastly,
8
9 296 having smaller family size might lead to less time spent by women while doing household chores
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11 297 and providing care to other family members and increase their time to seek healthcare [68].
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13 298 However, given the dearth of information regarding household size and SBA utilisation, we
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15 299 recommend further studies to explore this.
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20 300 **Strengths and limitations**

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23 301 The study used a nationally representative sample for the analysis and thus the results can be
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25 302 generalised to all Sierra Leone women. Since the data was extracted from DHS surveys, we are
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27 303 confident that standardized procedures such as validated questionnaires were used in data
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29 304 collection to ensure the validity of the results. This being a cross-sectional study, this creates a
30
31 305 limitation in establishing casual relationships from the established associations. In addition, since
32
33 306 most of the data was for women who had childbirths within five years preceding the survey, we
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35 307 anticipate recall bias in the process of collecting this data among the respondents.
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40 308 **Conclusion and public health implications**

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43 309 In Sierra Leon, SBA utilisation has greatly improved in the last decade. Utilisation is higher in
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45 310 the urban compared to the rural areas. Region of residence, exposure to mass media, and distance
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47 311 to the nearest health facility had a significant association with SBA uptake in both rural and
48
49 312 urban areas. Household size was only significantly associated with SBA in urban areas while
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51 313 being visited by a fieldworker, level of education and timing of initiation ANC were only
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53 314 significant in rural areas. Hence ensuring context specific policies and strategies is crucial to
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3 315 ensure effective SBA utilisation. Generally, maternal stakeholders need to focus on Western
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5 316 region, use of mass media for awareness and sensitization and ensuring increased availability of
6
7 317 affordable and accessible health facilities in both rural and urban areas. In addition, urban
8
9 318 specific programs need to focus on women residing in larger households and rural specific
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11 319 programs need to focus on use of field health workers, women educated to primary level and
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13 320 below and ensuring timely initiation of ANC services. Further research is need to explore
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15 321 reasons why maternal mortality is high despite the high SBA focusing on areas such as quality of
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17 322 care provided.
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326 **Author contributions**

327 QS conceived the idea, drafted the manuscript, performed data analysis and results interpretation.

328 IM, KK and MWM reviewed and interpreted the results and drafted the subsequent versions of
329 the manuscript. All authors read and approved the final manuscript.

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332 **Competing interests**

333 None

334 **Patient consent for publication** Not required.

335 **Data availability statement** This study's data are available from the DHS website (URL:
 336 <https://www.dhsprogram.com/data/available-datasets.cfm>) upon registration [11, 19]. Data are
 337 available from the authors with the permission of DHS.

338 **Ethics statement**

339 SLDHS ensured that recommended ethical standards are followed. *"The protocol was reviewed
 340 and approved by the Sierra Leone Ethics and Scientific Review Committee and the ICF
 341 Institutional Review Board" [11].* Furthermore, during data collection, local authorities'
 342 permission and well-informed verbal consent from participants were sought. Ethical approval ID
 343 was not provided in the SLDHS survey report. Authors received written permission from DHS to
 344 access this dataset.

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548 **Table 1: Categorisation of independent variables**

Variable	Categorization	Explanation
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Maternal age	15-19 years, 20–34 years and 35–49 years	-
Wealth index	poorest, poorer, middle, richer and richest quintiles	The SLDHS collected data on household asset ownership and calculated wealth index using Principal Component Analysis [69] . Among rural women, only 0.9% and 5.7% belonged to the richest and richer quintiles, hence these were combined into one to have rich, middle, poorer and poorest quintiles in logistic regression. Among urban women, only 0.3% and 3.0% belonged to the poorest and poorer quintiles, hence these were combined into one to have poor, middle, richer and richest quintiles in logistic regression.
Region	Northern, Eastern, Southern, Western and Northwestern	Among rural women, only 1.1% belonged to the Western region hence in logistic regression, Western and Northwestern regions were combined.

Education	No education, primary education, secondary and tertiary education	Among rural women, only 0.5% of the women had tertiary education and only 7.1% in urban hence secondary and tertiary were combined to have post-primary in the logistic regression analysis.
Household size	Less than seven members and seven and above members	Based on the dataset average of seven members per household
Sex of household head	Male or female	
Marital status	Married and Not Married	Marriage included those in formal and informal unions while not married included the never married, divorced, separated and widowed.
Religion	Muslims and Christians and others	
Problem seeking permission to access healthcare	Big problem and no big problem	In the original SLDHS questionnaire, three responses had been suggested : no problem, no big problem and big problem. However, the no problem response was not reported by anyone .
Difficulties accessing nearest health facility	big problem and no big problem	In the original SLDHS questionnaire, three responses had been suggested : no problem, no big problem and big

		problem. However, the no problem response was not reported by anyone
Exposure to media	Yes and No	Yes included women who had exposure to any of the four mass media (radio, television (TV) and newspapers and internet)
Working	Yes and No	-
Visited by fieldworker	Yes and No	-
Parity	5 and above, 2-4 and 1	-
ANC frequency	8 and above ANC contacts and less than 8 ANC contacts	-
ANC timing	Within the first trimester and after first trimester	-

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550 **Table 2: Socio-demographic characteristics of women in Sierra Leone as per the 2019**551 **SLDHS**

Characteristics	Rural		Urban	
	N=4531	%	N=2795	%
Age				
15 to 19	375	8.3	223	8.0
20 to 34	2835	62.6	1995	71.4
35 to 49	1322	29.2	577	20.6
Visited by field worker				
No	3126	69.0	1933	69.2
Yes	1405	31.0	862	30.8
Region				
Western	51	1.1	1428	51.1
Eastern	1059	23.4	483	17.3
Northwestern	1096	24.2	285	10.2

Northern	1082	23.9	351	12.6
Southern	1244	27.5	248	8.9
Religion				
Islam	3729	82.3	2036	72.9
Christianity and others	802	17.7	758	27.1
Sex household head				
Male	3663	80.8	1857	66.4
Female	868	19.2	938	33.6
Household Size				
7 and above	2083	46.0	1236	44.2
Less than 7	2448	54.0	1559	55.8
Working status				
Not working	684	15.1	998	35.7
Working	3847	84.9	1796	64.3
Marital status				
Not married	606	13.4	723	25.9
Married	3925	86.6	2072	74.1
Education Level				
No Education	2866	63.2	992	35.5
Primary Education	729	16.1	304	10.9
Secondary Education	913	20.1	1302	46.6
Tertiary	24	0.5	197	7.1
Wealth Index				
Poorest	1576	34.8	11	0.4
Poorer	1466	32.4	85	3.0
Middle	1192	26.3	296	10.6
Richer	258	5.7	1184	42.4
Richest	40	0.9	1219	43.6
Parity				
1	1011	22.3	977	35.0
2-4	2522	55.7	1493	53.4
5 and above	998	22.0	324	11.6
Exposure to mass media				
No	2890	63.8	846	30.3
Yes	1641	36.2	1948	69.7
Permission to access healthcare				
Big problem	1427	31.5	399	14.3
Not big problem	3104	68.5	2396	85.7
Distance to health facility				
Big problem	2732	60.3	722	25.8
Not big problem	1799	39.7	2073	74.2
ANC timing^a				
First trimester	2048	45.5	1165	42.9
After first trimester	2451	54.5	1549	57.1
ANC attendance				

8 contacts and above	988	21.8	622	22.3
Less than 8 contacts	3543	78.2	2173	77.7

552 ^a= missing 32 (0.7%) respondents in rural and 81 (2.9%) in urban areas

553 **Table 3: Factors associated with skilled birth attendance in rural Sierra Leone as per the**
554 **2019 SLDHS**

Characteristics	Not by SBA n (%)	Delivered by SBA n (%)	Crude model cOR (95% CI)	P-value	Adjusted model aOR (95% CI)
Age				0.002	
5 to 49	249 (34.8)	1073 (28.1)	1		1
0 to 34	424 (59.3)	2410 (63.2)	1.3 (1.1-1.6)		1.2 (0.9-1.5)
15 to 19	42 (5.9)	333 (8.7)	1.9 (1.3-2.8)		1.5 (0.9-2.3)
Visited by fieldworker				0.004	
No	540 (75.6)	2586 (67.8)	1		1
Yes	175 (24.4)	1230 (32.2)	1.5 (1.1-1.9)		1.4 (1.1-1.8)
Region				<0.001	
West and Northwestern	339 (47.4)	808 (21.2)	1		1
Southern	165 (23.1)	1079 (28.3)	2.7 (1.8-4.1)		3.1 (2.1-4.7)
Northern	134 (18.7)	947 (24.8)	3.0 (1.9-4.6)		2.9 (1.9-4.4)
Eastern	77 (10.8)	982 (25.7)	5.4 (3.0-9.8)		5.7 (3.1-10.7)
Religion				0.199	
Christianity and others	109 (15.2)	693 (18.2)	1		1
Islam	606 (84.8)	3123 (81.8)	0.8 (0.6-1.1)		1.4 (0.9-1.9)
Sex household head				0.269	
Male	590 (82.5)	3072 (80.5)	1		
Female	125 (17.5)	744 (19.5)	1.2 (0.9-1.5)		
Household Size				0.065	
7 and above	358 (50.1)	1725 (45.2)	1		1
Less than 7	357 (49.9)	2091 (54.8)	1.2 (1.0-1.5)		1.1 (0.9-1.4)
Working status				0.745	
Not working	104 (14.5)	581 (15.2)	1		
Working	611 (85.5)	3235 (84.8)	1.0 (0.7-1.3)		
Marital status				<0.001	
Not married	64 (8.9)	542 (14.2)	1		1
Married	651 (91.1)	3274 (85.8)	0.6 (0.4-0.8)		0.8 (0.6-1.1)
Education Level				<0.001	
No Education	525 (73.4)	2340 (61.3)	1		1
Primary	108 (15.1)	621 (16.3)	1.3 (1.0-1.7)		1.1 (0.8-1.4)
Post-primary	82 (11.5)	855 (22.4)	2.3 (1.7-3.2)		1.8 (1.3-2.5)
Wealth Index				0.282	
Poorest	265 (37.1)	1311 (34.4)	1		

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3 Poorer	244 (34.1)	1222 (32.0)	1.0 (0.8-1.3)		
4 Middle	173 (24.2)	1018 (26.7)	1.2 (0.9-1.6)		
5 Rich	33 (4.6)	265 (6.9)	1.6 (1.0-2.7)		
6 Parity				0.018	
8 5 and above	175 (24.4)	823 (21.6)	1		1
9 2-4	409 (57.3)	2112 (55.3)	1.1 (0.9-1.3)		0.9 (0.7-1.1)
10 1	131 (18.3)	881 (23.1)	1.4 (1.1-1.9)		1.0 (0.7-1.3)
11 Exposure to media				0.001	
13 No	514 (71.9)	2378 (62.3)	1		1
14 Yes	201 (28.1)	1440 (37.7)	1.6 (1.2-2.0)		1.5 (1.1-1.9)
15 Permission to access				0.916	
16 Big problem	224 (31.3)	1204 (31.6)	1		
17 Not big problem	491 (68.7)	2612 (68.4)	1.0 (0.8-1.3)		
18 Distance to health				<0.001	
20 Big problem	539 (75.4)	2193 (57.5)	1		1
21 Not big problem	176 (24.6)	1623 (42.5)	2.3 (1.7-3.1)		2.3 (1.7-3.0)
22 ANC timing ^a				0.001	
23 First trimester	260 (37.4)	1788 (47.0)	1		1
24 After first trimester	436 (62.6)	2015 (53.0)	0.7 (0.5-0.9)		0.8 (0.6-0.9)
25 ANC attendance				0.615	
28 8 contacts and above	163 (22.8)	825 (21.6)	1		
28 Less than 8	552 (77.2)	2991 (78.4)	1.1 (0.8-1.4)		

29 555 **bold**= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds Ratio

32 556 **Table 4: Factors associated with skilled birth attendance in urban Sierra Leone as per the**

35 557 **2019 SLDHS**

37 Characteristics	Not by SBA	Delivered by SBA	Crude model	P-value	Adjusted model
39	n (%)	n (%)	cOR (95% CI)		aOR (95% CI)
41 Age				0.825	
42 25 to 49	28 (19.7)	549 (20.7)	1		
43 20 to 34	101 (71.1)	1894 (71.4)	0.9 (0.6-1.6)		
44 15 to 19	13 (9.2)	210 (7.9)	0.8 (0.4-1.7)		
45 Visited by fieldworker				0.625	
46 No	102 (71.8)	1831 (69.0)	1		
47 Yes	40 (28.2)	822 (31.0)	1.1 (0.7-1.9)		
48 Region				<0.001	
50 West and Northwestern	116 (81.7)	1597 (60.1)	1		1
51 Southern	4 (2.8)	244 (9.2)	4.3 (1.6-11.4)		5.1 (2.0-13.3)
52 Northern	16 (11.3)	336 (12.7)	1.6 (0.7-3.3)		2.0 (0.9-4.5)
53 Eastern	6 (4.2)	477 (18.0)	6.1 (2.7-13.6)		11.7 (4.6-30.2)
54 Religion				0.094	

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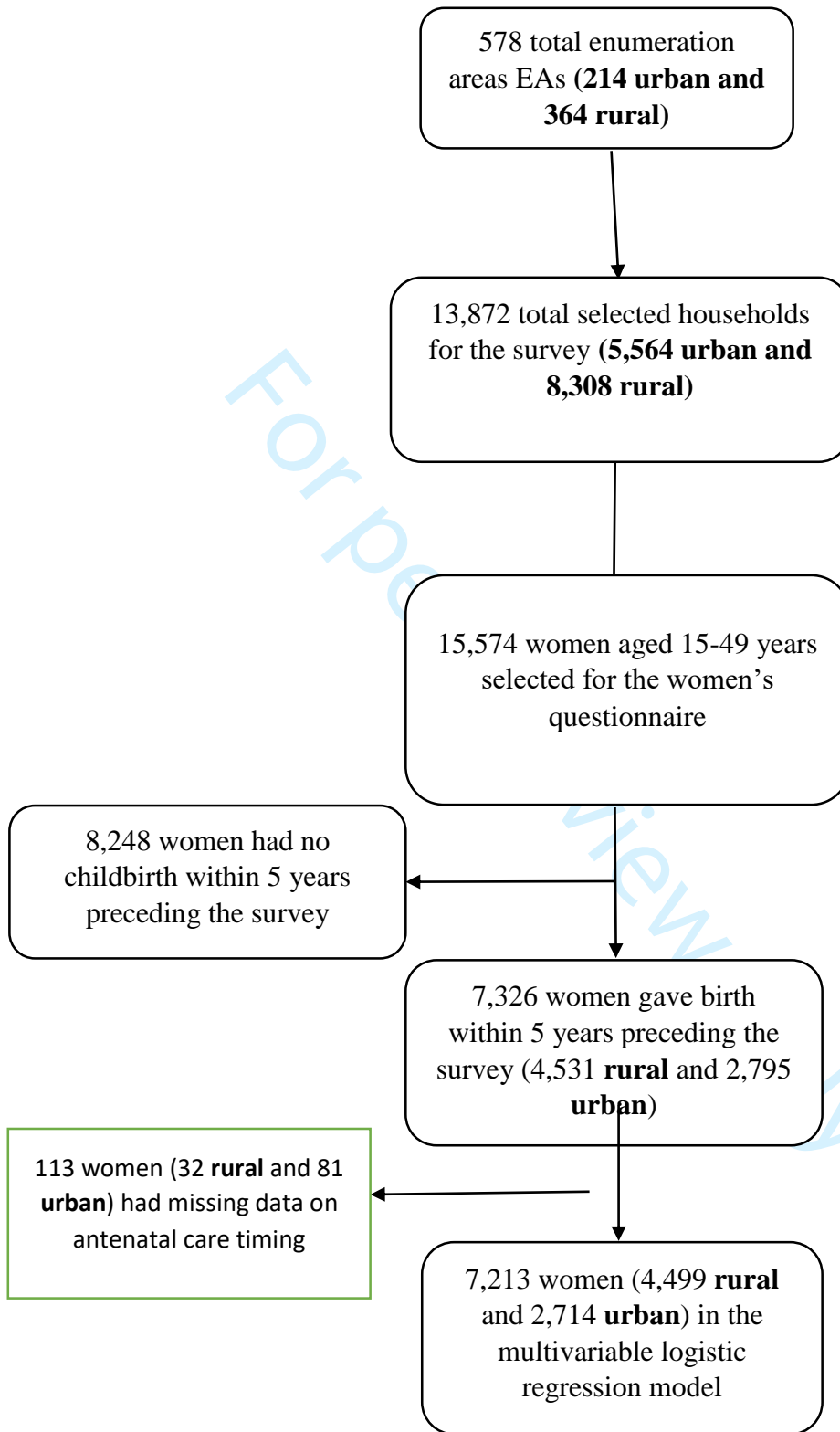
3	Christianity and others	27 (19.0)	732 (27.6)	1		1
4	Islam	115 (81.0)	1921 (72.4)	0.6 (0.3-1.1)		0.9 (0.5-1.7)
5	Sex household head				0.522	
6	Male	90 (63.4)	1767 (66.6)	1		
7	Female	52 (36.6)	886 (33.4)	0.9 (0.6-1.3)		
8	Household Size				0.036	
9	7 and above	79 (55.6)	1157 (43.6)	1		1
10	Less than 7	63 (44.4)	1496 (56.4)	1.6 (1.1-2.6)		1.5 (1.1-2.3)
11	Working status				0.080	
12	Not working	40 (28.2)	958 (36.1)	1		1
13	Working	102 (71.8)	1695 (63.9)	0.7 (0.5-1.0)		0.8 (0.5-1.3)
14	Marital status				0.885	
15	Not married	38 (26.8)	686 (25.8)	1		
16	Married	104 (73.2)	1967 (74.2)	1.0 (0.7-1.6)		
17	Education Level				0.020	
18	No Education	72 (50.7)	920 (34.7)	1		1
19	Primary	12 (8.5)	292 (11.0)	1.9 (1.0-3.8)		1.7 (0.8-3.6)
20	Post-primary	58 (40.8)	1441 (54.3)	1.9 (1.2-3.2)		1.4 (0.8-2.5)
21	Wealth Index				0.200	
22	Poor	7 (4.3)	90 (3.4)	1		1
23	Middle	19 (13.5)	277 (10.4)	1.0 (0.3-3.3)		1.2 (0.4-3.5)
24	Richer	73 (51.8)	1110 (41.9)	1.1 (0.4-3.0)		1.5 (0.6-3.4)
25	Richest	43 (30.5)	1176 (44.3)	2.0 (0.7-5.7)		2.5 (1.0-6.5)
26	Parity				0.106	
27	5 and above	25 (17.6)	299 (11.3)	1		1
28	3-4	79 (55.6)	1414 (53.3)	1.5 (0.8-2.9)		1.0 (0.5-1.2)
29	1-2	38 (26.8)	940 (35.4)	2.1 (1.1-4.3)		1.3 (0.6-2.7)
30	Exposure to media				<0.001	
31	No	68 (47.9)	779 (29.4)	1		1
32	Yes	74 (52.1)	1874 (70.6)	2.2 (1.4-3.4)		1.8 (1.1-2.9)
33	Permission to access				0.398	
34	Big problem	16 (11.3)	383 (14.4)	1		
35	Not big problem	126 (88.7)	2270 (85.6)	0.8 (0.4-1.4)		
36	Distance to health				0.104	
37	Big problem	47 (32.6)	676 (25.5)	1		1
38	Not big problem	95 (67.4)	1977 (74.5)	1.4 (0.9-2.2)		1.6 (1.1-2.5)
39	ANC timing^a				0.041	
40	First trimester	46 (33.3)	1120 (43.5)	1		1
41	After first trimester	92 (66.7)	1457 (56.5)	0.7 (0.4-1.0)		0.8 (0.5-1.2)
42	ANC attendance				0.060	
43	8 contacts and above	21 (14.8)	601 (22.7)	1		1
44	Less than 8	121 (85.2)	2052 (77.3)	0.6 (0.4-1.0)		0.6 (0.4-1.1)

53 558 **bold**= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds Ratio

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Additional file Figure 1: flow chat of sampling process

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Item No	Recommendation	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4,5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Bias	9	Describe any efforts to address potential sources of bias	6
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	6
		(b) Describe any methods used to examine subgroups and interactions	6
		(c) Explain how missing data were addressed	5
		(d) If applicable, describe analytical methods taking account of sampling strategy	5
		(e) Describe any sensitivity analyses	NA
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	5
		(c) Consider use of a flow diagram	5
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7
		(b) Indicate number of participants with missing data for each variable of interest	5
Outcome data	15*	Report numbers of outcome events or summary measures	7
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7

		(b) Report category boundaries when continuous variables were categorized	6-7
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			
Key results	18	Summarise key results with reference to study objectives	8
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	NA

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

Table 1: Factors associated with non-utilisation of skilled birth attendance in Sierra Leone as per the 2019 SLDHS

Characteristics	Crude model cOR (95% CI)	P-value	Adjusted model aOR (95% CI)
Age		<0.001	
35 to 49	1		1
20 to 34	0.7 (0.6-0.9)		0.9 (0.8-1.2)
15 to 19	0.6 (0.4-0.8)		0.9 (0.6-1.4)
Residence		<0.001	
Urban	1		1
Rural	3.5 (2.6-4.8)		1.8 (1.2-2.7)
Visited by fieldworker		0.006	
Yes	1		1
No	1.4 (1.1-1.8)		1.3 (1.1-1.7)
Region		<0.001	
Western	1		1
Southern	2.3 (1.4-3.8)		0.5 (0.3-0.9)
North-western	6.8 (4.4-10.6)		1.8 (1.2-2.9)
Northern	2.1 (1.3-3.4)		0.6 (0.4-1.0)
Eastern	1.0 (0.5-1.9)		0.3 (0.2-0.5)
Religion			
Islam	1	0.006	1
Christianity and others	0.7 (0.5-0.9)		1.3 (0.9-1.8)
Sex household head		0.012	
Male	1		1
Female	0.8 (0.6-0.9)		1.0 (0.8-1.3)
Household Size		0.006	
7 and above	1		1
Less than 7	0.8 (0.6-0.9)		0.8 (0.7-1.1)
Working status		0.002	
Not working	1		1
Working	1.5 (1.2-2.0)		1.10 (0.8-1.4)
Marital status		<0.001	
Not married	1		1
Married	1.7 (1.4-2.2)		1.10 (0.8-1.4)
Education Level		<0.001	
No Education	1		1
Primary	0.7 (0.6-0.9)		0.9 (0.7-1.1)
Secondary	0.3 (0.3-0.5)		0.6 (0.4-0.8)
Tertiary	0.2 (0.1-0.4)		0.5 (0.2-1.3)
Wealth Index		<0.001	
Richest	1		1
Richer	1.9 (1.2-3.2)		1.5 (0.9-2.4)
Middle	3.8 (2.3-6.3)		1.5 (0.9-2.6)
Poorer	4.9 (3.0-8.2)		1.6 (0.9-2.9)
Poorest	5.1 (3.1-8.4)		1.9 (1.1-3.4)

Parity		<0.001	
5 and above	1		1
2-4	0.8 (0.6-0.9)		1.1 (0.9-1.4)
1	0.5 (0.4-0.7)		0.9 (0.7-1.2)
Exposure to media		<0.001	
Yes	1		1
No	2.2 (1.8-2.8)		1.5 (1.2-1.9)
Permission to access		0.164	
Big problem	1		1
Not big problem	0.8 (0.7-1.1)		1.3 (1.0-1.7)
Distance to health facility		<0.001	
Big problem	1		1
Not big problem	0.4 (0.3-0.5)		0.5 (0.4-0.6)
ANC timing^a		<0.001	
First trimester	1		1
After first trimester	1.4 (1.2-1.8)		1.3 (1.1-1.6)
ANC attendance		0.787	
8 contacts and above	1		-
Less than 8	1.0 (0.8-1.3)		

bold= Significant at p-value <0.05, aOR: Adjusted odds ratio. cOR: Crude Odds

Ratio