BMJ Open

Determinants of accessing healthcare in Sub-Saharan Africa: a mixed-effect analysis of recent Demographic and Health Surveys from 36 countries

Zemenu Tadesse Tessema ,[1] Misganaw Gebrie Worku ,[2] Getayeneh Antehunegn Tesema ,[1] Tesfa Sewunet Alamneh ,[1] Achamyeleh Birhanu Teshale ,[1] Yigizie Yeshaw ,[3] Adugnaw Zeleke Alem ,[1] Hiwotie Getaneh Ayalew,[4] Alemneh Mekuriaw Liyew[1]

To cite: Tessema ZT, Worku MG, Tesema GA, *et al*. Determinants of accessing healthcare in Sub-Saharan Africa: a mixed-effect analysis of recent Demographic and Health Surveys from 36 countries. *BMJ Open* 2022;**12**:e054397. doi:10.1136/bmjopen-2021-054397

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-054397).

Received 14 June 2021
Accepted 12 November 2021

[1]Epidemiology and Biostatistics, University of Gondar College of Medicine and Health Sciences, Gondar, Ethiopia
[2]Human Anatomy, University of Gondar, Gondar, Ethiopia
[3]Medical Physiology, University of Gondar College of Medicine and Health Sciences, Gondar, Ethiopia
[4]Department of Midwifery, School of Nursing and Midwifery, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia

Correspondence to
Zemenu Tadesse Tessema; zemenut1979@gmail.com

ABSTRACT

Objective This study aimed to assess the determinants of accessing healthcare among reproductive-age women in Sub-Saharan Africa (SSA).

Design, setting and analysis Cross-sectional data were sourced from recent Demographic and Health Surveys in 36 SSA countries. We employed mixed-effect analysis to identify the determinants of accessing healthcare in SSA. OR and its 95% CI were reported for determinants associated with accessing healthcare.

Outcome The outcome for this study was whether accessing healthcare was a 'big problem' or 'not a big problem'. Responses to these questions were categorised as a big problem and not a big problem.

Participants A total weighted sample of 500 439 reproductive-age (15–49 years) women from each country's recent Demographic and Health Surveys from 2006 to 2018 were included in this study.

Results The pooled prevalence of healthcare access among reproductive-age women in SSA was 42.56% (95% CI 42.43% to 42.69%). The results of the mixed-effect analysis revealed that the determinants of accessing healthcare were urban residence (adjusted OR (AOR)=1.25, 95% CI 1.34 to 1.73), ability to read and write (AOR=1.15, 95% CI 1.22 to 1.28), primary education (AOR=1.08, 95% CI 1.07 to 1.12), secondary education and above (AOR=1.12, 95% CI 1.10 to 1.14), husband with primary education (AOR=1.06, 95% CI 1.07 to 1.1.12), husband with secondary education and above (AOR=1.22, 95% CI 1.18 to 1.27), middle wealth index (AOR=1.43, 95% CI 1.40 to 1.47), rich wealth index (AOR=2.19, 95% CI 2.13 to 2.24) and wanted pregnancy (AOR=1.27, 95% CI 1.19 to 1.29).

Conclusion Healthcare access in SSA was found at 42.56%, which is very low even if Sustainable Development Goal 3.8 targeted universal health coverage for everyone so they can obtain the health services they need. The major determinants of healthcare access among reproductive-age women in SSA were urban residence, higher educational level, higher wealth index and wanted pregnancy. The findings of this study suggest and recommend strengthening and improving healthcare access for women who reside in the countryside, women with low level of education and women of low socioeconomic status.

Strengths and limitations of this study

- The study included 36 Sub-Saharan African countries and each country's Demographic and Health Survey data set is representative of the country and is generalisable.
- The study used mixed-effect analysis which considers clustering effect in order to provide reliable estimates.
- Incorporating a large sample size with adequate power allows detection of the true effect of independent variables.
- This study has its own limitation, that is, the findings do not establish a cause and effect relationship due to the cross-sectional nature of the data/surveys.

INTRODUCTION

Globally, 50% of people are unable to access basic health services, as reported by the World Bank and the WHO in 2017.[1] In Africa, 11 million people are in poverty as a result of using their household income to access essential healthcare services.[2] There is wide discrepancy in accessibility and availability of essentials in Sub-Saharan Africa (SSA) and in Southern Asia.[3]

Healthcare access indicates the affordability, accessibility, availability and acceptability of services in order to achieve the best health outcome.[4] Access to maternal health services is different among women due to them having less land, wealth and properties despite carrying a higher burden of labour, which has a significant role in the society. Also, in most situations, girls are less fed and educated and physically restricted in certain contexts.[5–7]

Globally, women suffer from healthcare inequalities, which lead to excess mortality in all periods of life.[8] Maternal health service refers to providing health service to women during pregnancy, childbearing and postpartum period, and includes antenatal care visits, delivery care and postnatal care services.[9] Although Sustainable Development Goal (SDG) target 3.8 aims to provide universal health coverage, 400 million people in the world lack access to essential health services.[10] Previous studies have provided some evidence on the factors associated with healthcare access, including social, demographic and economic determinants such as marital status,[11] residence,[12] age,[13] literacy,[14] education,[14] wealth index,[15] birth order,[16] wanted pregnancy[17] and women empowerment.[18]

Different empirical evidence related to healthcare access among reproductive-age women has been explored at the country level. Meanwhile, accessing healthcare is a big challenge. There are limited studies that have incorporated all SSA countries and multicountry Demographic and Health Survey (DHS) data sets. This study attempted to generate new evidence by including data from all countries in SSA from 2006 to 2018.

This study aimed to identify the potential factors associated with healthcare access among the reproductive age group in SSA. The results will help improve coverage of access to healthcare and to design an intervention strategy to address issues of poor maternal health status and outcomes.

METHODS

Data source

Data for this study were sourced from the most recent surveys in 36 SSA countries from 2006 to 2018. The DHS programme collects data that are comparable across low-income and middle-income countries. The programme designs the same manual, code, value level, variable name and procedure in more than 90 countries across the world. The SSA countries included in this study are listed in table 1. Details can be found in our previously published work.[19–21] The inclusion and exclusion criteria for SSA countries are shown in figure 1. Data were collected from each country's survey year 5 years preceding the survey. The DHS collects data on HIV/AIDS, nutrition, child health, child nutrition, reproductive health, family planning, marriage, fertility and mortality. Individual record files were used in this study.

A two-stage stratified sampling method was used to select study participants. First, the enumeration area was selected based on each country frame developed from the previous census conducted. Second, households from each enumeration area were selected. The full sampling procedure is found elsewhere.[22] A total of 500 439 reproductive-age women were eligible for this study. Due to the observational nature of the study, the Strengthening the Reporting of Observational Studies in Epidemiology checklist was used and is provided in online supplemental file 1.

Table 1 Pooled Demographic and Health Survey (DHS) data from 36 Sub-Saharan African countries

Country	DHS year	Sample size (500 439)
Southern region of Africa		30 140
Lesotho	2014	6621
Namibia	2013	10 081
Swaziland	2006/2007	4987
South Africa	2016	8514
Central region of Africa		88 207
Angola	2015/2016	14 379
Democratic Republic of Congo	2013/2014	18 379
Congo	2011/2012	10 819
Cameroon	2011	15 426
Gabon	2012	8422
Sao Tome and Principe	2008/2009	2615
Chad	2014/2015	17 719
Eastern region of Africa		193 949
Burundi	2010	17 269
Ethiopia	2016	15 683
Kenya	2014	31 079
Comoros	2012	5329
Madagascar	2008/2009	17 375
Malawi	2015/2016	24 562
Mozambique	2011	13 745
Rwanda	2014/2015	13 497
Tanzania	2015/2016	13 266
Uganda	2011	18 266
Zambia	2018	13 683
Zimbabwe	2013/2014	9955
Western region of Africa		188 143
Burkina Faso	2010	17 087
Benin	2017	15 928
Cote d'Ivoire	2011	10 060
Ghana	2014	9396
Gambia	2013	10 233
Guinea	2018	10 233
Liberia	2013	9239
Mali	2018	10 519
Nigeria	2018	41 821
Niger	2012	11 160
Sierra Leone	2010/2011	16 658
Senegal	2010/2011	15 688
Togo	2013/2014	9480

Measurement of variables

Outcome variable

The outcome variable was accessibility. Most studies have ignored travel time and transport cost when looking at access to health facilities. In the DHS data, women were asked whether a range of factors would be a big problem

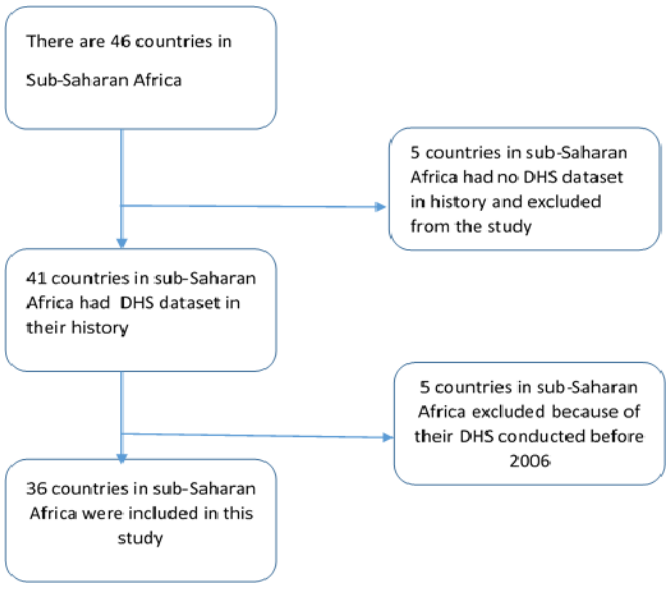

Figure 1 Diagrammatic representation of Sub-Saharan African countries included in the study. DHS, Demographic and Health Survey.

for them when accessing healthcare. We generated a composite outcome variable using each country's DHS standard question. The questions included the following:

- Getting the money needed for treatment (big problem/not a big problem).
- Distance to a healthcare facility (big problem/not a big problem).
- Having to take transport (big problem/not a big problem).
- Not wanting to go alone (big problem/not a big problem).

The responses to the questions asked are 'big problem' and 'not a big problem'. If a woman faces at least one problem, access to healthcare is considered a big problem and is coded 1 or 0 otherwise.

Explanatory variables

After reviewing different types of literature,[12 13 17 23–25] variables were retrieved from the DHS data set. Variables at the individual, community and regional levels were considered in this study. Individual-level variables include age group, literacy level, women's educational status, marital status, husband's educational status, maternal occupation status, media exposure, wealth status, birth order and wanted pregnancy, whereas residence was a community-level variable and region a regional-level variable.

Analytical procedure

In this study, both descriptive and inferential analyses were done. The survey year and the number of reproductive-age women in each country are presented in the tables. The weighted number of reproductive-age women and the weighted percentage of women for each sociodemographic variable are presented in table 2. Model comparison is presented in table 3. The results of the multivariable generalised mixed-effect model are presented to see the effect size of the association between the outcome and the independent variables.

STATA V.14 software was used for analysis. First, each country was given a code and then appended together to create a single data set that represents the SSA countries. There are individual-level and community-level variables in the data set. The nature of the DHS data set is hierarchical and needs advanced statistical techniques to account for variability. The generalised linear mixed-effect model was fitted. Both fixed and random estimates were reported. For fixed-effect estimates, adjusted OR (AOR) and its 95% CI were reported to see the effect size of the association between healthcare access problem and the independent variables (table 4). For random-effect estimates, intraclass correlation and median OR were reported (table 3). First, in the bivariable analysis, variables with a p value less than 0.2 were taken as a candidate variable for the final model. Variables in the final model with a p value less than 0.005 were declared as determinants significantly associated with accessing healthcare in SSA.

Patient and public involvement

There is no direct public and patient involvement in the design and conduct of this research.

RESULTS

A total of 500 439 reproductive-age women 5 years preceding the survey in SSA countries were included in this study. Of these, 193 949 (38.76%) respondents were from the eastern region of Africa and 30 140 (6.02%) respondents were from the southern region. A total of 313 428 (62.63%) respondents were rural residents. Among the respondents, 158 532 (31.68) women and 124 184 (37.32%) men had no formal education, and 195 653 (39.10%) respondents were of poor wealth status (table 2).

Pooled prevalence of healthcare access in SSA

The pooled prevalence of healthcare access in SSA was 42.56% (95% CI 42.43 to 42.69), with the highest rate of healthcare access in the southern region of Africa at 49% (95% CI 48 to 49) and the lowest rate of healthcare access in the central region at 37% (95% CI 37 to 37). Among the SSA countries, the highest rate of healthcare access was from Kenya at 77% (95% CI 76 to 77) and the lowest rate of healthcare access was from Gabon and Sao Tome at 17% for both countries (95% CI 16 to 18 and 95% CI 15 to 18, respectively; figure 2).

Model comparison

Model comparison was done and a mixed-effect logistic regression model was chosen over ordinary logistic regression model due to low deviance. Furthermore, the intraclass correlation coefficient value was 12.09% (95% CI 11.17 to 13.08) and the median OR was 1.44, indicating

Table 2 Socioeconomic and demographic characteristics of reproductive-age women in Sub-Saharan Africa

Variable	Category	Weighted frequency	%
Region	Southern Africa	30 140	6.02
	Central Africa	88 207	17.63
	Eastern Africa	193 949	38.76
	Western Africa	188 143	37.60
Residence	Rural	313 428	62.63
	Urban	187 011	37.37
Age group	15–24	198 907	39.75
	25–34	157 282	31.43
	35–49	144 250	28.82
Marital status	Single	136 519	27.28
	Married	363 920	72.72
Literacy level	Cannot read and write	212 244	42.41
	Can read and write	288 195	57.59
Maternal education	No education	158 532	31.68
	Primary education	163 734	32.72
	Secondary education and above	178 173	35.60
Husband's education (n=332 753)	No education	124 184	37.32
	Primary education	90 831	27.30
	Secondary education and above	117 738	35.38
Maternal occupation	No	155 707	31.11
	Yes	344 732	68.89
Wealth index	Poor	195 653	39.10
	Middle	95 039	18.99
	Rich	209 747	41.91
Media exposed	Yes	350 348	70.02
	No	150 023	29.98
Birth order (n=492 403)	1	70 740	14.37
	2–4	170 095	34.54
	5+	251 568	51.09
Wanted pregnancy (n=255 685)	No	17 434	6.82
	Yes	238 251	93.18

that if we randomly select two women from different clusters, women from a cluster with better healthcare access increased by 44% as compared with women with low healthcare access. Besides, the likelihood ratio test was (likelihood ratio test vs logistic model: chibar2 (01)=1486.67 Prob>=chibar2=<0.001), which informed that the mixed-effect logistic regression model (generalised linear mixed effect model (GLMM)) is the better model over the basic logistic regression model (table 3).

Determinants of accessing healthcare

In the multivariable mixed-effect logistic regression model, region, residence, literacy level, maternal and husband educational status, media exposure, wealth status, and wanted pregnancy were statistically associated with accessing healthcare in SSA.

Women living in the central, eastern and western regions of Africa had decreased likelihood of accessing healthcare, at 25%, 23% and 31% (AOR=0.75, 95% CI 0.71 to 0.80; AOR=0.77, 95% CI 0.73 to 0.81; AOR=0.69, 95% CI 0.65 to 0.73), respectively, as compared with women living in the southern region. Women who reside in urban areas are 1.25 times more likely (AOR=1.25, 95% CI 1.22 to 1.28) to access healthcare than women living in rural areas. Women who can read and write are 1.15 times more likely (AOR=1.15, 95% CI 1.08 to 1.18) to access healthcare than women who cannot read and write. Women with primary and secondary and above education are 1.08 and 1.12 times more likely (AOR=1.08, 95% CI 1.07 to 1.12; AOR=1.22, 95% CI 1.10 to 1.14) to access healthcare than women who had no formal education,

Table 3 Model comparison and random-effect results for the final model

Parameter	Standard logistic regression	Mixed-effect logistic regression analysis (GLMM)
LLR	−144 966	−144 223
Deviance	289 932	288 466
ICC		12 .09 (11.17, 13.08)
LR test		LR test vs logistic model: chibar2(01)=1486.67 Prob>=chibar2=<0.001
MOR		1.44 (1.40, 1.49)
Cluster variance		0.1526 (0.1289, 0.1806)

GLMM, generalised linear mixed effect model; ICC, intraclass correlation coefficient; LLR, log-likelihood ratio; LR test, likelihood ratio test; MOR, median OR.

respectively. Women whose husbands had primary and secondary and above education are 1.06 and 1.22 times more likely (AOR=1.08, 95% CI 1.07 to 1.12; AOR=1.22, 95% CI 1.10 to 1.14) to access healthcare than women whose husband had no formal education. The odds of accessing healthcare among media-exposed women increased by 15% compared with women who were not exposed to mass media (AOR=1.08, 95% CI 1.07 to 1.12). Women below the middle and rich wealth status are 1.43 and 2.19 times more likely (AOR=1.43, 95% CI 1.40 to 1.47; AOR=2.19, 95% CI 2.13 to 2.24) to access healthcare than poor women, respectively. The odds of accessing healthcare among women who wanted pregnancy increased by 24% compared with women who did not want their pregnancy (table 4).

Table 4 Multivariable mixed-effect logistic regression analysis of determinants of healthcare access in Sub-Saharan Africa

		Accessing healthcare			
Variable	Category	Not a big problem	Big problem	COR (95% CI)	AOR (95% CI)
Region	Southern Africa	14 875	15 265	1	1
	Central Africa	34 844	53 365	0.66 (0.64 to 0.68)	0.75 (0.71 to 0.80)*
	Eastern Africa	91 888	102 061	0.84 (0.82 to 0.87)	0.77 (0.73 to 0.81)*
	Western Africa	75 409	112 734	0.64 (0.63 to 0.66)	0.69 (0.65 to 0.73)*
Residence	Rural	117 457	195 971	1	1
	Urban	99 559	87 452	1.93 (1.90 to 1.95)	1.25 (1.22 to 1.28)*
Age group	15–24	88 177	110 730	1	
	25–34	69 064	88 218	0.97 (0.96 to 0.98)	1.01 (0.98 to 1.03)
	35–49	59 775	84 475	0.86 (0.86 to 0.89)	0.98 (0.95 to 1.02)
Literacy level	Cannot read and write	75 149	136 850	1	1
	Can read and write	146 421	141 774	1.68 (1.66 to 1.70)	1.15 (1.08 to 1.18)*
Maternal education	No education	55 647	102 858	1	
	Primary education	67 016	96 858	1.22 (1.20 to 1.24)	1.080 (1.07 to 1.10)*
	Secondary education and above	94 326	83 847	1.96 (1.94 to 1.99)	1.12 (1.10 to 1.14)*
Husband's education (n=332 753)	No education	43 689	80 495	1	1
	Primary education	33 628	57 203	1.06 (1.04 to 1.08)	1.06 (1.04 to 1.08)*
	Secondary education and above	58 147	59 591	1.76 (1.73 to 1.79)	1.22 (1.18 to 1.27)*
Maternal occupation	No	66 261	89 446	1	1
	Yes	150 755	193 977	0.99 (0.97 to 1.00)	1.02 (0.99 to 1.03)
Wealth index	Poor	62 413	133 240	1	
	Middle	39 054	55 985	1.46 (1.44 to 1.48)	1.43 (1.40 to 1.47)*
	Rich	115 549	94 198	2.60 (2.57 to 2.64)	2.19 (2.13 to 2.24)*
Media exposed	Yes	52 457	97 566	1.59 (1.57 to 1.61)	1.15 (1.13 to 1.17)*
	No	164 537	185 811	1	1
Birth order (n=492 403)	1	32 718	38 023	1	1
	2–4	74 434	95 660	0.89 (0.88 to 0.91)	0.98 (0.97 to 1.02)
	5+	105 803	145 765	0.83 (0.82 to 0.85)	0.96 (0.94 to 1.01)
Wanted pregnancy (n=255 685)	No	52 457	97 566	1	1
	Yes	164 537	185 811	1.23 (1.19 to 1.27)	1.24 (1.19 to 1.29)*

*significant at alpha 0.05, **significant at alpha 0.01 and ***significant at alpha 0.001
AOR, adjusted odds ratio; COR, crude odds ratio.

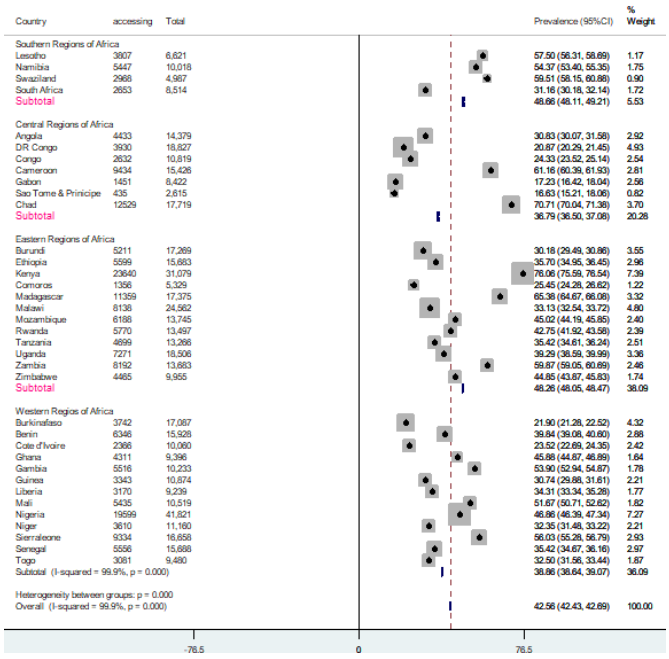

Figure 2 Forest plot of healthcare access among reproductive-age women in Sub-Saharan Africa. DR Congo, Democratic Republic of Congo.

DISCUSSION

This study attempted to assess the determinants of accessing healthcare among reproductive-age women in SSA. This study evidenced that the pooled prevalence of healthcare access in SSA was 42.56%. The determinants associated with accessing healthcare are place of residence, maternal education, husband's education, wealth index and wanted pregnancy.

The pooled prevalence of healthcare access among reproductive-age women in SSA was 42.56% (95% CI 42.43% to 42.69%), which is consistent with Myanmar,[18] South Africa[26] and Tanzania.[27]

This study showed that literacy level is a determinant of healthcare access among reproductive-age women in SSA. Women who can read and write had higher odds of accessing healthcare compared with women who cannot read and write. This finding is consistent with studies conducted in other countries.[14] The possible reason might be that women who can read and write can use the information they get from reading for health service utilisation.

This study revealed that women who reside in rural settings are less likely to access healthcare compared with women who reside in urban settings. This finding is consistent with studies done in Saudi Arabia,[28] Athens, Greece,[29] USA,[30] Washington,[31] East Africa[32] and Ethiopia.[17] Accessing healthcare is influenced by different infrastructures, such as roads, distance to a health facility and transport service, as well as access to education, economic limitations and the influence of sociocultural behaviours where women ask permission from their husbands before seeking healthcare.[33]

The findings also showed that maternal and husband education is a significant determinant of healthcare access among reproductive-age women in SSA. Women and husbands with low-level education are less likely to access healthcare compared with women and husbands with higher-level education. This finding is consistent with studies done in Africa,[34] South Africa,[35] SSA,[26] WHO global health survey,[36] and South Asia and SSA.[37] The possible reason might be that education is a basis for everything and that educated people have better sources of information and use the health education they get from health institutions. Women and men of higher educational level benefit economically compared with uneducated women and men.[23]

Wealth index is another determinant of healthcare access among reproductive-age women in SSA. Women of better wealth index status had higher odds of accessing healthcare compared with the poorest women. This finding is consistent with studies done in Namibia, Kenya, Nepal, India,[38] Myanmar,[18] East Africa,[32] Kenya,[39] Ethiopia[17] and SSA.[25 40] The possible reason might be that wealthy women can access healthcare because they can pay for their health services and have increased accessibility to healthcare. Meanwhile, it is a big problem for poor women as they are unable to pay for health services.

This study revealed that the odds of accessing healthcare among women who had wanted pregnancy increased by 24% compared with women who did not want their pregnancy. This finding is consistent with studies done in different countries, such as Tanzania,[41] UK[42] and Ghana.[24] The possible reason might be that women with unwanted pregnancy have a negative attitude towards maternal health service utilisation, such as Antenatal (ANC) visits, delivery and Postnatal (PNC) services.

Living regions in Africa also had a significant effect on healthcare access among reproductive-age women in SSA. Women living in the central, eastern and western regions of Africa had decreased likelihood of accessing healthcare at 25%, 23% and 31%, respectively, compared with women living in the southern region. This is due to the fact that the southern region of Africa had better economic status and health infrastructure compared with other regions.[43]

Strengths and limitations of this study

The study included 36 SSA countries and each country's DHS data set is representative of the country and is generalisable. The study used mixed-effect analysis which considers clustering effect in order to provide reliable estimates. Incorporating a large sample size with adequate power allows detection of the true effect of independent variables. This study has its own limitation, that is, the findings do not establish a cause and effect relationship due to the cross-sectional nature of the data/surveys.

CONCLUSION

Healthcare access in SSA was found at 42.56%, which is very low even if SDG 3.8 targeted universal health

coverage for everyone so they can obtain the health services they need. The major determinants of healthcare access among reproductive-age women in SSA were urban residence, higher educational level, higher wealth index and wanted pregnancy. The findings of this study suggest and recommend strengthening and improving healthcare access for women who reside in the countryside, women with low level of education and women of low socioeconomic status.

Acknowledgements We would like to thank the Measure DHS programme for providing the data set.

Contributors Conceptualisation: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Data curation: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Investigation: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Methodology: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Software: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Validation: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Writing: ZTT, MGW, GAT, TSA, ABT, YY, AZA, HGA and AML. Writing - review: ZTT, YY, AML, GAT, TSA, MGW and ABT. Writing - editing: AZA, ZTT, MGW, GAT, TSA, ABT, YY, HGA and AML. All authors read and approved the manuscript. ZTT is responsible for the overall content as the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Permission to get access to the data was obtained from the Measure DHS programme through an online request at https://dhsprogram.com/ and the data used were publicly available with no personal identifier. Data were obtained from the Measure DHS programme through an online request and the data used were publicly available with no personal identifier (The Demographic Health Survey Program. Guide to DHS statistics. Available: https://dhsprogram.com/data/dataset_admin/index.cfm)

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data are available online and can be accessed from www.measuredhs.com.

ORCID iDs

Zemenu Tadesse Tessema http://orcid.org/0000-0003-3878-7956
Misganaw Gebrie Worku http://orcid.org/0000-0002-7647-6449
Getayeneh Antehunegn Tesema http://orcid.org/0000-0001-6812-1659
Tesfa Sewunet Alamneh http://orcid.org/0000-0002-4830-931X
Achamyeleh Birhanu Teshale http://orcid.org/0000-0002-7572-9993
Yigizie Yeshaw http://orcid.org/0000-0003-4587-7925
Adugnaw Zeleke Alem http://orcid.org/0000-0002-1928-8548

REFERENCES

1 WHO WB. *Half the world lacks access to essential health services, 100 million still pushed into extreme poverty because of health expenses*, 2017.
2 Global Agenda. How Africa and Asia are joining forces on universal healthcare [Internet]. Available: https://www.weforum.org/agenda/2019/04/universal-health-coverage-uhc-asia-africa-kenya-thailand-japan-egypt/
3 WHO. *The 13 biggest threats to global health according to WHO*, 2020.
4 Gulliford M, Figueroa-Munoz J, Morgan M, *et al*. What does 'access to health care' mean? *J Health Serv Res Policy* 2002;7:186–8.
5 Pega F, Veale JF. The case for the world Health organization's Commission on social determinants of health to address gender identity. *Am J Public Health* 2015;105:e58–62.
6 Sen G, Östlin P. *Gender inequity in health: why it exists and how we can change it*. Taylor & Francis, 2008.
7 Shannon G, Jansen M, Williams K, *et al*. Gender equality in science, medicine, and global health: where are we at and why does it matter? *Lancet* 2019;393:560–9.
8 Myatra SN, Tripathy S, Einav S. Global health inequality and women - beyond maternal health. *Anaesthesia* 2021;76 Suppl 4:6–9.
9 WHO. Maternal health, 2016. Available: http://www.who.int/maternal_child_adolescent/topics/maternal/en/
10 WHO. How many people lack access to health care? (hint: more than who and the world bank report), 2019. Available: https://oneill.law.georgetown.edu/how-many-people-lack-access-to-health-care-hint-more-than-who-and-the-world-bank-report/
11 Pandey KR, Yang F, Cagney KA, *et al*. The impact of marital status on health care utilization among Medicare beneficiaries. *Medicine* 2019;98:e14871.
12 Yang Y-T, Iqbal U, Ko H-L, *et al*. The relationship between accessibility of healthcare facilities and medical care utilization among the middle-aged and elderly population in Taiwan. *Int J Qual Heal Care* 2015;27:222–31.
13 National Academies of Sciences, Engineering and M. *Health-Care utilization as a proxy in disability determination. health-care utilization as a proxy in disability determination*, 2018.
14 Cho. HHS public access. *Physiol Behav* 2016;176:100–6.
15 Minyihun A, Tessema ZT. Determinants of access to health care among women in East African countries: a multilevel analysis of recent demographic and health surveys from 2008 to 2017. *Risk Manag Healthc Policy* 2020;13:1803–13.
16 Pruckner GJ, Schneeweis N, Schober T, *et al*. Birth order, parental health investment, and health in childhood. *SSRN J* 2019.
17 Tamirat KS, Tessema ZT, Kebede FB. Factors associated with the perceived barriers of health care access among reproductive-age women in Ethiopia: a secondary data analysis of 2016 Ethiopian demographic and health survey. *BMC Health Serv Res* 2020;20:1–8.
18 Htun NMM, Hnin ZL, Khaing W. Empowerment and health care access barriers among currently married women in Myanmar. *BMC Public Health* 2021;21:1–9.
19 Tessema ZT, Teshale AB, Tesema GA, *et al*. Determinants of completing recommended antenatal care utilization in sub-Saharan from 2006 to 2018: evidence from 36 countries using demographic and health surveys. *BMC Pregnancy Childbirth* 2021;21:1–12.
20 Tessema ZT, Yazachew L, Tesema GA, *et al*. Determinants of postnatal care utilization in sub-Saharan Africa: a meta and multilevel analysis of data from 36 sub-Saharan countries. *Ital J Pediatr* 2020;46:1–11.
21 Tessema ZT, Tamirat KS, Teshale AB, *et al*. Prevalence of low birth weight and its associated factor at birth in sub-Saharan Africa: a generalized linear mixed model. *PLoS One* 2021;16:1–13.
22 Demographic T, Program HS. Guide to DHS statistics. Available: https://dhsprogram.com/data/dataset_admin/index.cfm
23 Becker G, Newsom E. Socioeconomic status and dissatisfaction with health care among chronically ill African Americans. *Am J Public Health* 2003;93:742–8.
24 Sakeah E, Okawa S, Rexford Oduro A, *et al*. Determinants of attending antenatal care at least four times in rural Ghana: analysis of a cross-sectional survey. *Glob Health Action* 2017;10:1291879.
25 Pons-Duran C, Lucas A, Narayan A, *et al*. Inequalities in sub-Saharan African women's and girls' health opportunities and outcomes: evidence from the demographic and health surveys. *J Glob Health* 2019;9:010410.
26 Seidu A-A. Mixed effects analysis of factors associated with barriers to accessing healthcare among women in sub-Saharan Africa: insights from demographic and health surveys. *PLoS One* 2020;15:1–16.
27 Nisingizwe MP, Tuyisenge G, Hategeka C, *et al*. Are perceived barriers to accessing health care associated with inadequate antenatal care visits among women of reproductive age in Rwanda? *BMC Pregnancy Childbirth* 2020;20:88.
28 Almalki M, FitzGerald G, Clark M. The nursing profession in Saudi Arabia: an overview. *Int Nurs Rev* 2011;58:304–11.

29 Pappa E, Niakas D. Assessment of health care needs and utilization in a mixed public-private system: the case of the Athens area. *BMC Health Serv Res* 2006;6:1–11.
30 Bhatt J, Bathija P. Ensuring access to quality health care in vulnerable communities. *Acad Med* 2018;93:1271–5.
31 National Academies of Sciences E, Medicine. *Health-care utilization as a proxy in disability determination*, 2018.
32 Tessema ZT, Minyihun A. Utilization and determinants of antenatal care visits in East African countries: a multicountry analysis of demographic and health surveys. *Adv Public Heal* 2021;2021:1–9.
33 Munguambe K, Boene H, Vidler M, *et al*. Barriers and facilitators to health care seeking behaviours in pregnancy in rural communities of southern Mozambique. *Reprod Health* 2016;13:83–97.
34 Tsala Dimbuene Z, Amo-Adjei J, Amugsi D, *et al*. Women's education and utilization of maternal health services in Africa: a multi-COUNTRY and socioeconomic status analysis. *J Biosoc Sci* 2018;50:725–48.
35 Tsawe M, Susuman AS. Determinants of access to and use of maternal health care services in the Eastern Cape, South Africa: a quantitative and qualitative investigation. *BMC Res Notes* 2014;7:1–10.
36 Karlsen S, Say L, Souza J-P, *et al*. The relationship between maternal education and mortality among women giving birth in health care institutions: analysis of the cross sectional WHO global survey on maternal and perinatal health. *BMC Public Health* 2011;11:1–10.
37 Tey N-P, Lai S-li. Correlates of and barriers to the utilization of health services for delivery in South Asia and sub-Saharan Africa. *Scientific World J* 2013;2013:1–11.
38 Namasivayam A, Osuorah DC, Syed R, *et al*. The role of gender inequities in women's access to reproductive health care: a population-level study of Namibia, Kenya, Nepal, and India. *Int J Womens Health* 2012;4:351–64.
39 Otieno PO, Wambiya EOA, Mohamed SM, *et al*. Access to primary healthcare services and associated factors in urban slums in Nairobi-Kenya. *BMC Public Health* 2020;20:1–9.
40 Annan J, Donald A, Goldstein M, *et al*. Taking power: women's empowerment and household well-being in Sub-Saharan Africa. *World Dev* 2021;140:105292.
41 Gupta S, Yamada G, Mpembeni R, *et al*. Factors associated with four or more antenatal care visits and its decline among pregnant women in Tanzania between 1999 and 2010. *PLoS One* 2014;9:e101893.
42 Haddrill R, Jones GL, Mitchell CA, *et al*. Understanding delayed access to antenatal care: a qualitative interview study. *BMC Pregnancy Childbirth* 2014;14:1–14.
43 Cigna. *A guide to healthcare in South Africa*, 2019.