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Women's Autonomy concerning Utilisation of Maternal Health Services in 31 sub-Saharan African Countries: Results from Demographic and Health Surveys, 2010-2016

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ABSTRACT

Objectives

To examine the association between women's autonomy and utilisation of maternal health services across 31 sub-Saharan Africa (SSA) countries.

Design, setting and participants:

We analysed the most recent Demographic and Health Survey (DHS) (2010-2016). The study consisted of 194,883 married women aged 15-49 years and uses four questions related to autonomy: attitude towards domestic and sexual violence and decision making on spending of household income and major household purchases. Multilevel regression analyses that adjust for clustering and sampling weights were used to examine the association between women autonomy and utilisation of maternal health services and the adjusted estimates were produced in forest plots.

Outcome

The primary outcomes are the utilisation of antenatal care visits (≥4 ANC) and delivery by skilled birth attendants (SBAs).

Results

Combined adjusted odds ratio (aOR) showed significant associations between all four measures of women's autonomy and utilisation of maternal services. Women who lived in Southern Africa region reported an association between women autonomy (decision making on spending of household income and major household purchases) and utilisation of maternal health services (≥4 ANC visits and SBA). Women who lived in Central Africa region revealed a significant association between opposing domestic violence and use of maternal health services (aOR=1.17, 95% Confidence Interval (CI): 1.06, 1.12) for ≥4 ANC visits and aOR=1.33, 95%CI: 1.16, 1.52 for SBAs).

Conclusion

Women's autonomy in SSA is only marginally associated with utilisation of maternal health services, with inverse associations in some countries. A better understanding of the role of women's autonomy in SSA may help the region achieve the Sustainable Development Goal (SDG-3) target of fewer than 70 maternal deaths per 100,000 livebirths by 2030. Therefore, Further research is needed in SSA to understand better why associations are weaker than in other parts of the world.

Strengths and limitations of this study

- We used nationally representative DHS datasets from countries across 31 SSA counties
- We used four separate measures of female autonomy.
- DHS Datasets were from cross-sectional studies which could lead to underestimation or overestimation of the association.

INTRODUCTION

Understanding the relationship between women's autonomy and utilisation of maternal health services is essential if sub-Saharan Africa (SSA) is to achieve the Sustainable Development Goal (SDG-3) target of fewer than 70 maternal deaths per 100,000 livebirths by 2030.[1] Global MMR has fallen from 385 to 216 per 100,000 between 1990 and 2015 but the MMR for SSA overall was still 546 per 100,000 in 2015 and 56% of all maternal deaths globally occurred in SSA.[1] Increased utilisation of antenatal care (ANC) and skilled birth attendants (SBA) could help reduce the high maternal deaths on the continent.[2-6]

Examining women's autonomy is not without challenges – related to its measurement and definition.[7-10] Similar to several other studies conducted in developing countries, in this study, we assessed women's autonomy using four measures in the Demographic and Health Survey (DHS) questionnaires.[7,9] Some scholars have used the term "autonomy" interchangeably with the term "empowerment", while others have argued that the two words differ.[11-15] In our study, we use the term autonomy to refer to empowerment. Autonomy or empowerment is the ability to make an independent decision, the degree to which one can manipulate the environment to control resources for one's benefit, as well as how to engage and hold accountable institutions.[16-19]

Most of the studies that have examined the relationship between women's autonomy and women's health were conducted in South and South-east Asia.[13,14,17,20-22] These studies have found that women's autonomy is essential for utilisation of maternal health services and women's well-being, but the lack of studies from SSA makes it difficult to know if these results apply to SSA.[9,23-25] This is a concern since SSA has the highest maternal deaths globally.[1] The empirical analysis reported in this paper examined the association between four measures of women's autonomy and utilisation of maternal health services across 31 SSA using DHS data collected during 2010-2016.

METHODS

Data source

This study is restricted to married women aged 15-49 years living with their male partners at the time the DHS surveys were conducted. DHS surveys are standardised cross-sectional datasets that are publicly available. Data are collected by National Statistics Agencies in collaboration with the United States Agency for International Development (USAID).[26] Details of the sampling methods used in the DHS are described elsewhere.[27] The results are released in publicly available DHS household datasets.

Study selection and inclusion criteria

From the 49 SSA countries, we selected the 31 countries that had had DHS data collected during 2010-2016. We divided the 31 countries into four regions, as used by Kassebaum et al. (2014)[28]: Central Africa (Congo, Democratic Republic of Congo (DRC), and Gabon); Eastern Africa (Burundi, Comoros, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia); Southern Africa (Lesotho, Namibia, and Zimbabwe); and Western Africa (Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo). Note that South Africa was excluded as it latest DHS was conducted 1992. We restricted our analysis to the most recent child born in 5 years preceding each survey.

Study variables

Outcome variables

We examined two key outcomes: utilisation of at least four ANC visits (≥4 ANC) and delivery of the last child by SBA. The utilisation of SBA included births attended by doctors, midwives and village midwives; non-utilisation included births attended by traditional birth attendants, family members and other relatives.[29] Utilisation of ANC services was based on mothers who had at least four ANC visits as recommended by the World Health Organization (WHO).[4] Primary outcomes took a binary form: the recommended four or more ANC services was assigned '1', and women who reported less than the four recommended ANC services was assigned '0'. Delivery with any SBAs was categorised as'1' and delivery without SBA was categorised as'0'.

Explanatory variables

We used four DHS indicators related to female autonomy in two areas: women's attitudes to sexual and domestic violence[30-36] and participation in decision-making (solely or jointly with the husband) on spending of household income and major household purchases.[8,9,37-39]

Attitude to sexual violence was measured based on responses to a question that asked if beating a wife by a husband for refusing sexual intercourse with him is acceptable. We coded a woman with a score of 1 if she responded "no" (positive association with empowerment) and 0 if she responded "yes" (agreement). Attitude to domestic violence was based on responses of women to five questions in the DHS asking whether a husband was justified in beating his wife if she: goes out without telling him; neglects the children; argues with him; refuses to have sexual intercourse with him or burns the food. We coded a woman with a score of 1 if she responded no to all five questions (positive association with empowered) and 0 if she responded "yes" (agreement) to any question.

Empowerment about household income was based on a question on spending of household income. Empowerment concerning decision making on major household purchases was based on a question on who decides on major household purchases. We coded the answers to these two questions as 1 (positive association with empowerment) if a woman chooses solely or jointly with the husband and 0 if the decision is made by the husband or someone else.

We adjusted for five potential confounding factors based on previous literature in low- and middle-income countries: place of residence (urban/rural)[40-43], women age at married or cohabitation[44], education attainment [25,44,45], wealth index [25,44-46], and working status.[44,45]

Statistical analysis

Preliminary analyses involved frequency tabulations of all selected socio-economic and demographic characteristics of women in each country. Then, univariate and multivariate logistic regression modelling was done for associations between autonomy measures and ≥4 ANC and SBA, using Generalized Linear Latent and Mixed Models (GLLAMM) with the logit link and binomial family that adjusts for DHS clustering and sampling weights.[47]

For multivariate analysis, a three-stage model was performed, and data were entered progressively into the model to assess the association with the study outcomes. In the first stage, the socioeconomic factors (mother's education, household wealth index and mother's working status) were entered into the baseline multivariable model to examine their association with the study outcomes, and only variables with p-values < 0·05 were retained in the model (model 1). In the second stage, individual-level factors (place of residence, mother's age at birth) were added to model 1 and, as before, those factors with p-values < 0·05 were retained (model 2). Last, the primary explanatory variables (autonomy) were added to model 2.

Adjusted odds ratios (aOR) and 95% confidence interval (95% CI) were used to measure the level of association of the four explanatory variables and the two outcome variables in each of the 31 studied countries. The "metan" function in STATA was used to produce the forest plots of adjusted odds ratios and 95% confidence intervals in individual countries and pooled adjusted odds ratios for all 31 countries combined and for countries in each of the four SSA regions. All analyses and plots were performed using STATA version 14·2 (Stata Corporation, College Station, TX, USA).

RESULTS

Table 1 shows the critical socio-economic and demographic characteristics of the women in our sample (n=194,883). There was considerable variation among the 31 countries. Most women who live lived in rural areas were in Burundi (92%) compared to 14% in Gabon. The percentage of women who gave birth to their first child at age 12-17 years was highest in Ethiopia (62%), and lowest in Rwanda (6%). The percentage of women with no education was highest in Burkina Faso (83%) and lowest in Lesotho and Zimbabwe (1%). The percentage of women who were unemployed was highest in Niger (77%) and lowest in Rwanda (14%). The three countries with the highest percentage of women having at least primary education were all in the Southern African region – Lesotho (99%), Namibia (92%) and Zimbabwe (99%) (Table 1).

Table 1: Socio-economic and demographic characteristics of married women aged 15-49 years living with their male partners at the time when the the Demographic and Health Surveys were conducted in 31 sub-Saharan African countries, (2010-2016).

sub-Saharan African regions (n=31)	Country (year of DHS)	Residency		Age at first childbirth				Education attainment			Work status	
		Urban	Rural	30+	24-29	18-23	12-17	No education	Primary	Secondary or higher	Not working	Working
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
West (15)	Benin (2011-2012)	3350 (40.0)	5021 (59.9)	238 (2.8)	13960 (16.7)	4299 (51.4)	2439 (29.14)	6032 (72.1)	1372 (16.4)	966 (11.5)	2577 (30.8)	5794 (69.2)
	Burkina Faso (2010)	1826 (18.0)	8307 (81.9)	80 (0.8)	675 (6.7)	6031 (59.5)	3347 (33.03)	8454 (83.5)	1113 (11.0)	561 (5.5)	2246 (22.2)	7886 (77.8)
	Cameroon (2011)	2824 (43.2)	3709 (56.8)	71 (1.1)	584 (8.9)	3227 (49.4)	2651 (40.57)	1922 (29.4)	2488 (38.1)	2123 (32.5)	2023 (31.0)	4510 (69.0)
	Chad (2014-2015)	1910 (18.7)	8319 (81.3)	68 (0.7)	545 (5.3)	3987 (38.9)	5629 (55.03)	6807 (66.5)	2383 (23.3)	1040 (10.2)	5766 (56.4)	4453 (43.6)
	Cote d'Ivoire (2011-	1640 (37.9)	2677 (62.0)	48 (1.1)	396 (9.2)	2134 (49.4)	1739 (40.3)	2858 (66.2)	1052 (24.4)	407 (9.4)	1210 (28.0)	3107 (72.0)

	2012)											
	Gambia 2013)	2355 (48.2)	2536 (51.9)	79 (1.6)	619 (12.7)	2574 (52.6)	1618 (33.1)	2960 (60.5)	678 (13.9)	1252 (25.6)	2555 (52.3)	2335 (47.8)
	Ghana (2014)	1576 (45.8)	1870 (54.3)	168 (4.9)	716 (20.8)	1789 (51.9)	772 (22.4)	985 (28.6)	642 (18.6)	1819 (52.8)	649 (18.8)	2797 (81.2)
	Guinea (2012)	1175 (25.8)	3377 (74.2)	59 (1.3)	359 (7.9)	1849 (40.6)	2286 (50.2)	3605 (79.2)	536 (11.8)	411 (9.0)	902 (19.8)	3650 (80.2)
	Liberia (2013)	1763 (50.6)	1721 (49.4)	30.70 (0.9)	271 (7.8)	1722 (49.5)	1459 (41.9)	1575 (45.2)	999.90 (28.7)	908 (26.1)	1377 (39.5)	2106 (60.5)
	Mali (2012-2013)	1284 (19.6)	5269 (80.4)	109 (1.7)	594 (9.1)	2998 (45.7)	2852 (43.5)	5460 (83.3)	579 (8.8)	515 (7.9)	3691 (56.3)	2863 (43.7)
	Niger (2012)	1089 (13.9)	6718 (86.1)	57 (0.7)	508 (6.5)	3348 (43.0)	3872 (49.7)	6634 (85.1)	785 (10.1)	380 (4.9)	6002 (76.9)	1804 (23.1)
	Nigeria (2013)	6830 (35.2)	12567 (64.8)	543 (2.8)	2646 (13.6)	8525 (44.0)	7683 (39.6)	9575 (49.4)	3679 (19.0)	6143 (31.7)	6067 (31.3)	13311 (68.7)
	Senegal (2010-2011)	1468 (36.5)	2555 (63.5)	96 (2.4)	558 (13.9)	2241 (55.7)	1128 (28.0)	2719 (67.6)	838 (20.8)	467 (11.6)	2225 (55.3)	1799 (44.7)
	Sierra Leone (2013)	1704 (23.4)	5571 (76.6)	110 (1.5)	777 (10.7)	3435 (47.2)	2950 (40.6)	5287 (72.7)	1017 (14.0)	970 (13.3)	1641 (22.6)	5626 (77.4)

	Togo (2013-2014)	1602 (36.2)	2824 (63.8)	132 (3.0)	720 (16.3)	2523 (57.0)	1050 (23.7)	1789 (40.4)	1608 (36.3)	1030 23.3)	849 (19.2)	3577 (80.8)
East (10)	Burundi (2010)	359 (8.0)	4146 (92.0)	77 (1.7)	716 (15.9)	3071 (68.2)	640 (14.2)	2361 (52.4)	1863 (41.4)	282 (6.3)	818 (18.2)	3687 (81.8)
	Comoros (2012)	555 (28.6)	1385 (71.4)	139 (7.1)	405 (20.9)	830 (42.8)	567 (29.2)	841 (43.5)	482 (24.9)	611 (31.6)	1171 (60.5)	764 (39.5)
	Ethiopia (2016)	882 (12.4)	6227 (87.6)	52 (0.7)	363 (5.2)	2223 (31.7)	4379 (62.4)	4508 (63.4)	1995 (28.1)	605 (8.5)	5138 (72.3)	1971(27.7)
	Kenya (2014)	4481 (38.1)	7284 (61.9)	154 (1.3)	1429 (12.2)	6822 (58.0)	3359 (28.6)	1251 (10.6)	64160 (54.5)	4099 (34.8)	1972 (35.3)	3611 (64.7)
	Malawi (2015-2016)	1608 (14.4)	9572 (85.6)	72 (0.6)	569 (5.1)	6549 (58.6)	3990 (35.7)	1404 (12.6)	7389 (66.1)	2387 (21.4)	3814 (34.1)	7366 (65.9)
	Mozambique (2015)	800 (26.0)	2282 (74.0)	46 (1.5)	170 (5.6)	995 (32.6)	1837 (60.3)	884 (28.7)	1710 (55.5)	480 (15.9)	1877 (60.9)	1206 (39.1)
	Rwanda (2014-2015)	794 (16.4)	4050 (83.6)	161 (3.3)	1262 (26.1)	3107 (64.1)	313 (6.5)	717 (14.8)	3513 (72.5)	614 (12.7)	672 (13.9)	4172 (86.1)
	Tanzania (2015-2016)_	1571 (27.6)	4115 (72.4)	79 (1.4)	528 (9.3)	3401 (59.9)	1675 (29.5)	1168 (20.5)	3695 (65.0)	824 (14.5)	1283 (22.6)	4403 (77.4)

	Uganda (2016)	1834 (22.2)	6422 (77.8)	136 (1.7)	592 (7.2)	3709 (45.2)	3773 (46.0)	890 (10.8)	4975 (60.3)	2392 (29.0)	1746 (21.1)	6510 (78.9)
	Zambia (2013-2014)	2694 (36.3)	4730 (63.7)	60 (0.8)	420 (5.7)	4070 (54.8)	2875 (38.7)	813 (11.0)	4170 (56.2)	2435 (32.8)	3397 (45.8)	4026 (54.2)
Central (3)	Congo, Rep. (2011-2012)	2764 (62.1)	1690 (38.0)	83 (1.9)	469 (10.5)	2317 (52.0)	1586 (35.6)	319 (7.2)	1307 (29.3)	2829 (63.5)	1288 (28.9)	3166 (71.1)
	DRC (2013-2014)	2867 (30.7)	6469 (69.3)	126 (1.3)	925 (9.9)	5179 (55.5)	3104 (33.3)	1762 (18.9)	4035 (43.2)	3539 (37.9)	2277 (24.4)	7058 (75.6)
	Gabon (2012)	2199 (85.6)	371 (14.4)	74 (2.9)	294 (11.4)	1261 (49.1)	941 (36.6)	230 (9.0)	639 (24.9)	1700 (66.2)	1338 (52.1)	1228 (47.9)
Southern (3)	Lesotho (2014)	574 (28.6)	1434 (71.4)	58 (2.9)	243 (12.1)	1364 (67.9)	343 (17.1)	20 (1.0)	902 (44.9)	1086 (54.1)	1318 (65.6)	690 (34.4)
	Namibia (2013)	944 (53.4)	826 (46.7)	81 (4.6)	324 (18.3)	934 (52.8)	431(24.4)	136 (7.7)	442 (25.0)	1192 (67.4)	967 (54.7)	801 (45.3)
	Zimbabwe (2015)	1355 (32.1)	2864 (67.9)	42.60 (1.0)	393 (9.3)	2688 (63.7)	1095 (26.0)	51 (1.22)	1304 (30.9)	2864 (67.9)	2478 (58.8)	1740 (41.3)

Figures 1-4 (antenatal care) and figures 5-8 (skilled birth attendants) summarise the meta-analysis results (ORs and 95% CI) for all 31 countries combined as well as for regions and individual countries (after adjusting for the five potential confounders).

The pooled results for all 31 countries combined showed weak (ORs ranged from 1.07 to 1.15), but statistically significant associations between all four measures of women's autonomy and utilisation of maternal services (≥4 ANC and SBA). Associations were strongest in the Southern region: women in this region who made decisions on household income were more likely to use SBA (aOR: 1.44, 95% CI: 1.21-1.70); women in this region who made decisions on major household purchases were more likely to use ≥4 ANC (aOR: 1.37, 95% CI: 1.14-1.64) and SBA (aOR: 1.42, 95% CI: 1.16-1.74); and those to opposed sexual violence were more likely to use SBA (aOR: 1.44, 95% CI: 1.22-1.70).

Interestingly, our country analysis showed that in three countries (Chad, Mali, and Senegal), women with higher autonomy on some measures were less likely to use maternal health services. Women with higher autonomy about domestic violence were less likely to use ≥4 ANC in Chad (aOR: 0.85, 95% CI: 0.71-1.00) and Mali (aOR: 0.83, 95% CI: 0.69-0.99) (Figure 1). Women who made decisions on household income were less likely to use ≥4 ANC in Mali (aOR: 0.82, 95% CI: 0.67-1.00) (Figure 2). Women who made decisions on major household purchases were less likely to use SBA in Senegal (aOR: 0.74, 95% CI: 0.59-0.94) (Figure 7).

Figures 1 – 8 here

DISCUSSION

Relevant to the current debate on how SSA will achieve the SDG-3 target by 2030,[1] this study examined the association between women's autonomy and usage of maternal health services across 31 SSA countries. In the pooled results for all 31 countries combined there were only weak, albeit statistically significant, associations between women's autonomy and utilisation of maternal health services. The exception was the Southern African region where three measures of women's autonomy were relatively strongly associated with the use of maternal health services. Surprisingly, the country-level analyses suggested that in Chad, Mali, and Senegal,

women with higher autonomy on some measures were less likely to use maternal health services.

Our combined pooled results for all 31 countries show that women's autonomy is associated with use of both ≥4 ANC and SBA in SSA. However, this association was weak, suggesting that many other factors other than women's empowerment affect the use of maternal health services in SSA. In a study similar to ours, Ahmed et al. used DHS data to investigate autonomy and utilisation of ≥4 ANC and SBA in 31 developing countries, including 21 SSA counties.[48] They found weaker associations between women's empowerment and utilisation of maternal health services in SSA than in other parts of the world. For example, the pooled odds ratio for autonomy and ≥4 ANC was 1.52 for all 31 countries and 1.29 in the 21 SSA countries.[48] Note that we used slightly different DHS measures of autonomy to Ahmed et al. We used women's attitudes to violence as well as women's participation in decisions (finance and major household purchases). Ahmed et al. only examined women's autonomy about decisions as well as their paper was published in 2010 and so used older DHS data than we did.

Based mainly on studies in Asia, women's autonomy is considered a crucial contributor to their utilisation of maternal health services. Women's autonomy has consistently been shown to be associated with utilisation of ANC and SBA in South and Northern India,[8,13] and in Nepal and Indonesia where women's financial autonomy has been found to be associated with their utilisation of maternal health service.[21,22]

Three measures of women's autonomy were relatively strongly associated with utilisation of maternal health services in the Southern SSA region. Women who made decisions on household income, who opposed sexual violence, and who made decisions on major household purchases were nearly 50% more likely to use both ≥4 ANC and SBA. Weaker associations in other African regions could be explained by differences in levels of female's education across countries in SSA. Education has been shown to be associated with utilisation of maternal health services.[21,23,48-50] It has also been found that female education is related to empowerment.[51,52] The Southern African region had the highest mean percentage of female education (at least primary

education) at 97 %, compared to 88% in the Central Region, 73% in the Eastern Region and 38% in the Western region. Furthermore, the three countries with highest levels of at least primary education were all in this Southern region: Lesotho and Zimbabwe (99%) and Namibia (92%). This finding raises the possibility that an underlying level of education is needed in a country to enable women's autonomy to play a role in the utilisation of maternal health services.

One unexpected finding in our study is that women with higher autonomy on some measures in Chad, Mali and Senegal were less likely to utilise either ≥4 ANC or SBA than women with less autonomy. These unexpected findings are consistent with some previous research in Malawi and Mali.[24,53] In a study in Malawi it was found that women with higher autonomy were less likely to be accompanied by their male partners to ANC services.[24] In Mali, Upadhyay and colleagues found that women who had higher autonomy towards sexual violence tended to have more children, perhaps because higher fertility is regarded as a sign of empowerment.[53,54] Another explanation for the inverse associations that we observed might be that more empowered women in Chad, Mali and Senegal might be more likely to successfully refuse to use maternal health services that they perceive to be inadequate.[55-59]

Strengths of our study are that we used nationally representative DHS surveys from countries across SSA and we used four separate measures of female autonomy. One of the limitations is that DHS surveys are cross-sectional studies where autonomy is measured after the relevant pregnancy has occurred. Longitudinal studies measuring women's autonomy before pregnancy and then following women through to the end of the pregnancy, assessing utilisation of maternal health services, would provide higher quality evidence about the causal relationship between autonomy and ≥4 ANC and SBA. Another limitation is the measurement of autonomy. Despite many definitions and measures of women's autonomy, no measure can capture its true complex meaning.[9,18,21,23,44] Women's autonomy remains a multifaceted concept, which varies between cultures and societies, even within the same country.[7,53] The DHS provides useful indicators of autonomy for comparison across countries, but further in-depth research into cultural differences of the meaning of autonomy is needed for a better understanding of women's autonomy and its association with maternal health.

CONCLUSION

Our findings suggest that there are substantial variations in the relationship between women's autonomy and use of maternal health services in SSA at both regional and country level. In most parts of SSA, women's autonomy is only very weakly associated with the utilisation of maternal health services, with inverse associations in some countries. Given these weak associations, much more research on women's autonomy is needed in SSA to inform gender and health policies required to maximise utilisation of maternal health services. Understanding women's autonomy in SSA is necessary if the region is to reduce its high maternal deaths to the SDG-3 target by the year 2030.

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Contributors

All authors contributed to the study design and review of the manuscript. CSC collected the data, produced the tables and figures and wrote the first draft with vital input from KA and RGC. KA contributed significantly is the statistical analyses. CSC wrote the report. JN provided critical contributions to the paper.

Role of the funding

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Competing interests

All authors have no competing interests to declare.

Ethical approval

This study is based on publically available DHS data. The first author was granted access to the data by the MEASURE DHS/ICF International, Rockville, Maryland, USA.

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FIGURES

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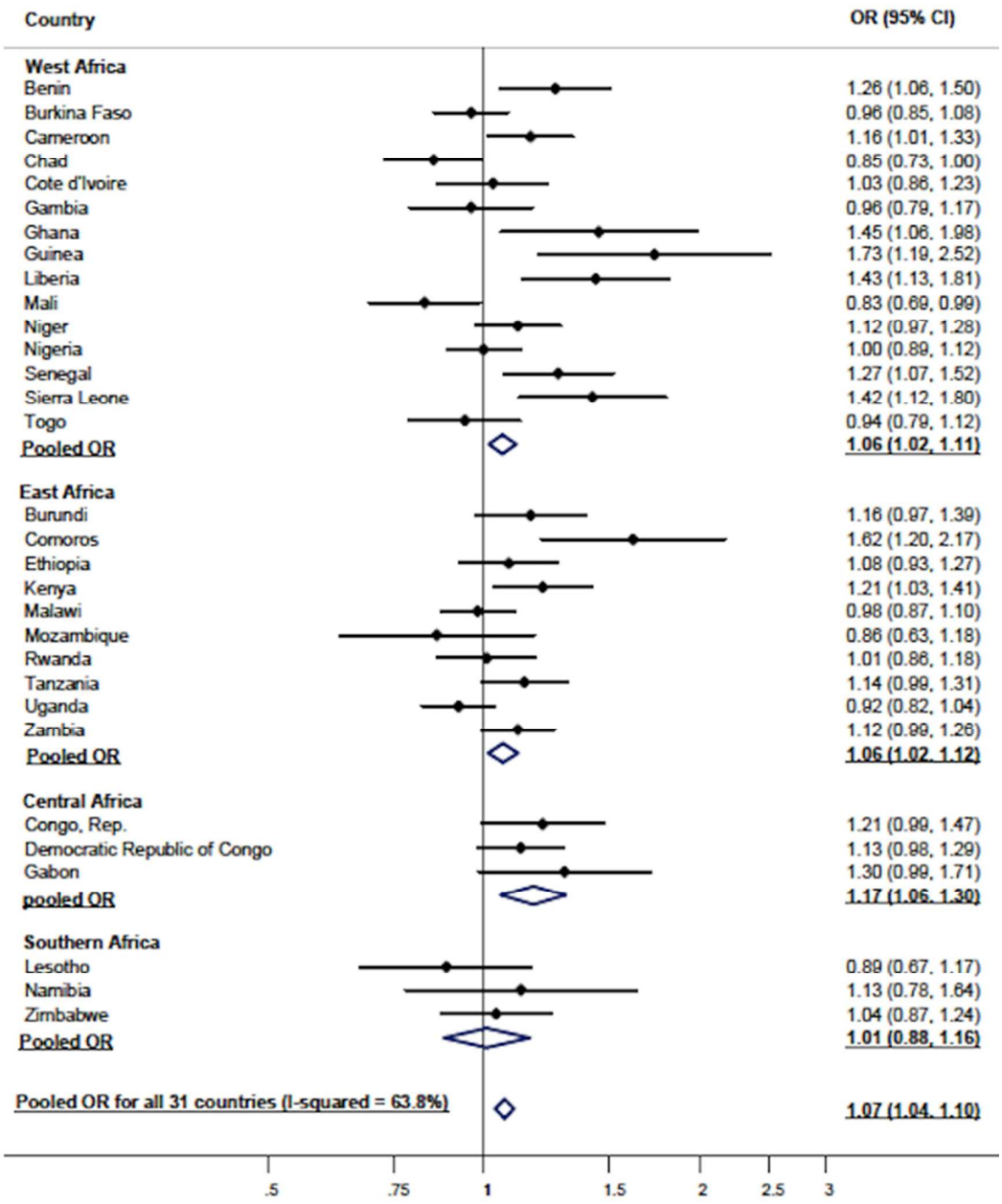
Figure 8: The association between women autonomy (opposing sexual violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016



[1]OR = Independent variables adjusted for are: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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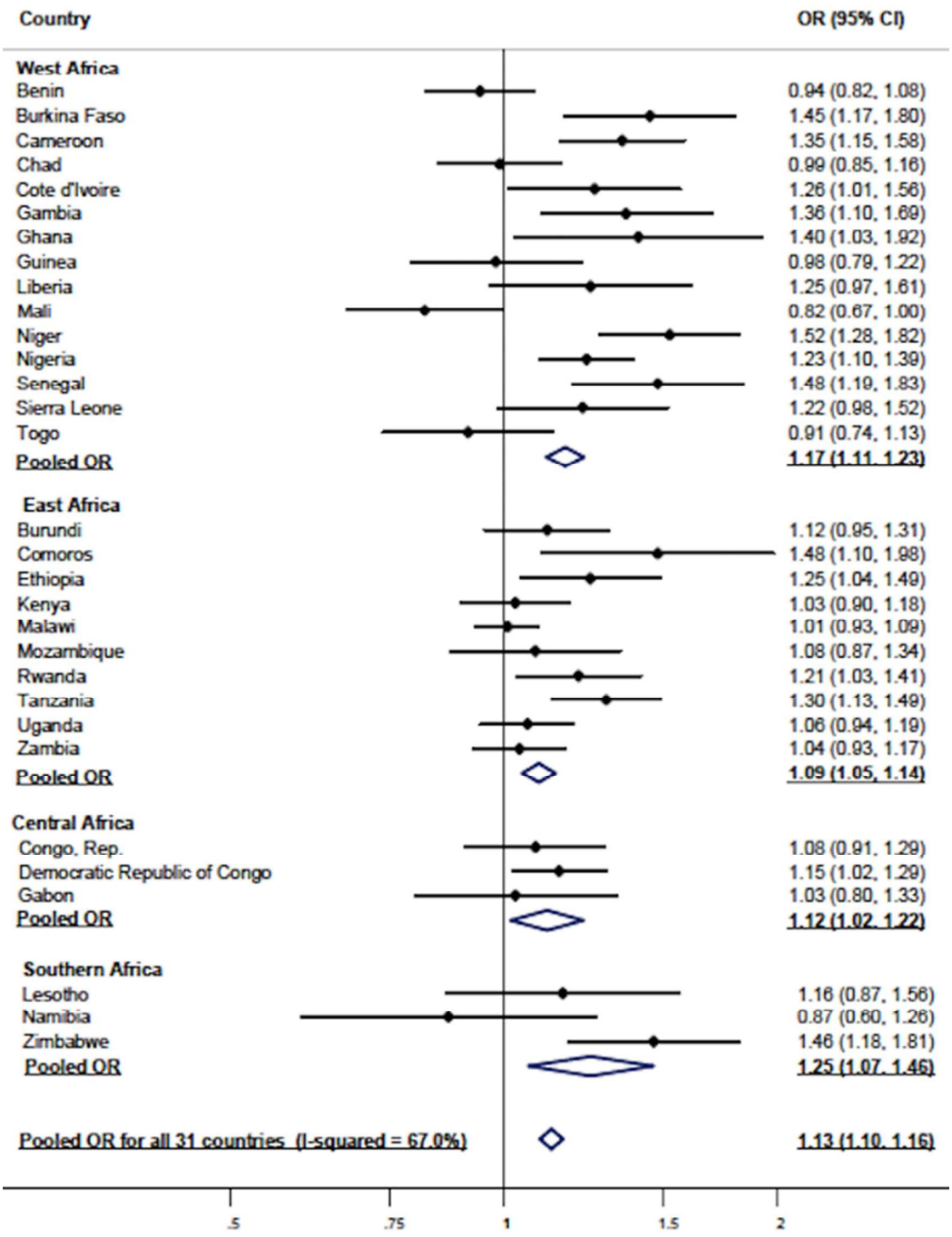

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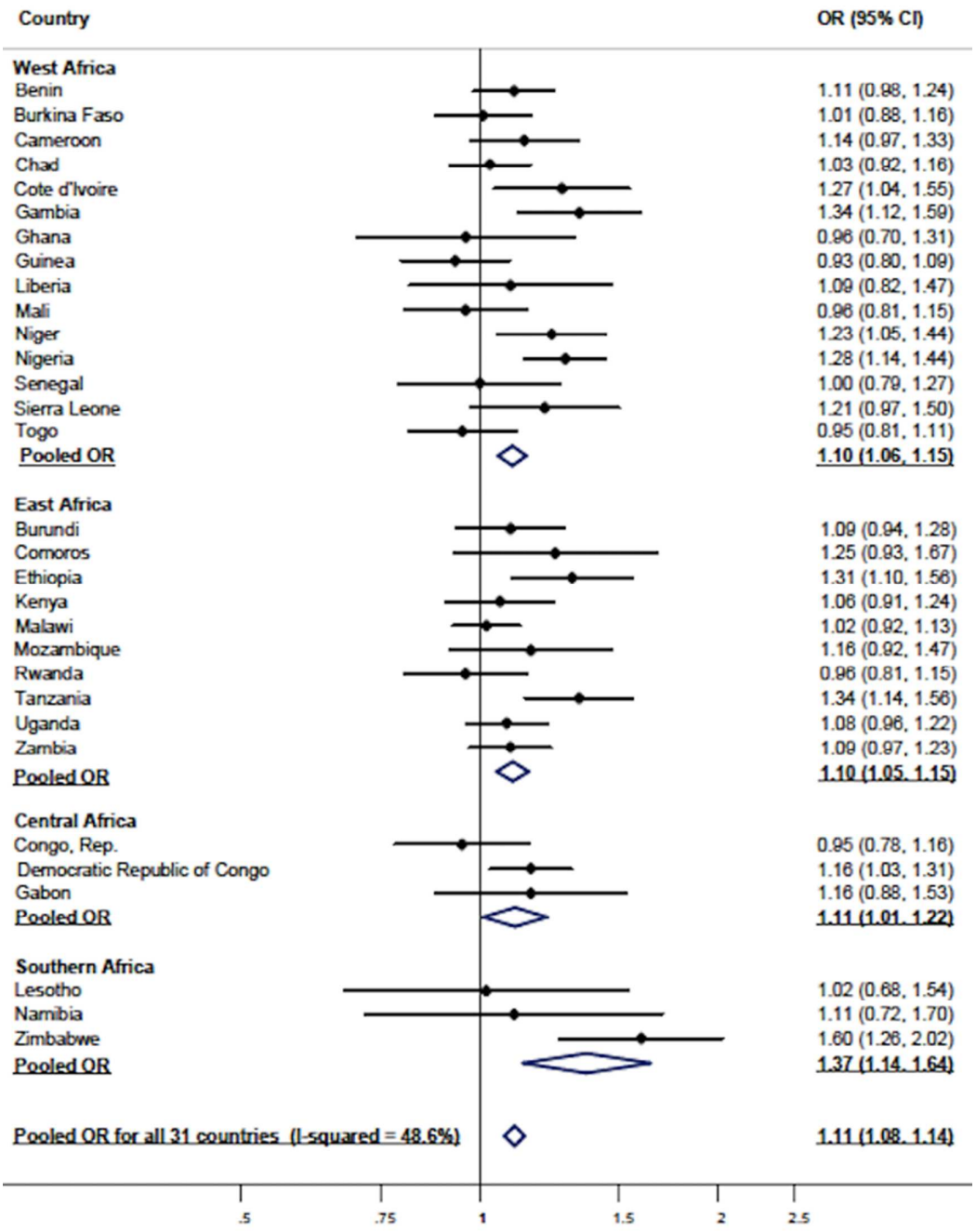

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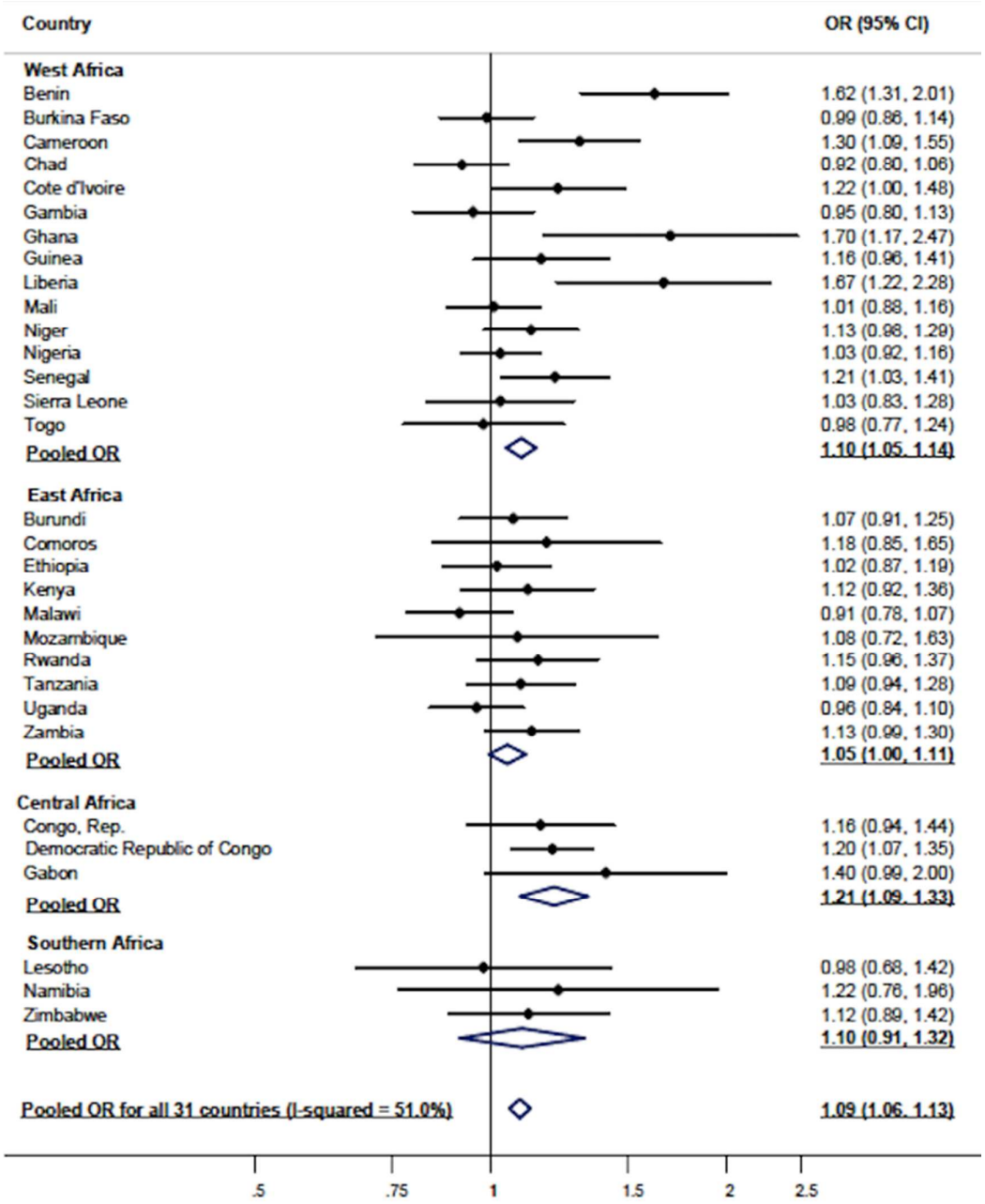

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Figure 4: The association between women autonomy in opposing sexual violence and utilisation of ≥4 ANC visits in 31 sub-Saharan African countries, 2010-2016.

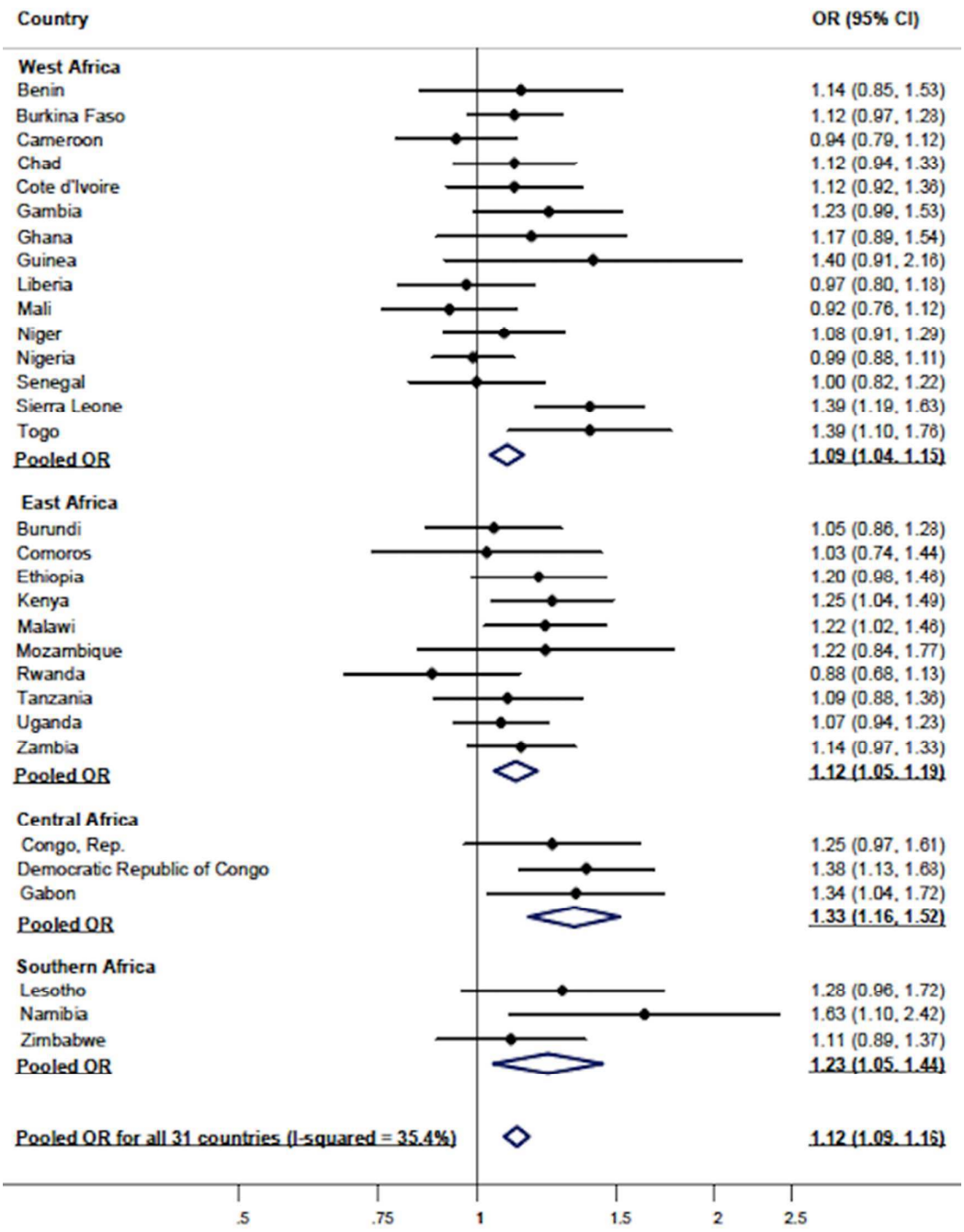

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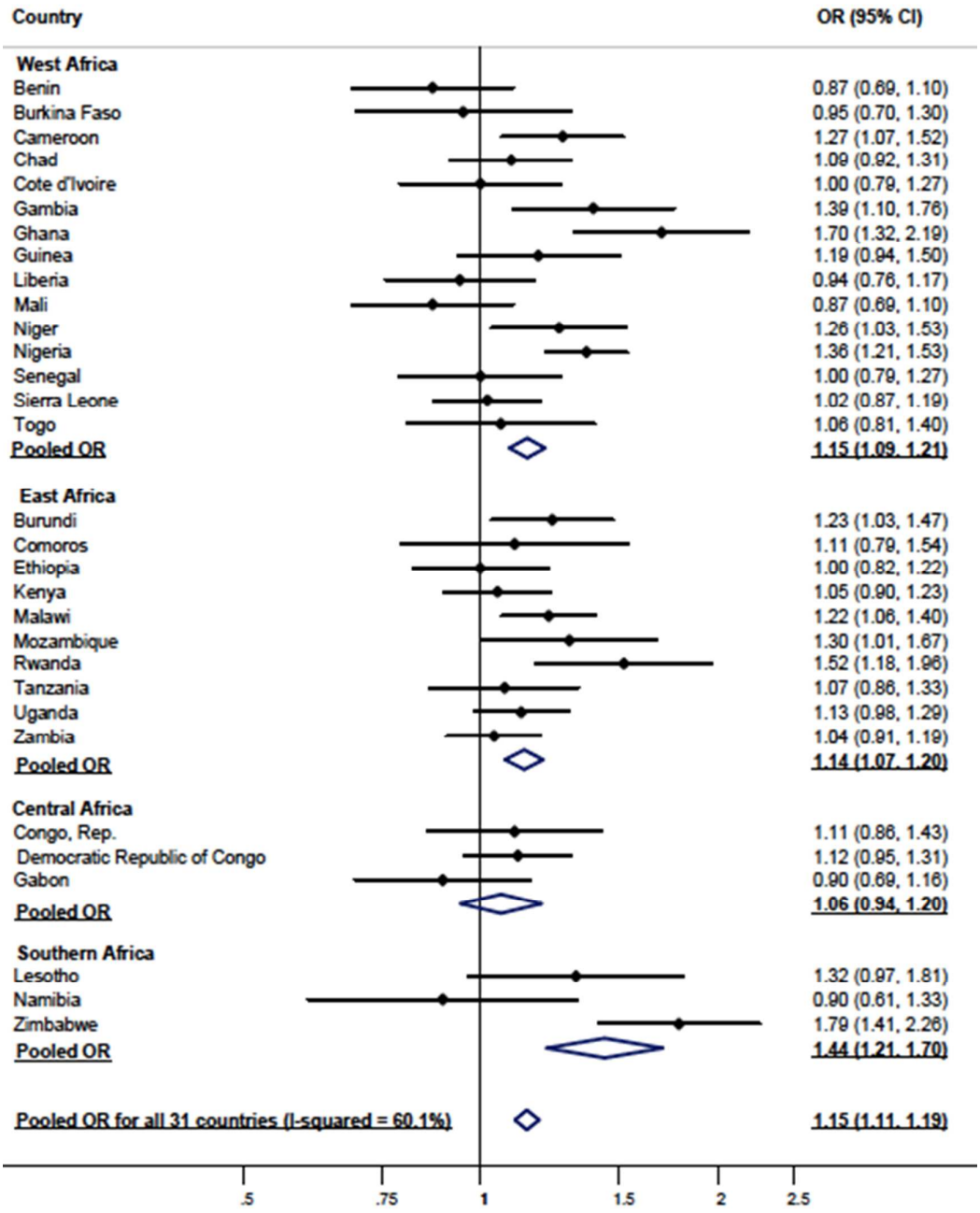
Figure 5: The association between women autonomy (opposing domestic violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.



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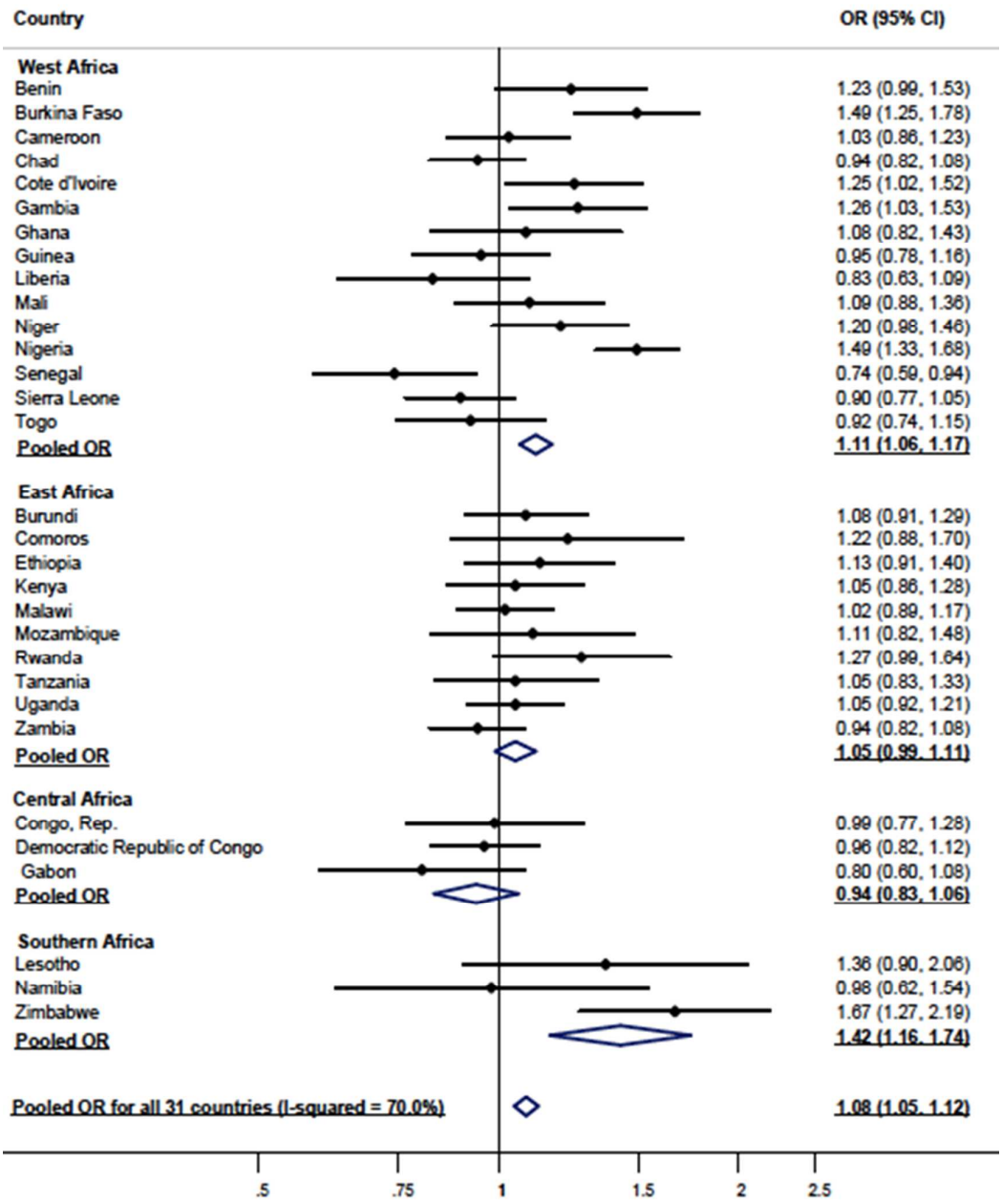

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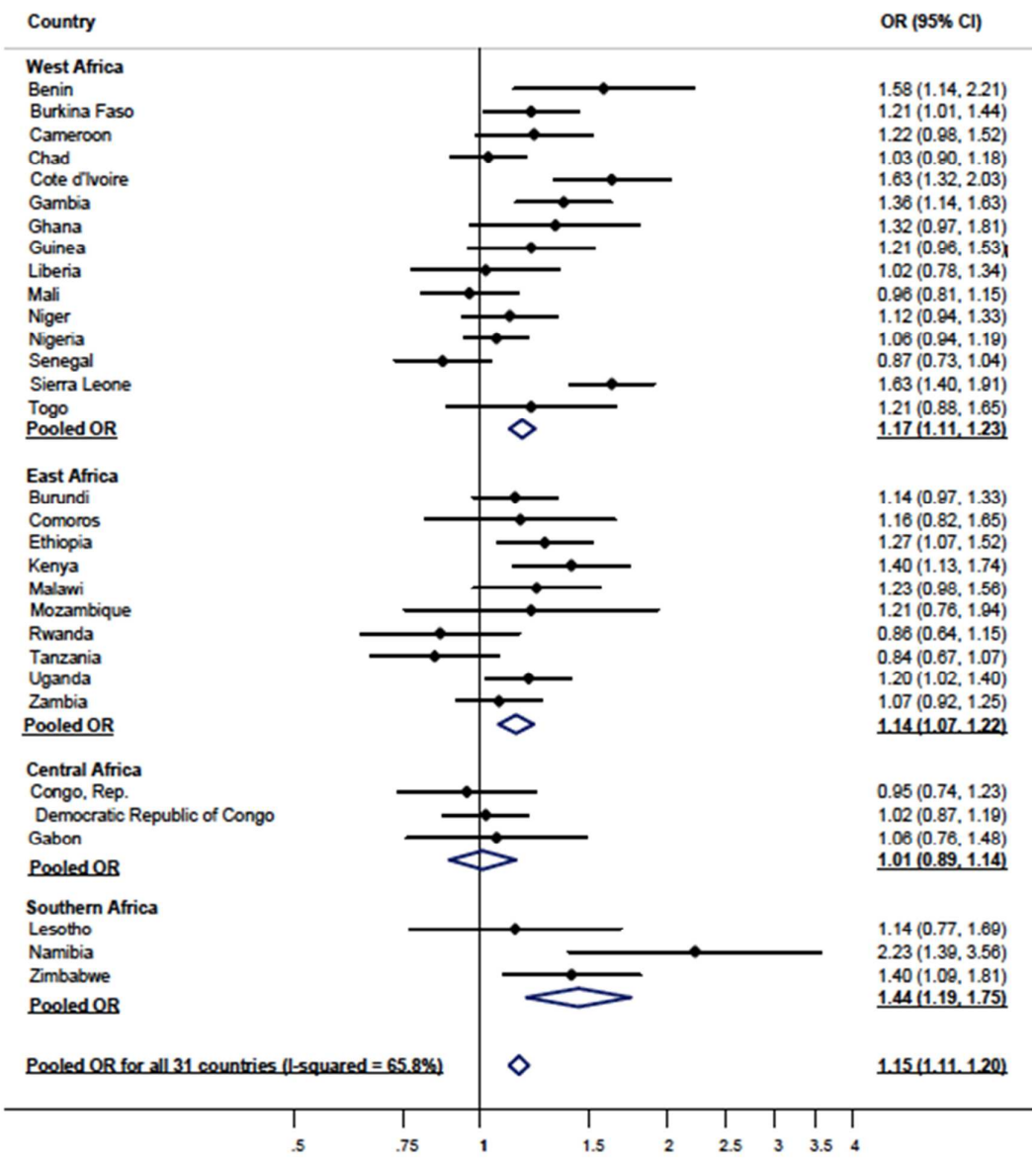

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Figure 8: The association between women autonomy (opposing sexual violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.

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Women's Autonomy and Utilisation of Maternal Healthcare Services in 31 Sub-Saharan African Countries: Results from the Demographic and Health Surveys, 2010-2016

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ABSTRACT

Objectives

To examine the association between women's autonomy and the utilisation of maternal healthcare services across 31 Sub-Saharan African countries (SSA).

Design, setting, and participants:

We analysed the Demographic and Health Survey (DHS) (2010-2016) data collected from married women aged 15-49 years. We used four DHS measures related to women's autonomy: attitude towards domestic violence, attitude towards sexual violence, decision making on spending of household income made by the women solely or jointly with husbands, and decision making on major household purchases made by the women solely or jointly with husbands. We used multiple logistic regression analyses to examine the association between women's autonomy and the utilisation of maternal healthcare services adjusted for five potential confounders: place of residence, age at birth of the last child, household wealth, educational attainment, and working status. Adjusted odds ratios (aORs) and 95% confidence interval (95% CI) were used to produce the forest plots.

Outcome measures

The primary outcome measures were the utilisation of ≥ 4 antenatal care (ANC) visits and delivery by skilled birth attendants (SBA).

Results

Pooled results for all 31 countries (194,883 women) combined showed weak statistically significant associations between all four measures of women's autonomy and utilisation of maternal healthcare services (aORs ranged from 1.07 to 1.15). The strongest associations were in the Southern African region. For example, the aOR for women who made decisions

on household income solely or jointly with husbands in relation to the use of SBAs in the Southern African region was 1.44 (95% CI 1.21 to 1.70). Paradoxically, there were three countries where women with higher autonomy on some measures were less likely to use maternal healthcare services. For example, the aOR in Senegal for women who made decisions on major household purchases solely or jointly with husbands in relation to the use of SBAs (aOR=0.74 95% CI 0.59 to 0.94).

Conclusion

Our results revealed a weak relationship between women's autonomy and the utilisation of maternal healthcare services. More research is needed to understand why these associations are not stronger.

Strengths and limitations of this study

- We used nationally representative DHS datasets from 31 SSA countries.
- We used four separate measures of women's autonomy.
- DHS data are cross-sectional, and so the direct relationship between women's autonomy and the utilisation of maternal healthcare services cannot be determined with certainty.

INTRODUCTION

Maternal mortality – measured as maternal mortality ratio (MMR) – remains a major concern despite the decline globally from 385 to 216 maternal deaths per 100,000 live births between 1990 and 2015.[1] Sixty-six percent of all maternal deaths occur in sub-Saharan Africa (SSA).[1] this is of concern if SSA is to achieve the Sustainable Development Goal (SDG-3) target of fewer than 70 maternal deaths per 100,000 livebirths by 2030.[1] The leading causes of maternal deaths in SSA are abortion, haemorrhage, hypertension, obstructed labour and sepsis.[2] Increasing the utilisation of antenatal care (ANC) and skilled birth attendants (SBA) could help reduce the high number of maternal deaths in SSA.[3-7]

A better understanding of the relationship between women's autonomy and the utilisation of maternal healthcare services may contribute to reducing maternal deaths in SSA. However, examining women's autonomy is not without challenges – especially disagreements related to its measurement and definition.[8-11] Similar to several other studies conducted in developing countries, in this study, we assessed women's autonomy using four measures included in Demographic and Health Survey (DHS) questionnaires.[8-11] Some scholars have used the term "autonomy" and "empowerment" interchangeably, while others have argued that the two words differ.[12-16] In this study we use the term autonomy to indicate women's ability to make an independent decision, to manipulate the environment and control resources, as well as to engage and hold accountable institutions.[17-20]

Most of the studies that have examined the relationship between women's autonomy and women's health were conducted in South and South-east Asia.[14 15 18 21-23] These studies

have found that women's autonomy is essential for utilisation of maternal healthcare services and women's well-being. However, a recent review by Osamar and Grady found few relevant studies from SSA, making it difficult to know if these results apply there.[10] [24-28] The aim of our study was to examine the association between four measures of women's autonomy and utilisation of maternal healthcare services across 31 SSA countries using DHS data collected during 2010-2016.

METHODS

Data source

Data from DHS surveys were used. This study is restricted to married women aged 15-49 years at the time the DHS surveys were conducted. DHS surveys are standardised cross-sectional datasets that are publicly available. Data are collected by the National Statistics Agencies in collaboration with the United States Agency for International Development (USAID).[29]

Sampling methods

DHS surveys use probability sampling methods to produce representative national samples of women aged 15-49 years. The sample results are weighted to ensure the results are relevant to each country.[30] DHS surveys collect information on a wide range of topics using mainly identical questionnaires in all countries.

Study selection and inclusion criteria

From the 49 SSA countries, we selected the 31 countries that had had DHS data collected during 2010-2016. We divided the 31 countries into four regions, as used by the Global Burden of Disease Study[2] : Central Africa (Congo, Democratic Republic of Congo (DRC), and Gabon); Eastern Africa (Burundi, Comoros, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda, and Zambia); Southern Africa (Lesotho, Namibia, and Zimbabwe); and Western Africa (Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo). Note that South Africa was excluded as its latest DHS was conducted in 1992. We restricted our analysis to the most recent child born in the five years preceding each survey to improve the accuracy of recall of use of maternal healthcare services.

Study variables

Outcome variables

We examined two outcome measures: utilisation of at least four ANC visits (≥ 4 ANC) and delivery of the last child by SBA. The utilisation of SBA included births attended by doctors, midwives and village midwives; non-utilisation included births attended by traditional birth attendants, family members and other relatives.[31] The utilisation of ANC services was based on mothers who had at least four ANC visits as recommended by the World Health Organisation (WHO).[5] There was no data on the time of each ANC visit. Primary outcome measures took a binary form: women with the recommended four or more ANC services were assigned '1', and women who reported less than the four recommended ANC services were assigned '0'. Delivery with any SBA was categorised as'1', and delivery without SBA was categorised as '0'.

Explanatory variables

We used four DHS indicators related to women's autonomy in two areas: women's attitudes to sexual and domestic violence [32-38] and participation in decision-making (solely or jointly with the husband) on spending of household income and major household purchases.[9 10 39-41]

Attitude to sexual violence was measured based on responses to a question that asked if beating a wife by a husband for refusing sexual intercourse with him is acceptable. We coded a woman with a score of 1 if she responded "no" (positive association with autonomy) and 0 if she responded "yes" (agreement). Attitude to domestic violence was based on responses of women to four DHS questions asking whether a husband was justified in beating his wife if she: goes out without telling him; neglects the children; argues with him; or burns the food. We coded a woman with a score of 1 if she responded no to all four DHS questions (positive association with empowered) and 0 if she responded "yes" (agreement) to any question.

Autonomy about household income was based on a question on spending of household income. Autonomy concerning decision making on major household purchases was based on a question regarding who decides on major household purchases. We coded the answers to these two questions as 1 (positive association with autonomy) if a woman chooses solely or jointly with the husband and 0 if the husband alone or someone else makes the decision.

Potential confounding factors

We adjusted for five potential confounding factors based on previous literature in low- and middle-income countries: place of residence (urban/rural)[42-45], mother's age at birth [46],

mother's educational attainment [26 46 47], household wealth index[26 46-48], and mother's working status.[46 47]

Statistical analysis

Preliminary analyses involved frequency tabulations of all selected socio-economic and demographic characteristics of women in each country (descriptive analysis). Then, logistic regression modelling was done to assess the associations between autonomy measures and outcome measures (≥ 4 ANC and SBA), using Generalised Linear Latent and Mixed Models (GLLAMM) with the logit link and binomial family that adjusts for DHS clustering and sampling weights.[49]

Our analysis was conducted in four stages where data were entered progressively into the model to assess associations with the study outcomes. In model 1, we conducted logistic regression models with each measure of autonomy and each outcome variable (≥ 4 ANC and SBA). In the second stage, to avoid collinearity, the socioeconomic factors (mother's education, household wealth index and mother's working status) were entered into model 1 to examine their association with the study outcomes (model 2). In the third stage, individual-level factors (place of residence, mother's age at birth) were added to model 2 to form model 3. Last, the primary explanatory variables (autonomy) were added to model 3 to form the final model 4. As all five potential confounders were significant at p-values < 0·05, they were retained in the final model.

Adjusted odds ratios (aOR) and 95% confidence interval (95% CI) were used to measure the level of association between the four explanatory autonomy variables and the two outcome variables in each of the 31 studied countries. The "metan" function in

STATA was used to produce the forest plots of aORs and 95% CIs in individual countries for all 31 countries combined, and for countries in each of the four SSA regions. All analyses and plots were performed using STATA version 14.2 (Stata Corporation, College Station, TX, USA).[50]

Patient and Public Involvement

We had no contact with any patients or the public for this study as we used publicly accessible data previously collected for National Demographic and Health Surveys.

RESULTS

Table 1 the shows socio-economic and demographic characteristics of the women in our sample (n=194,883). There was considerable variation among the 31 countries. Ninety-two percent of women surveyed in Burundi lived in rural areas compared to just 14% surveyed in Gabon. The percentage of women who gave birth to their first child at age 12-17 years was highest in Ethiopia (62%) and lowest in Rwanda (6%). The percentage of surveyed women with no education was highest in Burkina Faso (83%) and lowest in Lesotho and Zimbabwe (1%). The percentage of surveyed women who were unemployed was highest in Niger (77%) and lowest in Rwanda (14%). The three countries with the highest percentage of surveyed women having at least primary education were all in the Southern African region – Lesotho (99%), Namibia (92%) and Zimbabwe (99%).

Table 1: Socio-economic and demographic characteristics of surveyed married women aged 15-49 years living with their male partners. Data from Demographic and Health Surveys conducted in 31 sub-Saharan Africa countries, (2010-2016).

sub-Saharan African regions (n=31)	Country (year of DHS)	Residency		Age at first childbirth				Educational attainment			Work status	
		Urban	Rural	30+	24-29	18-23	12-17	No education	Primary	Secondary or higher	Not working	Working
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
West (15)	Benin (2011-2012)	3350 (40.1)	5021 (59.9)	238 (2.8)	13960 (16.7)	4299 (51.4)	2439 (29.14)	6032 (72.1)	1372 (16.4)	966 (11.5)	2577 (30.8)	5794 (69.2)
	Burkina Faso (2010)	1826 (18.1)	8307 (81.9)	80 (0.8)	675 (6.7)	6031 (59.5)	3347 (33.03)	8454 (83.5)	1113 (11.0)	561 (5.5)	2246 (22.2)	7886 (77.8)
	Cameroon (2011)	2824 (43.2)	3709 (56.8)	71 (1.1)	584 (8.9)	3227 (49.4)	2651 (40.57)	1922 (29.4)	2488 (38.1)	2123 (32.5)	2023 (31.0)	4510 (69.0)

	Chad (2014-2015)	1910 (18.7)	8319 (81.3)	68 (0.7)	545 (5.3)	3987 (38.9)	5629 (55.03)	6807 (66.5)	2383 (23.3)	1040 (10.2)	5766 (56.4)	4453 (43.6)
	Cote d'Ivoire (2011-2012)	1640 (37.9)	2677 (62.0)	48 (1.1)	396 (9.2)	2134 (49.4)	1739 (40.3)	2858 (66.2)	1052 (24.4)	407 (9.4)	1210 (28.0)	3107 (72.0)
	Gambia 2013)	2355 (48.2)	2536 (51.9)	79 (1.6)	619 (12.7)	2574 (52.6)	1618 (33.1)	2960 (60.5)	678 (13.9)	1252 (25.6)	2555 (52.3)	2335 (47.8)
	Ghana (2014)	1576 (45.8)	1870 (54.3)	168 (4.9)	716 (20.8)	1789 (51.9)	772 (22.4)	985 (28.6)	642 (18.6)	1819 (52.8)	649 (18.8)	2797 (81.2)
	Guinea (2012)	1175 (25.8)	3377 (74.2)	59 (1.3)	359 (7.9)	1849 (40.6)	2286 (50.2)	3605 (79.2)	536 (11.8)	411 (9.0)	902 (19.8)	3650 (80.2)
	Liberia (2013)	1763 (50.6)	1721 (49.4)	30.70 (0.9)	271 (7.8)	1722 (49.5)	1459 (41.9)	1575 (45.2)	999.90 (28.7)	908 (26.1)	1377 (39.5)	2106 (60.5)

	Mali (2012-2013)	1284 (19.6)	5269 (80.4)	109 (1.7)	594 (9.1)	2998 (45.7)	2852 (43.5)	5460 (83.3)	579 (8.8)	515 (7.9)	3691 (56.3)	2863 (43.7)
	Niger (2012)	1089 (13.9)	6718 (86.1)	57 (0.7)	508 (6.5)	3348 (43.0)	3872 (49.7)	6634 (85.1)	785 (10.1)	380 (4.9)	6002 (76.9)	1804 (23.1)
	Nigeria (2013)	6830 (35.2)	12567 (64.8)	543 (2.8)	2646 (13.6)	8525 (44.0)	7683 (39.6)	9575 (49.4)	3679 (19.0)	6143 (31.7)	6067 (31.3)	13311 (68.7)
	Senegal (2010-2011)	1468 (36.5)	2555 (63.5)	96 (2.4)	558 (13.9)	2241 (55.7)	1128 (28.0)	2719 (67.6)	838 (20.8)	467 (11.6)	2225 (55.3)	1799 (44.7)
	Sierra Leone (2013)	1704 (23.4)	5571 (76.6)	110 (1.5)	777 (10.7)	3435 (47.2)	2950 (40.6)	5287 (72.7)	1017 (14.0)	970 (13.3)	1641 (22.6)	5626 (77.4)
	Togo (2013-2014)	1602 (36.2)	2824 (63.8)	132 (3.0)	720 (16.3)	2523 (57.0)	1050 (23.7)	1789 (40.4)	1608 (36.3)	1030 23.3)	849 (19.2)	3577 (80.8)

East (10)	Burundi (2010)	359 (8.0)	4146 (92.0)	77 (1.7)	716 (15.9)	3071 (68.2)	640 (14.2)	2361 (52.4)	1863 (41.4)	282 (6.3)	818 (18.2)	3687 (81.8)
	Comoros (2012)	555 (28.6)	1385 (71.4)	139 (7.1)	405 (20.9)	830 (42.8)	567 (29.2)	841 (43.5)	482 (24.9)	611 (31.6)	1171 (60.5)	764 (39.5)
	Ethiopia (2016)	882 (12.4)	6227 (87.6)	52 (0.7)	363 (5.2)	2223 (31.7)	4379 (62.4)	4508 (63.4)	1995 (28.1)	605 (8.5)	5138 (72.3)	1971(27.7)
	Kenya (2014)	4481 (38.1)	7284 (61.9)	154 (1.3)	1429 (12.2)	6822 (58.0)	3359 (28.6)	1251 (10.6)	64160 (54.5)	4099 (34.8)	1972 (35.3)	3611 (64.7)
	Malawi (2015-2016)	1608 (14.4)	9572 (85.6)	72 (0.6)	569 (5.1)	6549 (58.6)	3990 (35.7)	1404 (12.6)	7389 (66.1)	2387 (21.4)	3814 (34.1)	7366 (65.9)
	Mozambique (2015)	800 (26.0)	2282 (74.0)	46 (1.5)	170 (5.6)	995 (32.6)	1837 (60.3)	884 (28.7)	1710 (55.5)	480 (15.9)	1877 (60.9)	1206 (39.1)
	Rwanda (2014-2015)	794 (16.4)	4050 (83.6)	161 (3.3)	1262 (26.1)	3107 (64.1)	313 (6.5)	717 (14.8)	3513 (72.5)	614 (12.7)	672 (13.9)	4172 (86.1)

	Tanzania (2015-2016)_	1571 (27.6)	4115 (72.4)	79 (1.4)	528 (9.3)	3401 (59.9)	1675 (29.5)	1168 (20.5)	3695 (65.0)	824 (14.5)	1283 (22.6)	4403 (77.4)
	Uganda (2016)	1834 (22.2)	6422 (77.8)	136 (1.7)	592 (7.2)	3709 (45.2)	3773 (46.0)	890 (10.8)	4975 (60.3)	2392 (29.0)	1746 (21.1)	6510 (78.9)
	Zambia (2013-2014)	2694 (36.3)	4730 (63.7)	60 (0.8)	420 (5.7)	4070 (54.8)	2875 (38.7)	813 (11.0)	4170 (56.2)	2435 (32.8)	3397 (45.8)	4026 (54.2)
Central (3)	Congo, Rep. (2011-2012)	2764 (62.1)	1690 (38.0)	83 (1.9)	469 (10.5)	2317 (52.0)	1586 (35.6)	319 (7.2)	1307 (29.3)	2829 (63.5)	1288 (28.9)	3166 (71.1)
	DRC (2013-2014)	2867 (30.7)	6469 (69.3)	126 (1.3)	925 (9.9)	5179 (55.5)	3104 (33.3)	1762 (18.9)	4035 (43.2)	3539 (37.9)	2277 (24.4)	7058 (75.6)
	Gabon (2012)	2199 (85.6)	371 (14.4)	74 (2.9)	294 (11.4)	1261 (49.1)	941 (36.6)	230 (9.0)	639 (24.9)	1700 (66.2)	1338 (52.1)	1228 (47.9)

Southern (3)	Lesotho (2014)	574 (28.6)	1434 (71.4)	58 (2.9)	243 (12.1)	1364 (67.9)	343 (17.1)	20 (1.0)	902 (44.9)	1086 (54.1)	1318 (65.6)	690 (34.4)
	Namibia (2013)	944 (53.4)	826 (46.7)	81 (4.6)	324 (18.3)	934 (52.8)	431(24.4)	136 (7.7)	442 (25.0)	1192 (67.4)	967 (54.7)	801 (45.3)
	Zimbabwe (2015)	1355 (32.1)	2864 (67.9)	42.60 (1.0)	393 (9.3)	2688 (63.7)	1095 (26.0)	51 (1.22)	1304 (30.9)	2864 (67.9)	2478 (58.8)	1740 (41.3)

3

Figures 1-4 (≥ 4 ANC) and figures 5-8 (SBA) summarise the meta-analysis results (aORs and 95% CI) for all 31 countries combined, as well as for regions and individual countries (after adjusting for the five potential confounders). Pooled results for all 31 countries (194,883 women) combined, showed weak statistically significant associations between all four measures of women's autonomy and the utilisation of maternal services. Associations were strongest in the Southern African region (Figures 1-8).

The pooled aORs and 95% CIs for all 31 SSA countries and utilisation of ≥ 4 ANC visits were: (1) for opposing domestic violence (aOR=1.07 95% CI 1.04 to 1.10); (2) for decision making on major household income (aOR=1.13 95% CI 1.10 to 1.16); (3) for decision making on major household purchases (aOR=1.11 95% CI 1.08 to 1.14); and (4)for opposing sexual violence (aOR=1.09 95% CI 1.06 to 1.13).

The pooled aORs and 95% CI for all 31 SSA countries and utilisation of SBA visits were: (1) for opposing domestic violence (aOR=1.12 95% CI 1.09 to 1.16); (2) for decision making on major household income (aOR=1.15 95% CI 1.11 to 1.19); (3) for decision making on major household purchases (aOR=1.08 95% CI 1.05 to 1.12); and (4) for opposing sexual violence (aOR=1.15 95% CI 1.1 to 1.20).

Interestingly, our country-level analyses showed that in three countries (Chad, Mali, and Senegal), women with higher autonomy were less likely to use maternal healthcare services. Women with higher autonomy about domestic violence were less likely to use ≥ 4 ANC in Chad (aOR= 0.85, 95% CI 0.71 to 1.00) and Mali (aOR= 0.83, 95% CI 0.69 to 0.99) (Figure 1). Women who made decisions on household income were less likely to use ≥ 4 ANC in Mali (aOR= 0.82, 95% CI 0.67 to 1.00) (Figure 2). Women who made decisions

on major household purchases were less likely to use SBAs in Senegal (aOR= 0.74, 95% CI 0.59 to 0.94) (Figure 7).

Figures 1 – 8 here

DISCUSSION

Our pooled results for all 31 countries showed weak, albeit statistically significant, associations between women's autonomy and use of both ≥ 4 ANC and SBAs. The exception was the Southern African region where three measures of women's autonomy were relatively strongly associated with the use of maternal healthcare services. Surprisingly, the country-level analyses suggested that in Chad, Mali, and Senegal, women with higher autonomy on some measures were less likely to use maternal healthcare services.

Although our combined pooled results for all 31 countries show that women's autonomy is associated with the use of maternal healthcare services in SSA, this association was weak, suggesting that many factors other than women's autonomy affect the use of maternal healthcare services in SSA. In a study similar to ours, Ahmed et al. used DHS data to investigate the autonomy and utilisation of ≥ 4 ANC and SBA in 31 developing countries, including 21 SSA counties.[51] They found weaker associations between women's autonomy and utilisation of maternal healthcare services in SSA than in other parts of the world. For example, the pooled aORs for autonomy and ≥ 4 ANC was 1.52 for all 31 countries and 1.29 in the 21 SSA countries.[51] Note that we used slightly different DHS measures of autonomy to Ahmed et al. We used women's attitudes to violence as well as women's participation in decisions (finance and major household purchases), while Ahmed et al.

only examined women's autonomy about decisions. The paper by Ahmed et al. was published in 2010 and so used older DHS data than we did.

Based mainly on studies in Asia, women's autonomy is considered a crucial contributor to their utilisation of maternal healthcare services. For example, women's autonomy has consistently been shown to be associated with the utilisation of ANC and SBA in South and Northern India,[9 14] and in Nepal and Indonesia where women's financial autonomy has been found to be associated with their utilisation of maternal healthcare service.[22 23]

Three measures of women's autonomy were relatively strongly related to use of maternal healthcare services in the Southern African region. Women who made decisions on household income, who opposed sexual violence, and who made decisions on major household purchases were nearly 50% more likely to use both ≥ 4 ANC and SBA.

Weaker associations in other African regions are unlikely to be explained by differences in women's education or household wealth, as we adjusted for these variables. The explanation is probably related to differences in economic development and culture across countries in SSA.[51-53] A qualitative study in Zambia found that factors leading to delivery at home rather than at a clinic included: lack of female autonomy, the influence of husbands and parents, perceived low quality of clinic-based services, and positive attitudes towards traditional birth attendants.[28] Jayachandran showed that the level of female autonomy tended to be higher in countries with higher GDP per capita.[53] Economic development is also associated with better education for men and women and higher quality health services.

One unexpected finding in our study is that women with higher autonomy on some measures in Chad, Mali and Senegal were less likely to utilise either ≥ 4 ANC or SBA than women with less autonomy. These results are consistent with some previous research in Malawi and Mali.[25 54] In a study in Malawi it was found that women with higher autonomy were less likely to be accompanied by their male partners to ANC services.[25] In Mali, Upadhyay and colleagues found that women who had higher autonomy towards sexual violence tended to have more children, perhaps because higher fertility is regarded as a sign of autonomy.[54 55] Another explanation for the inverse associations that we observed might be that more empowered women in Chad, Mali and Senegal might be more likely to successfully refuse to use maternal healthcare services that they perceive to be inadequate.[56-60]

The strengths of our study are that we used nationally representative DHS surveys from countries across SSA in addition to utilisation of four separate measures of female autonomy. One of the limitations is that DHS surveys are cross-sectional studies where autonomy is measured after the relevant pregnancy has occurred. Longitudinal studies measuring women's autonomy before pregnancy and then following women through to the end of the pregnancy, assessing utilisation of maternal healthcare services, would provide higher quality evidence about the causal relationship between autonomy and ≥ 4 ANC and SBA. Also, we did not study as separate variables the four recommended ANC timings – first visit 8-12 weeks, second visit 24-26 weeks, third visit 32 weeks, and the fourth visit 36-38 weeks.[5] Another limitation is the measurement of autonomy. Despite many definitions and measures of women's autonomy, no measure can capture its true complex meaning.[10 19 22 24 46] Women's autonomy remains a multifaceted concept which varies between cultures and societies, even within the same country.[8 54] Poor measurements of autonomy may explain why we found such weak associations between autonomy and use of maternal healthcare services. The DHS provides useful indicators of autonomy for comparison across countries, but further in-depth research into cultural differences

concerning the meaning of autonomy is needed for a better understanding of women's autonomy and its association with maternal healthcare.

CONCLUSION

The overall goal of this study was to examine the association between women's autonomy and the utilisation of maternal healthcare services – ≥ 4 ANC visits and delivery by SBA – across 31 SSA countries. We found weak associations at both regional and country level. The exception was the Southern Africa region where associations between women's autonomy and the utilisation of maternal healthcare services were reasonably strong. Further research on women's autonomy is needed in SSA to inform gender and health policies concerning utilisation of maternal healthcare services. Moreover, additional research is required into the inverse associations between some countries where women with higher autonomy on some measures were less likely to use maternal healthcare services.

Contributors

The concept was initiated by CC, who also collected the data, produced the tables and figures and wrote the first draft. All authors contributed to the study design and review of the manuscript with vital input from KA and RGC. KA contributed significantly to the statistical analyses. JN provided critical contributions to the paper.

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Competing interests

The authors have no competing interests to declare.

Ethical approval

This study is based on publicly available DHS data. CC was granted access to the data by the MEASURE DHS/ICF International, Rockville, Maryland, USA.

Data sharing statement

The data used in this study are freely accessible to the public at the DHS website https://www.dhsprogram.com/Data/.

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302

Figure 1: The association between women's autonomy (opposing domestic violence) and utilisation of ≥ 4 ANC visits in 31 Sub-Saharan African countries, 2010-2016

Figure 2: The association between women's autonomy (opposing domestic violence) and utilisation of ≥ 4 ANC visits in 31 Sub-Saharan African countries, 2010-2016

Figure 3: The association between women's autonomy (decisions making on spending of household income) and utilisation of ≥ 4 ANC visits in 31 Sub-Saharan African countries, 2010-2016

Figure 4: The association between women's autonomy (decision making on major household purchases) and utilisation of ≥ 4 ANC visits in 31 Sub-Saharan African countries, 2010-2016.

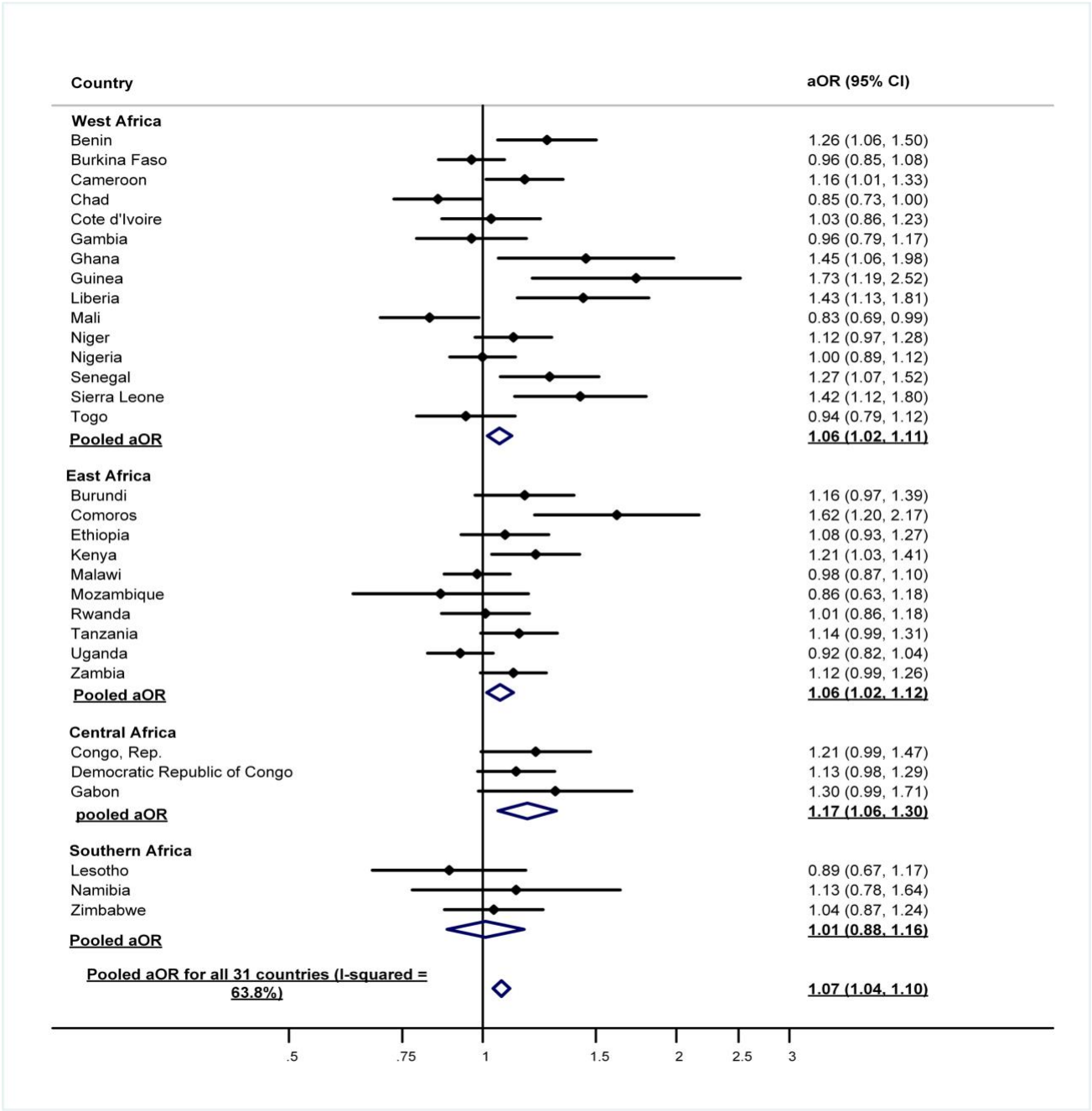
Figure 4: The association between women's autonomy in opposing sexual violence and utilisation of ≥ 4 ANC visits in 31 Sub-Saharan African countries, 2010-2016

Figure 5: The association between women's autonomy (opposing domestic violence) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016

Figure 6: The association between women's autonomy (decisions making on spending of household income) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016

Figure 7: The association between women's autonomy (decision making on major household purchases) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016

Figure 8: The association between women's autonomy (opposing sexual violence) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016.



aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 1: The association between women autonomy (opposing domestic violence) and utilisation of ≥4 ANC visits in 31 sub-Saharan African countries, 2010-2016.

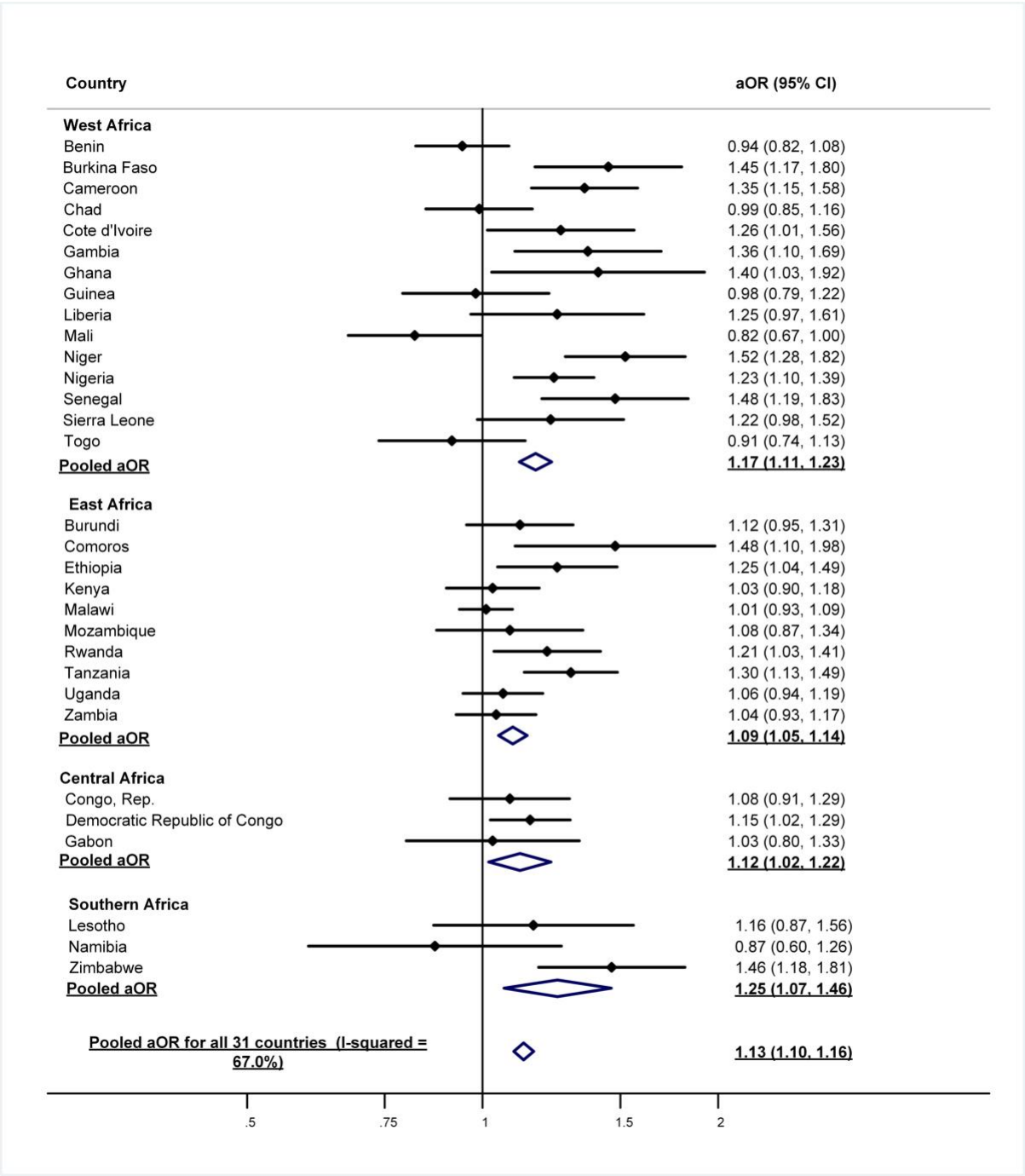


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Figure 2: The association between women autonomy (decisions making on spending of household income) and utilisation of ≥4 ANC visits in 31 sub-Saharan African countries, 2010-2016.

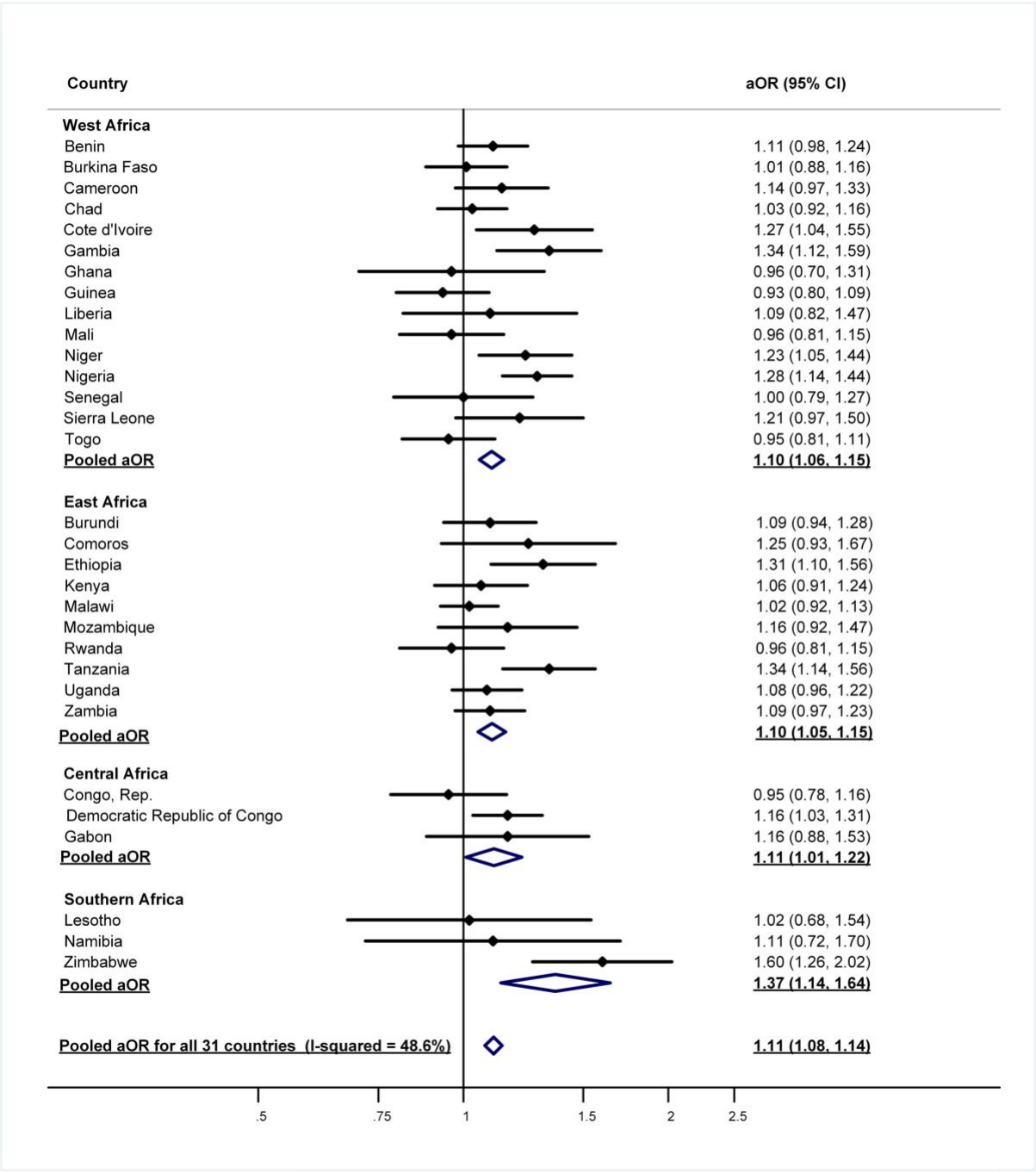

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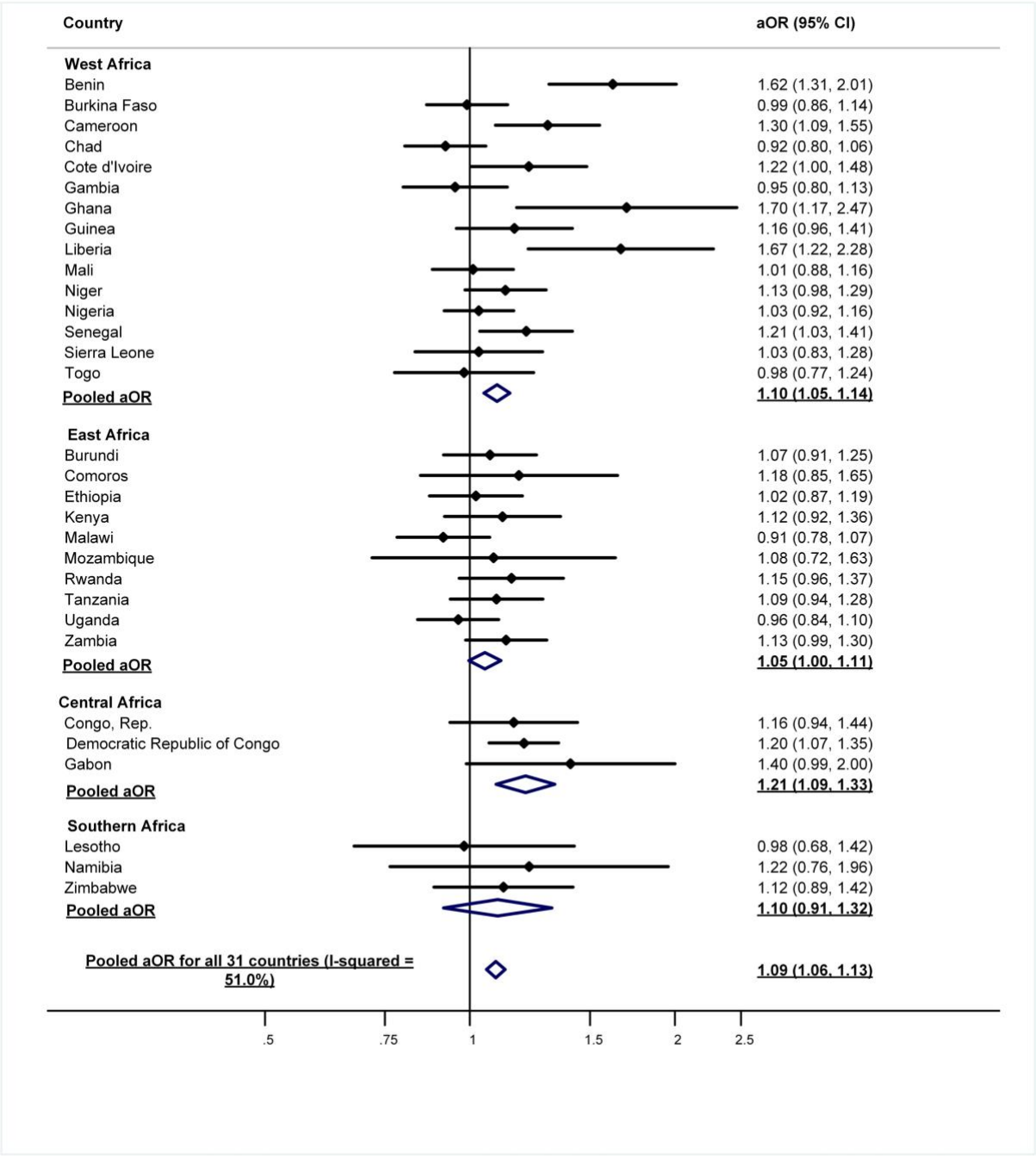
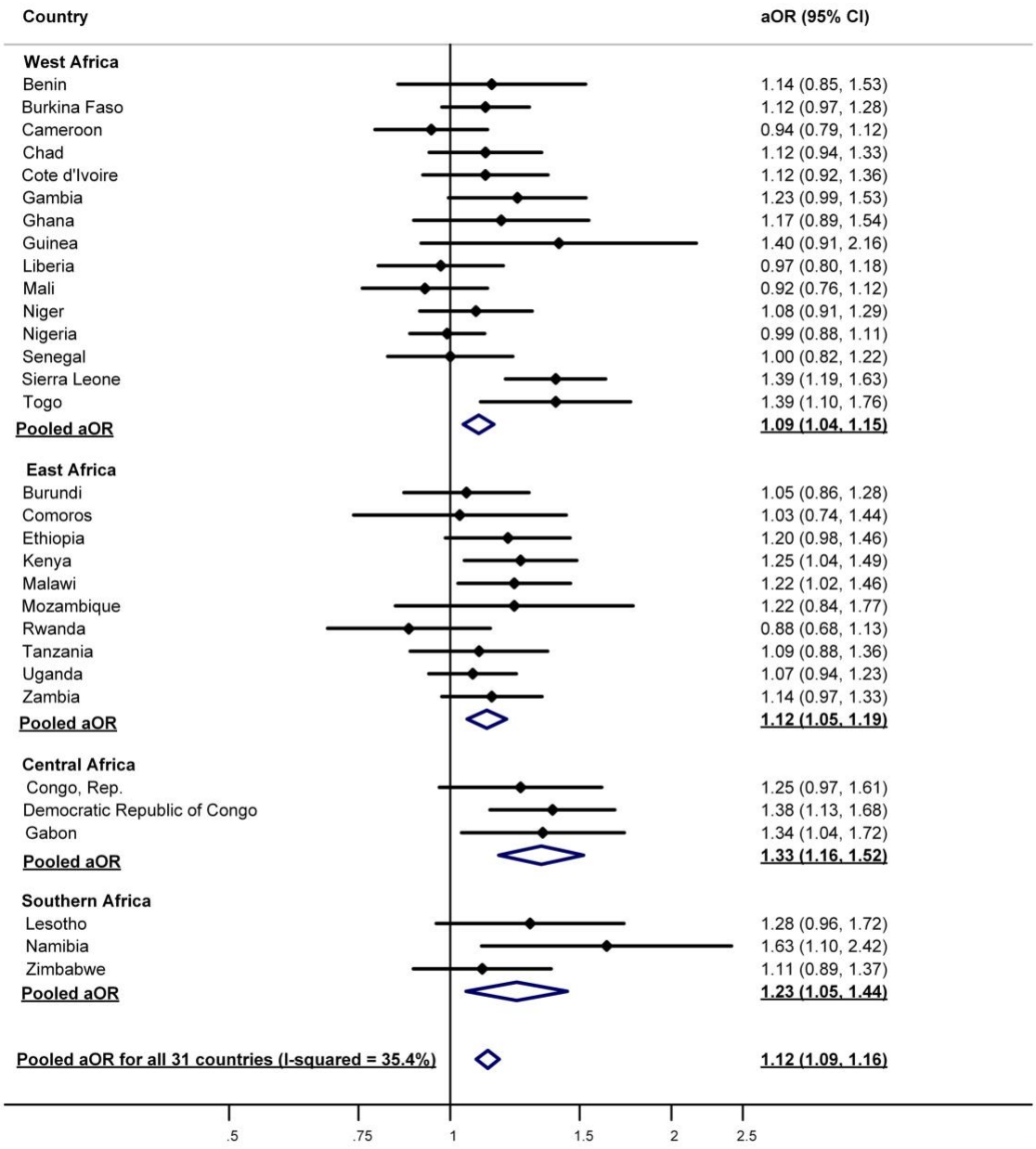
Figure 3: The association between women autonomy (decision making on major household purchases) and utilisation of ≥4 ANC visits in 31 sub-Saharan African countries, 2010-2016.



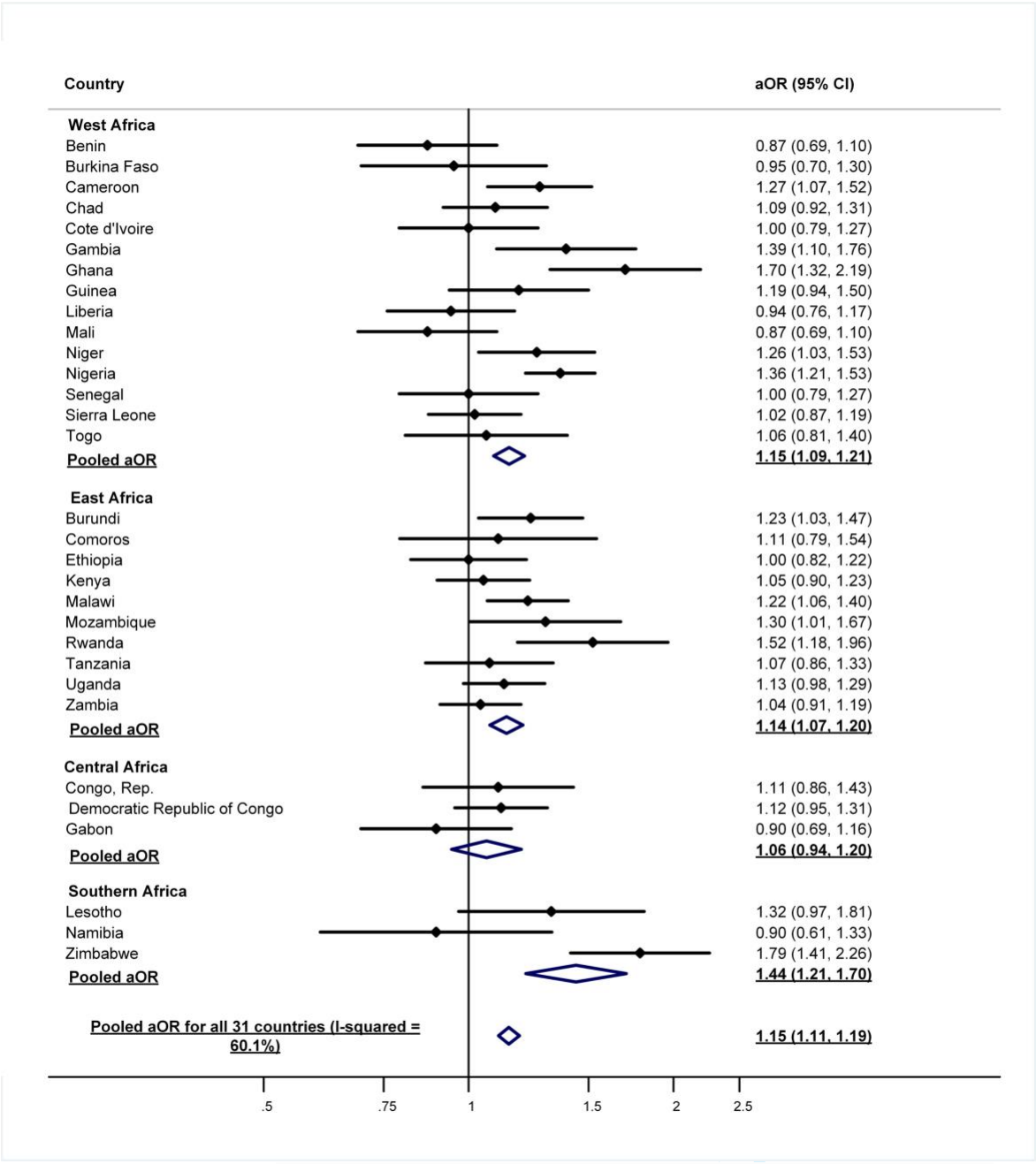
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 4: The association between women autonomy in opposing sexual violence and utilisation of ≥4 ANC visits in 31 sub-Saharan African countries, 2010-2016.



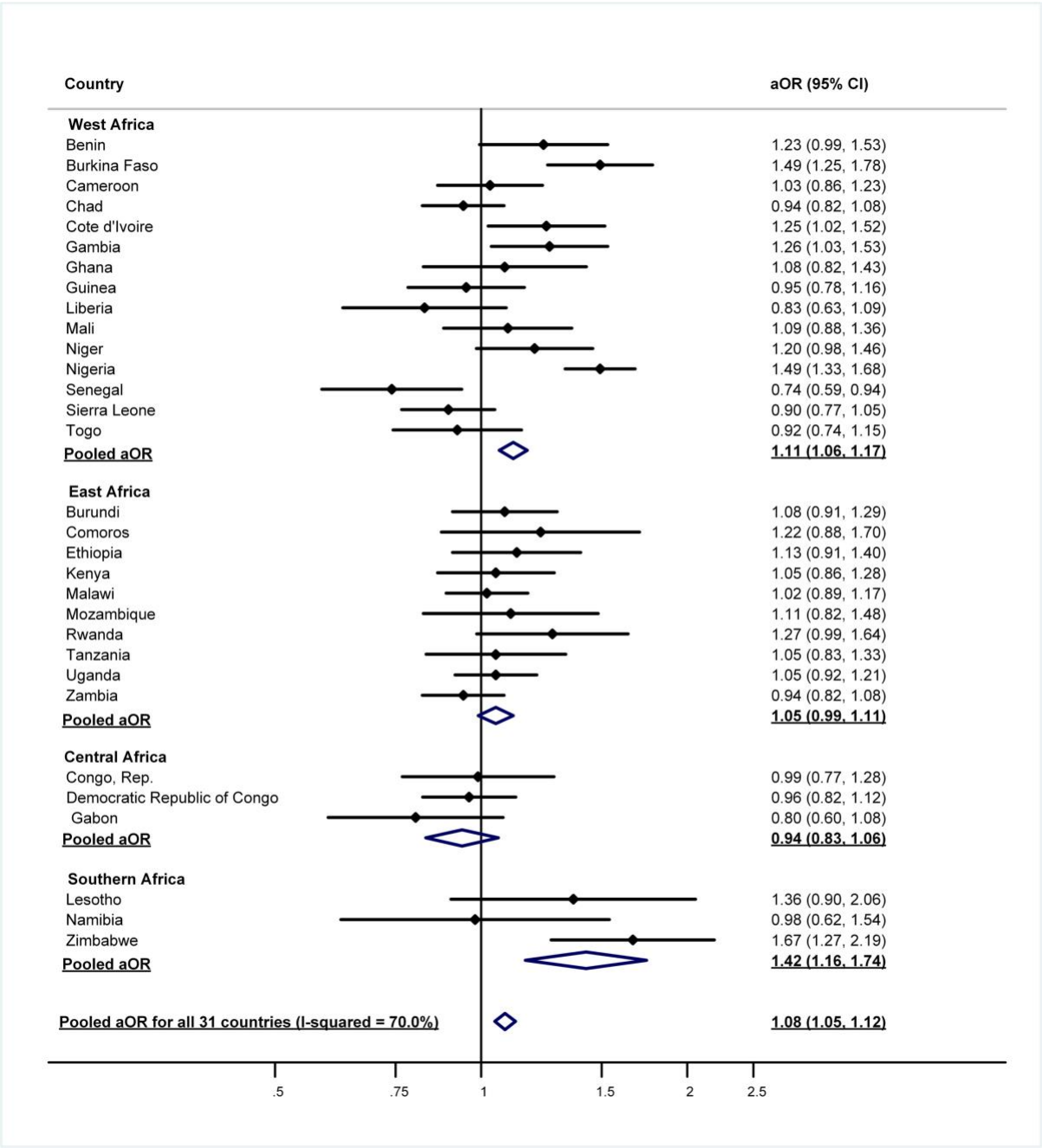
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 5: The association between women autonomy (opposing domestic violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.



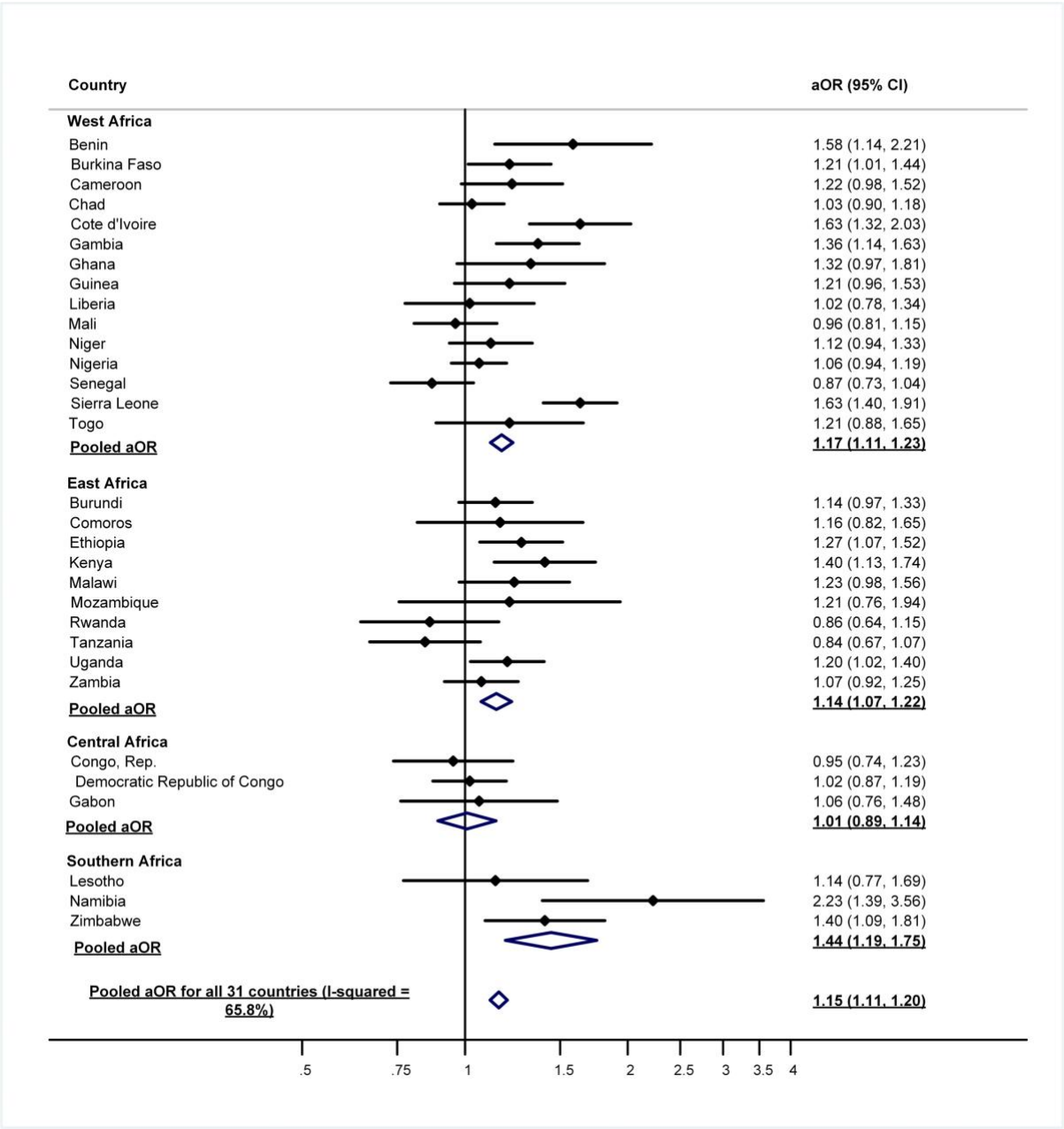
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 6: The association between women autonomy (decisions making on spending of household income) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.



aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 7: The association between women autonomy (decision making on major household purchases) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.



aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

Figure 8: The association between women autonomy (opposing sexual violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.

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

NOTE: We used data from 31 separate Demographic and Health Surveys from publicly accessible databases. Hence, several items are not relevant or not available.

	Item No	Recommendation	Reported on page no.
Title and abstract	1	(*a*) Indicate the study's design with a used term in the title or the abstract	**Page 1, lines 1-3 & Page 2, line 22-36**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	**Page 2,3, lines 20-48**
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	**Page 4-5, lines 61-86**
Objectives	3	State specific objectives, including any prespecified hypotheses	**Page 5, lines 86-88**
Methods			
Study design	4	Present key elements of study design early in the paper	**Page 5-6, lines 90-113**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	**Page 5-6, lines 103-111**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	**Page 5,6, lines 97-113**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	**Page 6-7, line 114-150**
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	**Page 5, lines 103-104**
Bias	9	Describe any efforts to address potential sources of bias	**We adjusted for five potential cofounders Page 7, lines 146-150**
Study size	10	Explain how the study size was arrived at	**N/A**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	**Page 6-7, lines 114-150.**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	**Page 7-8, lines 151-178**
		(*b*) Describe any methods used to examine subgroups and interactions	**We conducted subgroup analyses (Figures 1-8 and Table 1). However, no interactions were examined.**

		(*c*) Explain how missing data were addressed	**N/A**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	**Page 8, Lines 155-157**
		(*e*) Describe any sensitivity analyses	**N/A**
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	**Page 9, line182**
		(b) Give reasons for non-participation at each stage	**N/A**
		(c) Consider use of a flow diagram	**N/A**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	**Table 1 (page 10-15), Page 9, line 182-191**
		(b) Indicate number of participants with missing data for each variable of interest	**N/A**
Outcome data	15*	Report numbers of outcome events or summary measures	**N/A**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	**Figures 1-8**
		(*b*) Report category boundaries when continuous variables were categorized	**N/A**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	**N/A**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	**Figures 1-8**
Discussion			
Key results	18	Summarise key results with reference to study objectives	**Page 17, line 28 -34**
Limitations	19	Discuss limitations of the study, considering sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	**Page 19 lines 81-98**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	**Page17-18 lines 35-80**
Generalisability	21	Discuss the generalisability (external validity) of the study results	**Page 20, line 100-110**
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	**N/A**