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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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3 **Women's Autonomy concerning Utilisation of Maternal Health Services in 31**  
4 **sub-Saharan African Countries: Results from Demographic and Health Surveys,**  
5 **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 ( $\geq 4$  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 ( $\geq 4$  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  $\geq 4$  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 countries
- 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.

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## 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.<sup>1</sup> 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.<sup>1</sup> Increased utilisation of antenatal care (ANC) and skilled birth attendants (SBA) could help reduce the high maternal deaths on the continent.<sup>2-6</sup>

Examining women's autonomy is not without challenges – related to its measurement and definition.<sup>7-10</sup> 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.<sup>7,9</sup> Some scholars have used the term “autonomy” interchangeably with the term “empowerment”, while others have argued that the two words differ.<sup>11-15</sup> 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.<sup>16-19</sup>

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.<sup>13,14,17,20-22</sup> 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.<sup>9,23-25</sup> This is a concern since SSA has the highest maternal deaths globally.<sup>1</sup> 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

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3 This study is restricted to married women aged 15-49 years living with their male  
4 partners at the time the DHS surveys were conducted. DHS surveys are standardised  
5 cross-sectional datasets that are publicly available. Data are collected by National  
6 Statistics Agencies in collaboration with the United States Agency for International  
7 Development (USAID).<sup>26</sup> Details of the sampling methods used in the DHS are  
8 described elsewhere.<sup>27</sup> The results are released in publicly available DHS household  
9 datasets.  
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### 14 15 **Study selection and inclusion criteria**

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17 From the 49 SSA countries, we selected the 31 countries that had had DHS data  
18 collected during 2010-2016. We divided the 31 countries into four regions, as used by  
19 Kassebaum et al. (2014)<sup>28</sup>: Central Africa (Congo, Democratic Republic of Congo  
20 (DRC), and Gabon); Eastern Africa (Burundi, Comoros, Ethiopia, Kenya, Malawi,  
21 Mozambique, Rwanda, Tanzania, Uganda, and Zambia); Southern Africa (Lesotho,  
22 Namibia, and Zimbabwe); and Western Africa (Benin, Burkina Faso, Cameroon,  
23 Chad, Cote d'Ivoire, Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal,  
24 Sierra Leone, and Togo). Note that South Africa was excluded as its latest DHS was  
25 conducted 1992. We restricted our analysis to the most recent child born in 5 years  
26 preceding each survey.  
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### 34 35 **Study variables**

#### 36 37 *Outcome variables*

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39 We examined two key outcomes: utilisation of at least four ANC visits ( $\geq 4$  ANC) and  
40 delivery of the last child by SBA. The utilisation of SBA included births attended by  
41 doctors, midwives and village midwives; non-utilisation included births attended by  
42 traditional birth attendants, family members and other relatives.<sup>29</sup> Utilisation of ANC  
43 services was based on mothers who had at least four ANC visits as recommended by  
44 the World Health Organization (WHO).<sup>4</sup> Primary outcomes took a binary form: the  
45 recommended four or more ANC services was assigned '1', and women who reported  
46 less than the four recommended ANC services was assigned '0'. Delivery with any  
47 SBAs was categorised as '1' and delivery without SBA was categorised as '0'.  
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#### 54 55 *Explanatory variables*

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3 We used four DHS indicators related to female autonomy in two areas: women's  
4 attitudes to sexual and domestic violence<sup>30-36</sup> and participation in decision-making  
5 (solely or jointly with the husband) on spending of household income and major  
6 household purchases.<sup>8,9,37-39</sup>  
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10 Attitude to sexual violence was measured based on responses to a question that asked  
11 if beating a wife by a husband for refusing sexual intercourse with him is acceptable.  
12 We coded a woman with a score of 1 if she responded "no" (positive association with  
13 empowerment) and 0 if she responded "yes" (agreement). Attitude to domestic  
14 violence was based on responses of women to five questions in the DHS asking  
15 whether a husband was justified in beating his wife if she: goes out without telling  
16 him; neglects the children; argues with him; refuses to have sexual intercourse with  
17 him or burns the food. We coded a woman with a score of 1 if she responded no to all  
18 five questions (positive association with empowered) and 0 if she responded "yes"  
19 (agreement) to any question.  
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27 Empowerment about household income was based on a question on spending of  
28 household income. Empowerment concerning decision making on major household  
29 purchases was based on a question on who decides on major household purchases. We  
30 coded the answers to these two questions as 1 (positive association with  
31 empowerment) if a woman chooses solely or jointly with the husband and 0 if the  
32 decision is made by the husband or someone else.  
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38 We adjusted for five potential confounding factors based on previous literature in  
39 low- and middle-income countries: place of residence (urban/rural)<sup>40-43</sup>, women age at  
40 married or cohabitation<sup>44</sup>, education attainment<sup>25,44,45</sup>, wealth index<sup>25,44-46</sup>, and  
41 working status.<sup>44,45</sup>  
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### 45 **Statistical analysis**

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47 Preliminary analyses involved frequency tabulations of all selected socio-economic  
48 and demographic characteristics of women in each country. Then, univariate and  
49 multivariate logistic regression modelling was done for associations between  
50 autonomy measures and  $\geq 4$  ANC and SBA, using Generalized Linear Latent and  
51 Mixed Models (GLLAMM) with the logit link and binomial family that adjusts for  
52 DHS clustering and sampling weights.<sup>47</sup>  
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3 For multivariate analysis, a three-stage model was performed, and data were  
4 entered progressively into the model to assess the association with the study  
5 outcomes. In the first stage, the socioeconomic factors (mother's education,  
6 household wealth index and mother's working status) were entered into the  
7 baseline multivariable model to examine their association with the study outcomes,  
8 and only variables with p-values < 0.05 were retained in the model (model 1). In  
9 the second stage, individual-level factors (place of residence, mother's age at birth)  
10 were added to model 1 and, as before, those factors with p-values < 0.05 were  
11 retained (model 2). Last, the primary explanatory variables (autonomy) were added  
12 to model 2.  
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20 Adjusted odds ratios (aOR) and 95% confidence interval (95% CI) were used to  
21 measure the level of association of the four explanatory variables and the two  
22 outcome variables in each of the 31 studied countries. The "metan" function in  
23 STATA was used to produce the forest plots of adjusted odds ratios and 95%  
24 confidence intervals in individual countries and pooled adjusted odds ratios for all  
25 31 countries combined and for countries in each of the four SSA regions. All  
26 analyses and plots were performed using STATA version 14.2 (Stata Corporation,  
27 College Station, TX, USA).  
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## 33 RESULTS

34  
35 Table 1 shows the critical socio-economic and demographic characteristics of the  
36 women in our sample (n=194,883). There was considerable variation among the 31  
37 countries. Most women who live lived in rural areas were in Burundi (92%) compared  
38 to 14% in Gabon. The percentage of women who gave birth to their first child at age  
39 12-17 years was highest in Ethiopia (62%), and lowest in Rwanda (6%). The  
40 percentage of women with no education was highest in Burkina Faso (83%) and  
41 lowest in Lesotho and Zimbabwe (1%). The percentage of women who were  
42 unemployed was highest in Niger (77%) and lowest in Rwanda (14%). The three  
43 countries with the highest percentage of women having at least primary education  
44 were all in the Southern African region – Lesotho (99%), Namibia (92%) and  
45 Zimbabwe (99%) (Table 1).  
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**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 (%)
<b>West (15)</b>	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)
<b>East (10)</b>	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)
<b>Central (3)</b>	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)
<b>Southern (3)</b>	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)

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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 ( $\geq 4$  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  $\geq 4$  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  $\geq 4$  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  $\geq 4$  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,<sup>1</sup> 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,

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3 women with higher autonomy on some measures were less likely to use maternal  
4 health services.  
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7 Our combined pooled results for all 31 countries show that women's autonomy is  
8 associated with use of both  $\geq 4$  ANC and SBA in SSA. However, this association was  
9 weak, suggesting that many other factors other than women's empowerment affect the  
10 use of maternal health services in SSA. In a study similar to ours, Ahmed et al. used  
11 DHS data to investigate autonomy and utilisation of  $\geq 4$  ANC and SBA in 31  
12 developing countries, including 21 SSA countries.<sup>48</sup> They found weaker associations  
13 between women's empowerment and utilisation of maternal health services in SSA  
14 than in other parts of the world. For example, the pooled odds ratio for autonomy and  
15  $\geq 4$  ANC was 1.52 for all 31 countries and 1.29 in the 21 SSA countries.<sup>48</sup> Note that  
16 we used slightly different DHS measures of autonomy to Ahmed et al. We used  
17 women's attitudes to violence as well as women's participation in decisions (finance  
18 and major household purchases). Ahmed et al. only examined women's autonomy  
19 about decisions as well as their paper was published in 2010 and so used older DHS  
20 data than we did.  
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30 Based mainly on studies in Asia, women's autonomy is considered a crucial  
31 contributor to their utilisation of maternal health services. Women's autonomy has  
32 consistently been shown to be associated with utilisation of ANC and SBA in South  
33 and Northern India,<sup>8,13</sup> and in Nepal and Indonesia where women's financial  
34 autonomy has been found to be associated with their utilisation of maternal health  
35 service.<sup>21,22</sup>  
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42 Three measures of women's autonomy were relatively strongly associated with  
43 utilisation of maternal health services in the Southern SSA region. Women who made  
44 decisions on household income, who opposed sexual violence, and who made  
45 decisions on major household purchases were nearly 50% more likely to use both  $\geq 4$   
46 ANC and SBA. Weaker associations in other African regions could be explained by  
47 differences in levels of female's education across countries in SSA. Education has  
48 been shown to be associated with utilisation of maternal health services.<sup>21,23,48-50</sup> It has  
49 also been found that female education is related to empowerment.<sup>51,52</sup> The Southern  
50 African region had the highest mean percentage of female education (at least primary  
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3 education) at 97 %, compared to 88% in the Central Region, 73% in the Eastern  
4 Region and 38% in the Western region. Furthermore, the three countries with highest  
5 levels of at least primary education were all in this Southern region: Lesotho and  
6 Zimbabwe (99%) and Namibia (92%). This finding raises the possibility that an  
7 underlying level of education is needed in a country to enable women's autonomy to  
8 play a role in the utilisation of maternal health services.  
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13 One unexpected finding in our study is that women with higher autonomy on some  
14 measures in Chad, Mali and Senegal were less likely to utilise either  $\geq 4$  ANC or SBA  
15 than women with less autonomy. These unexpected findings are consistent with some  
16 previous research in Malawi and Mali.<sup>24,53</sup> In a study in Malawi it was found that  
17 women with higher autonomy were less likely to be accompanied by their male  
18 partners to ANC services.<sup>24</sup> In Mali, Upadhyay and colleagues found that women  
19 who had higher autonomy towards sexual violence tended to have more children,  
20 perhaps because higher fertility is regarded as a sign of empowerment.<sup>53,54</sup> Another  
21 explanation for the inverse associations that we observed might be that more  
22 empowered women in Chad, Mali and Senegal might be more likely to successfully  
23 refuse to use maternal health services that they perceive to be inadequate.<sup>55-59</sup>  
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32 Strengths of our study are that we used nationally representative DHS surveys from  
33 countries across SSA and we used four separate measures of female autonomy. One  
34 of the limitations is that DHS surveys are cross-sectional studies where autonomy is  
35 measured after the relevant pregnancy has occurred. Longitudinal studies measuring  
36 women's autonomy before pregnancy and then following women through to the end  
37 of the pregnancy, assessing utilisation of maternal health services, would provide  
38 higher quality evidence about the causal relationship between autonomy and  $\geq 4$  ANC  
39 and SBA. Another limitation is the measurement of autonomy. Despite many  
40 definitions and measures of women's autonomy, no measure can capture its true  
41 complex meaning.<sup>9,18,21,23,44</sup> Women's autonomy remains a multifaceted concept,  
42 which varies between cultures and societies, even within the same country.<sup>7,53</sup> The  
43 DHS provides useful indicators of autonomy for comparison across countries, but  
44 further in-depth research into cultural differences of the meaning of autonomy is  
45 needed for a better understanding of women's autonomy and its association with  
46 maternal health.  
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## 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 to the statistical analyses. CSC wrote the report. JN provided critical contributions to the paper.

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No funding to declare.

### **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

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

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

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

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

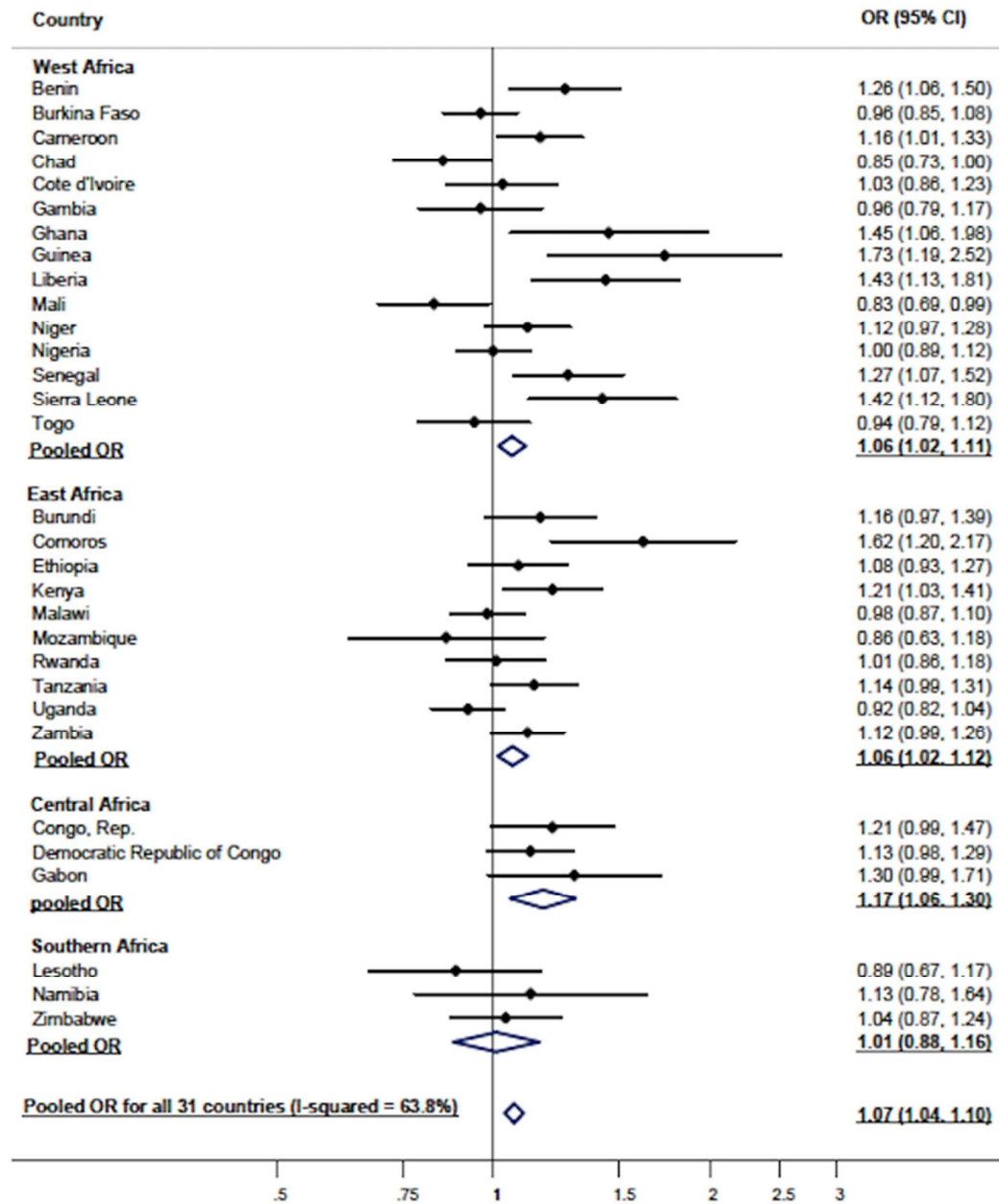
**Figure 5:** The association between women autonomy (opposing domestic violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016

**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

**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

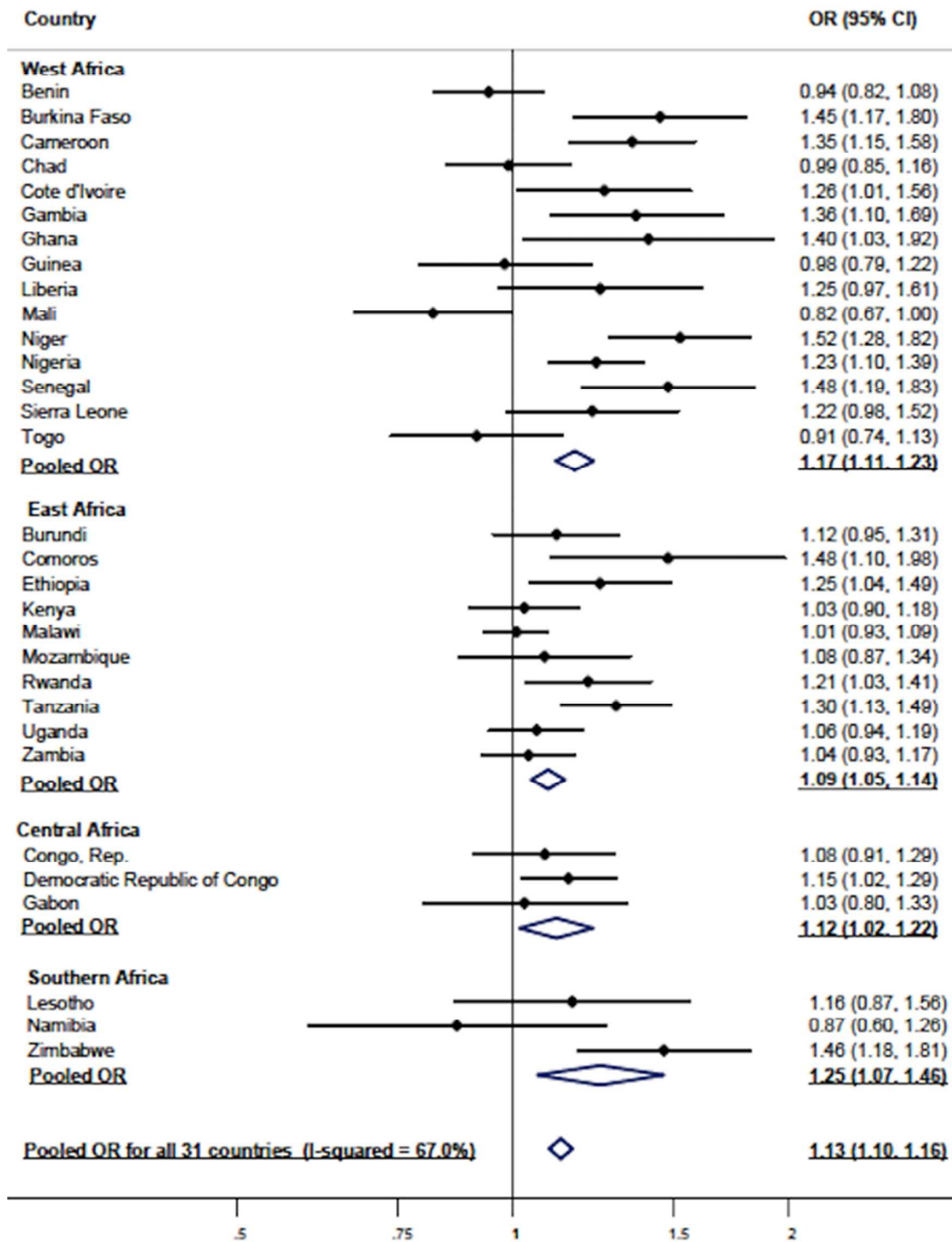
**Figure 8:** The association between women autonomy (opposing sexual violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016





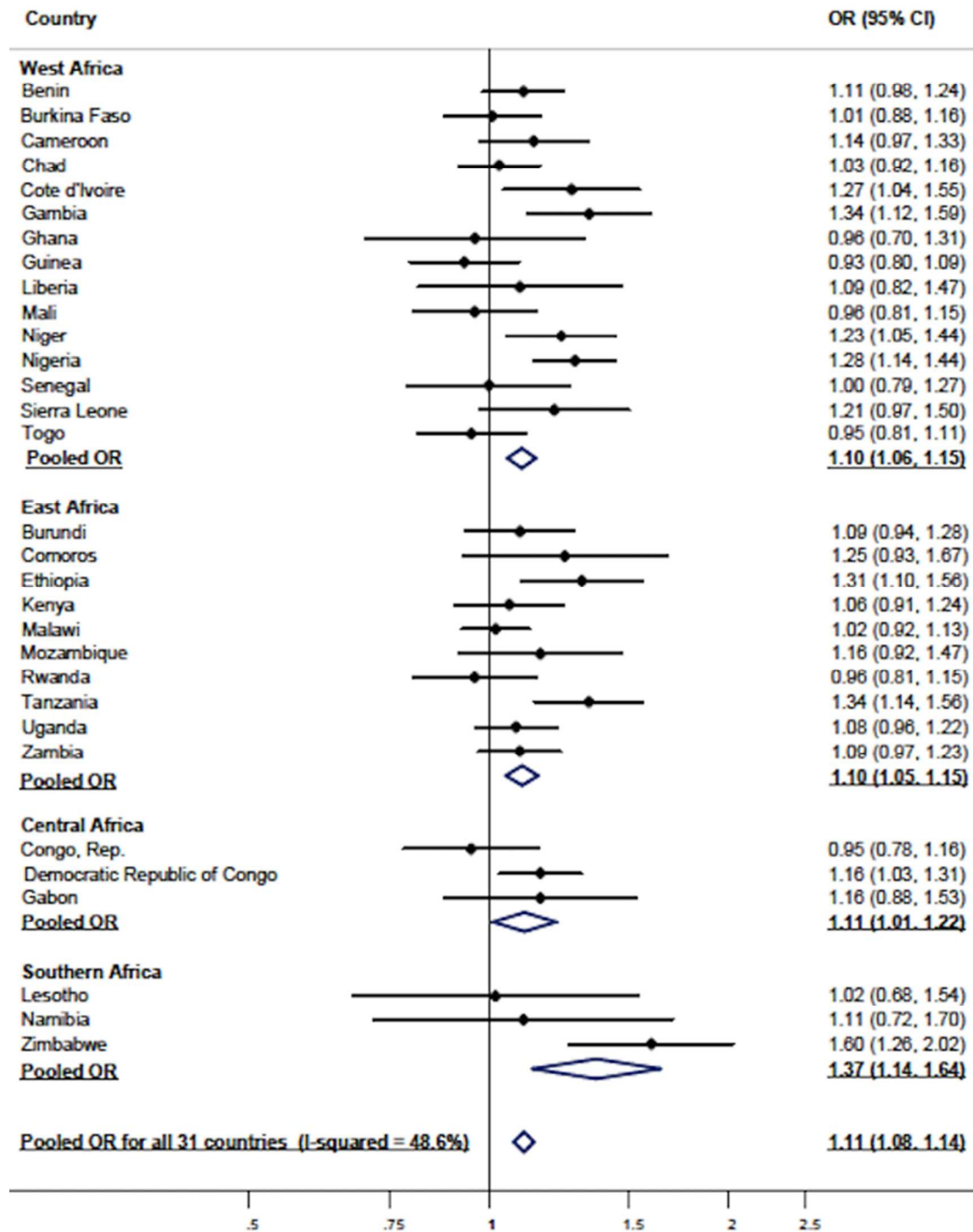
<sup>1</sup>OR = Independent variables adjusted for are: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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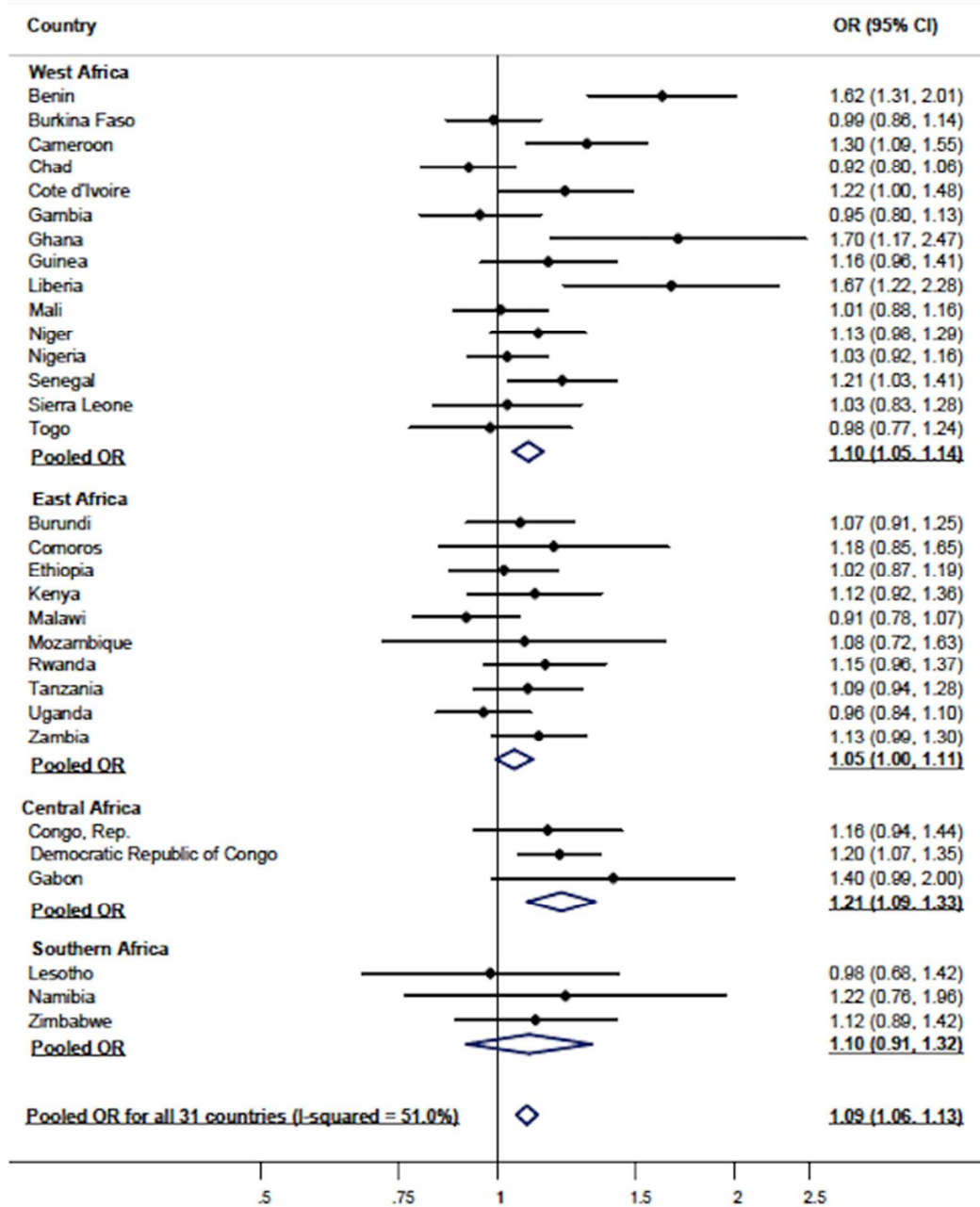
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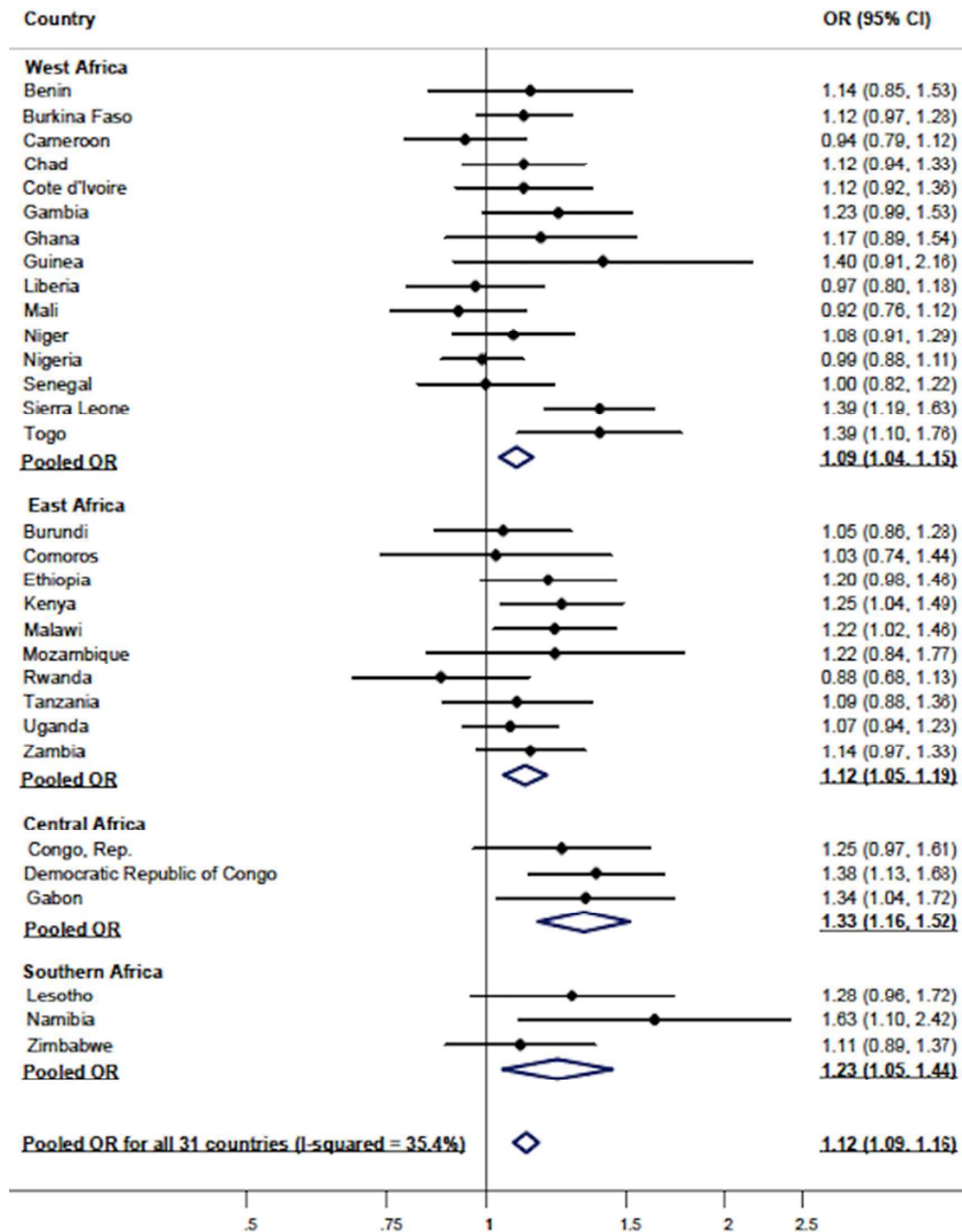
<sup>1</sup>OR = Independent variables adjusted for are: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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

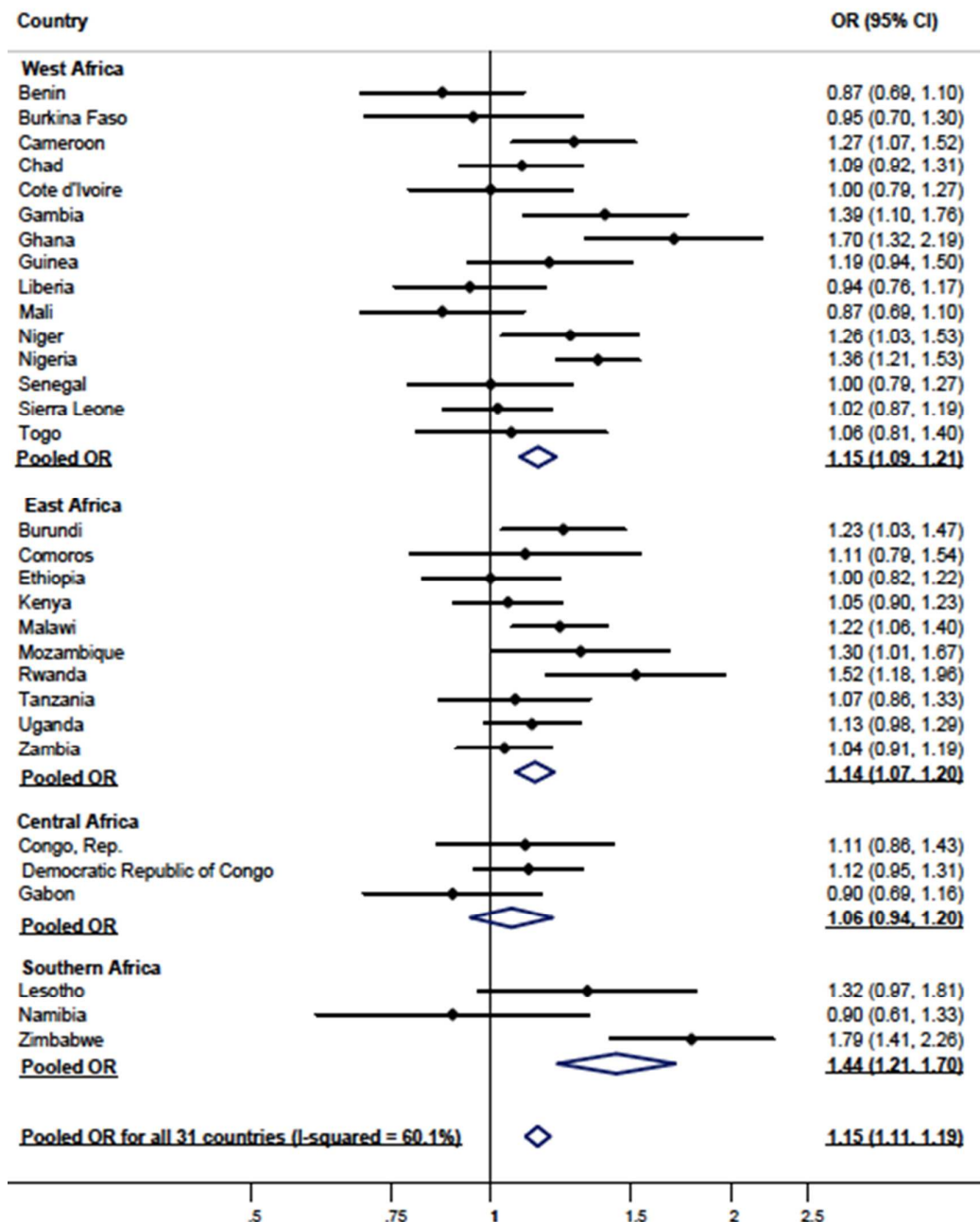
**Figure 4:** The association between women autonomy in opposing sexual violence and utilisation of  $\geq 4$  ANC visits in 31 sub-Saharan African countries, 2010-2016.



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

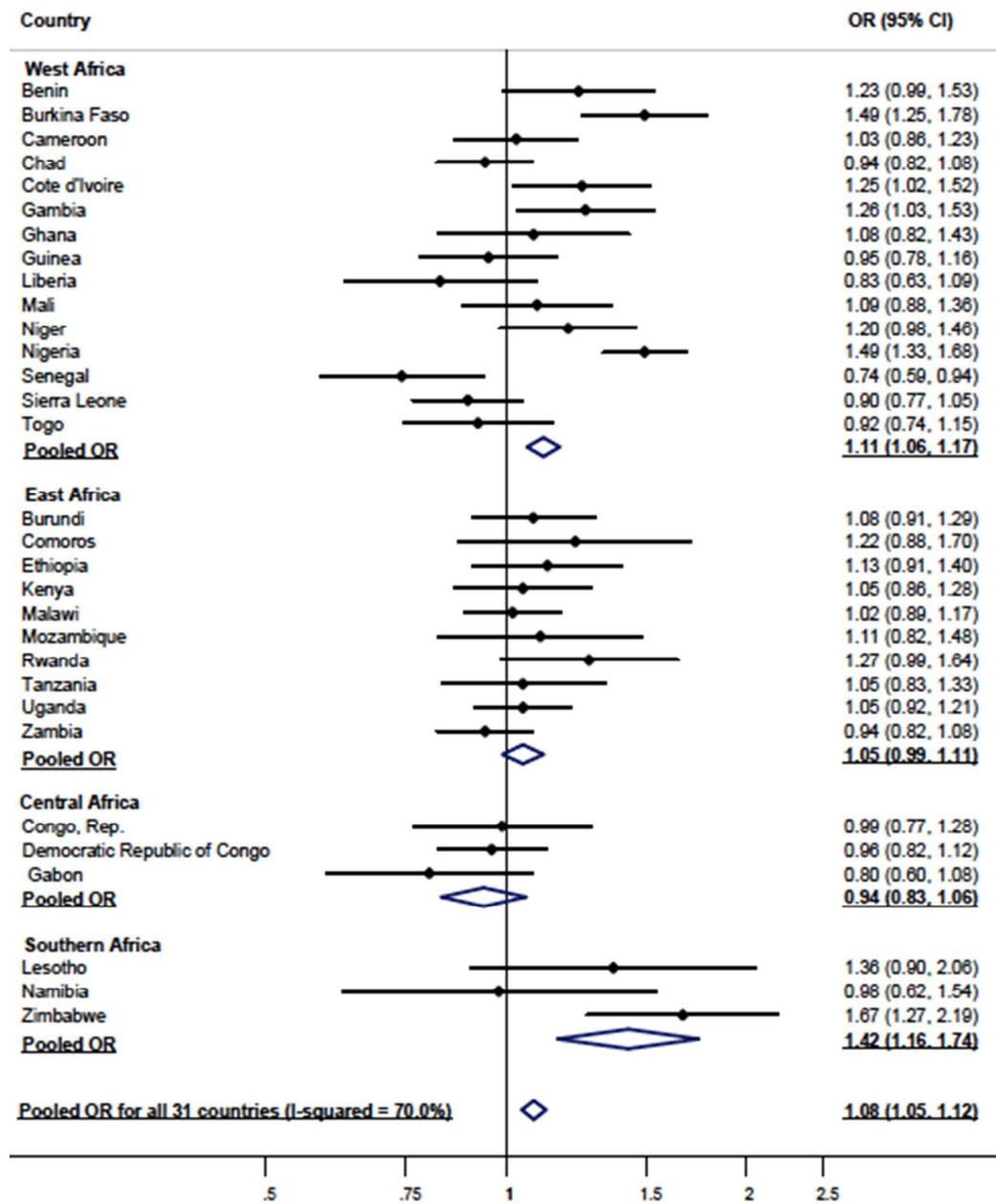
**Figure 5:** The association between women autonomy (opposing domestic violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.





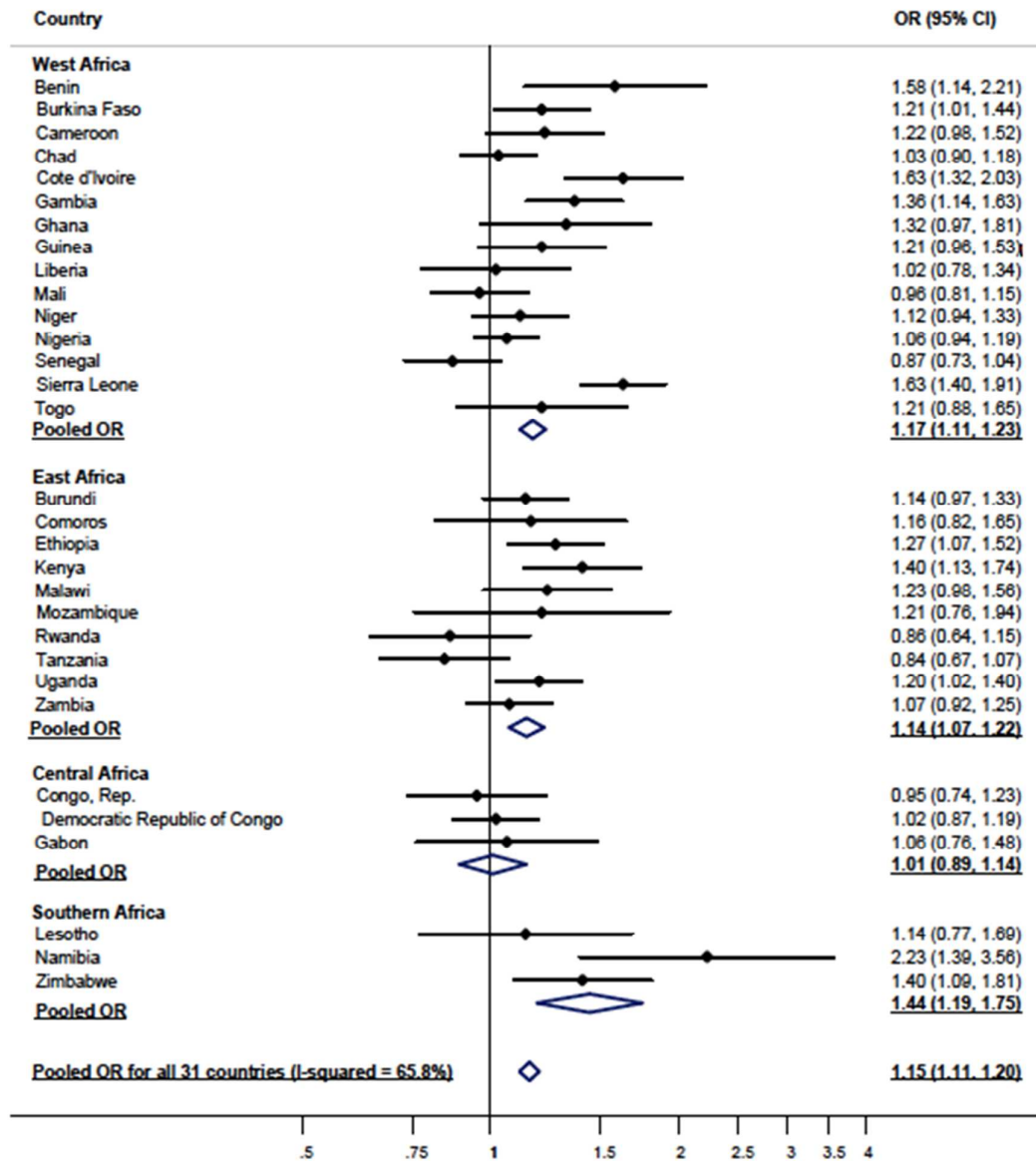
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**Figure 6:** The association between women autonomy (decisions making on spending of household income) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.



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**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.



<sup>1</sup>OR = Independent variables adjusted for are: 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.



# BMJ Open

## 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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Keywords:	Antenatal care, Autonomy, Sub-Saharan Africa, Empowerment, Skilled birth attendants, Maternal health services

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3 **18 ABSTRACT**

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5 **19 Objectives**

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8 **20** To examine the association between women's autonomy and the utilisation of maternal  
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10 **21** healthcare services across 31 Sub-Saharan African countries (SSA).

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12 **22 Design, setting, and participants:**

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15 **23** We analysed the Demographic and Health Survey (DHS) (2010-2016) data collected from  
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17 **24** married women aged 15-49 years. We used four DHS measures related to women's  
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19 **25** autonomy: attitude towards domestic violence, attitude towards sexual violence, decision  
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21 **26** making on spending of household income made by the women solely or jointly with  
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23 **27** husbands, and decision making on major household purchases made by the women solely  
24  
25 **28** or jointly with husbands. We used multiple logistic regression analyses to examine the  
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27 **29** association between women's autonomy and the utilisation of maternal healthcare services  
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29 **30** adjusted for five potential confounders: place of residence, age at birth of the last child,  
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31 **31** household wealth, educational attainment, and working status. Adjusted odds ratios  
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33 **32** (aORs) and 95% confidence interval (95% CI) were used to produce the forest plots.

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35 **33 Outcome measures**

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38 **34** The primary outcome measures were the utilisation of  $\geq 4$  antenatal care (ANC) visits and  
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40 **35** delivery by skilled birth attendants (SBA).

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42 **36 Results**

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45 **37** Pooled results for all 31 countries (194,883 women) combined showed weak statistically  
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47 **38** significant associations between all four measures of women's autonomy and utilisation of  
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49 **39** maternal healthcare services (aORs ranged from 1.07 to 1.15). The strongest associations  
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51 **40** were in the Southern African region. For example, the aOR for women who made decisions  
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3 41 on household income solely or jointly with husbands in relation to the use of SBAs in the  
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5 42 Southern African region was 1.44 (95% CI 1.21 to 1.70). Paradoxically, there were three  
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7 43 countries where women with higher autonomy on some measures were less likely to use  
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9 44 maternal healthcare services. For example, the aOR in Senegal for women who made  
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11 45 decisions on major household purchases solely or jointly with husbands in relation to the  
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13 46 use of SBAs (aOR=0.74 95% CI 0.59 to 0.94).  
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### 18 47 **Conclusion**

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20 48 Our results revealed a weak relationship between women's autonomy and the utilisation of  
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22 49 maternal healthcare services. More research is needed to understand why these associations  
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25 50 are not stronger.  
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### 27 51 **Strengths and limitations of this study**

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30 52 • We used nationally representative DHS datasets from 31 SSA countries.  
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32 53 • We used four separate measures of women's autonomy.  
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34 54 • DHS data are cross-sectional, and so the direct relationship between women's  
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36 55 autonomy and the utilisation of maternal healthcare services cannot be determined  
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39 56 with certainty.  
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## 58 INTRODUCTION

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

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

78 Most of the studies that have examined the relationship between women’s autonomy and  
79 women’s health were conducted in South and South-east Asia.<sup>14 15 18 21-23</sup> These studies

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3 80 have found that women's autonomy is essential for utilisation of maternal healthcare  
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5 81 services and women's well-being. However, a recent review by Osamar and Grady found  
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7 82 few relevant studies from SSA, making it difficult to know if these results apply there.<sup>10</sup>  
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10 83 <sup>24-28</sup> The aim of our study was to examine the association between four measures of  
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12 84 women's autonomy and utilisation of maternal healthcare services across 31 SSA countries  
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15 85 using DHS data collected during 2010-2016.  
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## 19 87 **METHODS**

### 22 88 **Data source**

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25 89 Data from DHS surveys were used. This study is restricted to married women aged 15-49  
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27 90 years at the time the DHS surveys were conducted. DHS surveys are standardised cross-  
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29 91 sectional datasets that are publicly available. Data are collected by the National Statistics  
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31 92 Agencies in collaboration with the United States Agency for International Development  
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33 93 (USAID).<sup>29</sup>  
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### 38 94 **Sampling methods**

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41 95 DHS surveys use probability sampling methods to produce representative national samples  
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43 96 of women aged 15-49 years. The sample results are weighted to ensure the results are  
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45 97 relevant to each country.<sup>30</sup> DHS surveys collect information on a wide range of topics using  
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47 98 mainly identical questionnaires in all countries.  
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### 51 99 **Study selection and inclusion criteria**

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3 100 From the 49 SSA countries, we selected the 31 countries that had had DHS data collected  
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5 101 during 2010-2016. We divided the 31 countries into four regions, as used by the Global  
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7 102 Burden of Disease Study<sup>2</sup>: Central Africa (Congo, Democratic Republic of Congo (DRC),  
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9 103 and Gabon); Eastern Africa (Burundi, Comoros, Ethiopia, Kenya, Malawi, Mozambique,  
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11 104 Rwanda, Tanzania, Uganda, and Zambia); Southern Africa (Lesotho, Namibia, and  
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13 105 Zimbabwe); and Western Africa (Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire,  
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15 106 Gambia, Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo).  
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17 107 Note that South Africa was excluded as its latest DHS was conducted in 1992. We restricted  
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19 108 our analysis to the most recent child born in the five years preceding each survey to improve  
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21 109 the accuracy of recall of use of maternal healthcare services.  
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## 27 110 **Study variables**

### 28 29 30 111 *Outcome variables*

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33 112 We examined two outcome measures: utilisation of at least four ANC visits ( $\geq 4$  ANC) and  
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35 113 delivery of the last child by SBA. The utilisation of SBA included births attended by  
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37 114 doctors, midwives and village midwives; non-utilisation included births attended by  
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39 115 traditional birth attendants, family members and other relatives.<sup>31</sup> The utilisation of ANC  
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41 116 services was based on mothers who had at least four ANC visits as recommended by the  
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43 117 World Health Organisation (WHO).<sup>5</sup> There was no data on the time of each ANC visit.  
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45 118 Primary outcome measures took a binary form: women with the recommended four or more  
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47 119 ANC services were assigned '1', and women who reported less than the four recommended  
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49 120 ANC services were assigned '0'. Delivery with any SBA was categorised as '1', and  
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51 121 delivery without SBA was categorised as '0'.  
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3 122 *Explanatory variables*  
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6 123 We used four DHS indicators related to women's autonomy in two areas: women's  
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8 124 attitudes to sexual and domestic violence<sup>32-38</sup> and participation in decision-making (solely  
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10 125 or jointly with the husband) on spending of household income and major household  
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13 126 purchases.<sup>9 10 39-41</sup>  
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16 127 Attitude to sexual violence was measured based on responses to a question that asked if  
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18 128 beating a wife by a husband for refusing sexual intercourse with him is acceptable. We  
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20 129 coded a woman with a score of 1 if she responded "no" (positive association with  
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22 130 autonomy) and 0 if she responded "yes" (agreement). Attitude to domestic violence was  
23  
24 131 based on responses of women to four DHS questions asking whether a husband was  
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26 132 justified in beating his wife if she: goes out without telling him; neglects the children;  
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28 133 argues with him; or burns the food. We coded a woman with a score of 1 if she responded  
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30 134 no to all four DHS questions (positive association with empowered) and 0 if she responded  
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32 135 "yes" (agreement) to any question.  
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38 136 Autonomy about household income was based on a question on spending of household  
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40 137 income. Autonomy concerning decision making on major household purchases was based  
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42 138 on a question regarding who decides on major household purchases. We coded the answers  
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44 139 to these two questions as 1 (positive association with autonomy) if a woman chooses solely  
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46 140 or jointly with the husband and 0 if the husband alone or someone else makes the decision.  
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50 141 **Potential confounding factors**  
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53 142 We adjusted for five potential confounding factors based on previous literature in low- and  
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55 143 middle-income countries: place of residence (urban/rural)<sup>42-45</sup>, mother's age at birth<sup>46</sup>,  
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3 144 mother's educational attainment<sup>26 46 47</sup>, household wealth index<sup>26 46-48</sup>, and mother's  
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5 145 working status.<sup>46 47</sup>  
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## 8 146 **Statistical analysis**

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11 147 Preliminary analyses involved frequency tabulations of all selected socio-economic and  
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13 148 demographic characteristics of women in each country (descriptive analysis). Then,  
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15 149 logistic regression modelling was done to assess the associations between autonomy  
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17 150 measures and outcome measures ( $\geq 4$  ANC and SBA), using Generalised Linear Latent  
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19 151 and Mixed Models (GLLMM) with the logit link and binomial family that adjusts for  
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21 152 DHS clustering and sampling weights.<sup>49</sup>  
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26 153 Our analysis was conducted in four stages where data were entered progressively into  
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28 154 the model to assess associations with the study outcomes. In model 1, we conducted  
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30 155 logistic regression models with each measure of autonomy and each outcome variable  
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32 156 ( $\geq 4$  ANC and SBA). In the second stage, to avoid collinearity, the socioeconomic factors  
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34 157 (mother's education, household wealth index and mother's working status) were entered  
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36 158 into model 1 to examine their association with the study outcomes (model 2). In the third  
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38 159 stage, individual-level factors (place of residence, mother's age at birth) were added to  
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40 160 model 2 to form model 3. Last, the primary explanatory variables (autonomy) were  
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42 161 added to model 3 to form the final model 4. As all five potential confounders were  
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44 162 significant at p-values  $< 0.05$ , they were retained in the final model.  
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50 163 Adjusted odds ratios (aOR) and 95% confidence interval (95% CI) were used to  
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52 164 measure the level of association between the four explanatory autonomy variables and  
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54 165 the two outcome variables in each of the 31 studied countries. The "metan" function in  
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3 166 STATA was used to produce the forest plots of aORs and 95% CIs in individual  
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5 167 countries for all 31 countries combined, and for countries in each of the four SSA  
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7 168 regions. All analyses and plots were performed using STATA version 14.2 (Stata  
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9 169 Corporation, College Station, TX, USA).<sup>50</sup>

### 12 170 **Patient and Public Involvement**

15 171 We had no contact with any patients or the public for this study as we used publicly  
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17 172 accessible data previously collected for National Demographic and Health Surveys.

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## 23 174 **RESULTS**

26 175 Table 1 the shows socio-economic and demographic characteristics of the women in our  
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28 176 sample (n=194,883). There was considerable variation among the 31 countries. Ninety-two  
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30 177 percent of women surveyed in Burundi lived in rural areas compared to just 14% surveyed  
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32 178 in Gabon. The percentage of women who gave birth to their first child at age 12-17 years  
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34 179 was highest in Ethiopia (62%) and lowest in Rwanda (6%). The percentage of surveyed  
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36 180 women with no education was highest in Burkina Faso (83%) and lowest in Lesotho and  
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38 181 Zimbabwe (1%). The percentage of surveyed women who were unemployed was highest  
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40 182 in Niger (77%) and lowest in Rwanda (14%). The three countries with the highest  
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42 183 percentage of surveyed women having at least primary education were all in the Southern  
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44 184 African region – Lesotho (99%), Namibia (92%) and Zimbabwe (99%).

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6 **1 Table 1: Socio-economic and demographic characteristics of surveyed married women aged 15-49 years living with their male**  
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8 **2 partners. Data from Demographic and Health Surveys conducted in 31 sub-Saharan Africa countries, (2010-2016).**  
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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 (%)
<b>West (15)</b>	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)

<b>East (10)</b>	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)
<b>Central (3)</b>	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)

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<b>Southern (3)</b>	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)

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Peer review only



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4 1 Figures 1-4 ( $\geq 4$  ANC) and figures 5-8 (SBA) summarise the meta-analysis results (aORs  
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6 2 and 95% CI) for all 31 countries combined, as well as for regions and individual countries  
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8 3 (after adjusting for the five potential confounders). Pooled results for all 31 countries  
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10 4 (194,883 women) combined, showed weak statistically significant associations between all  
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12 5 four measures of women's autonomy and the utilisation of maternal services. Associations  
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14 6 were strongest in the Southern African region (Figures 1-8).

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18 7 The pooled aORs and 95% CIs for all 31 SSA countries and utilisation of  $\geq 4$  ANC visits  
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20 8 were: (1) for opposing domestic violence (aOR=1.07 95% CI 1.04 to 1.10); (2) for decision  
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22 9 making on major household income (aOR=1.13 95% CI 1.10 to 1.16); (3) for decision  
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24 10 making on major household purchases (aOR=1.11 95% CI 1.08 to 1.14); and (4) for  
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26 11 opposing sexual violence (aOR=1.09 95% CI 1.06 to 1.13).

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31 12 The pooled aORs and 95% CI for all 31 SSA countries and utilisation of SBA visits were:  
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33 13 (1) for opposing domestic violence (aOR=1.12 95% CI 1.09 to 1.16); (2) for decision  
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35 14 making on major household income (aOR=1.15 95% CI 1.11 to 1.19); (3) for decision  
36  
37 15 making on major household purchases (aOR=1.08 95% CI 1.05 to 1.12); and (4) for  
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39 16 opposing sexual violence (aOR=1.15 95% CI 1.1 to 1.20).

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43 17 Interestingly, our country-level analyses showed that in three countries (Chad, Mali, and  
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45 18 Senegal), women with higher autonomy were less likely to use maternal healthcare  
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47 19 services. Women with higher autonomy about domestic violence were less likely to use  $\geq$   
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49 20 4 ANC in Chad (aOR= 0.85, 95% CI 0.71 to 1.00) and Mali (aOR= 0.83, 95% CI 0.69 to  
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51 21 0.99) (Figure 1). Women who made decisions on household income were less likely to use  
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53 22  $\geq 4$  ANC in Mali (aOR= 0.82, 95% CI 0.67 to 1.00) (Figure 2). Women who made decisions  
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3 23 on major household purchases were less likely to use SBAs in Senegal (aOR= 0.74, 95%  
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5 24 CI 0.59 to 0.94) (Figure 7).  
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9 25 *Figures 1 – 8 here*  
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## 11 26 **DISCUSSION**

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14 27 Our pooled results for all 31 countries showed weak, albeit statistically significant,  
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16 28 associations between women's autonomy and use of both  $\geq 4$  ANC and SBAs. The  
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18 29 exception was the Southern African region where three measures of women's autonomy  
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20 30 were relatively strongly associated with the use of maternal healthcare services.  
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22 31 Surprisingly, the country-level analyses suggested that in Chad, Mali, and Senegal, women  
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24 32 with higher autonomy on some measures were less likely to use maternal healthcare  
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26 33 services.  
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31 34 Although our combined pooled results for all 31 countries show that women's autonomy is  
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33 35 associated with the use of maternal healthcare services in SSA, this association was weak,  
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35 36 suggesting that many factors other than women's autonomy affect the use of maternal  
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37 37 healthcare services in SSA. In a study similar to ours, Ahmed et al. used DHS data to  
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39 38 investigate the autonomy and utilisation of  $\geq 4$  ANC and SBA in 31 developing countries,  
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41 39 including 21 SSA counties.<sup>51</sup> They found weaker associations between women's autonomy  
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43 40 and utilisation of maternal healthcare services in SSA than in other parts of the world. For  
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45 41 example, the pooled aORs for autonomy and  $\geq 4$  ANC was 1.52 for all 31 countries and  
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47 42 1.29 in the 21 SSA countries.<sup>51</sup> Note that we used slightly different DHS measures of  
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49 43 autonomy to Ahmed et al. We used women's attitudes to violence as well as women's  
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51 44 participation in decisions (finance and major household purchases), while Ahmed et al.  
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3 45 only examined women's autonomy about decisions. The paper by Ahmed et al. was  
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6 46 published in 2010 and so used older DHS data than we did.  
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9 47 Based mainly on studies in Asia, women's autonomy is considered a crucial contributor to  
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11 48 their utilisation of maternal healthcare services. For example, women's autonomy has  
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13 49 consistently been shown to be associated with the utilisation of ANC and SBA in South  
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15 50 and Northern India,<sup>9 14</sup> and in Nepal and Indonesia where women's financial autonomy has  
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17 51 been found to be associated with their utilisation of maternal healthcare service.<sup>22 23</sup>  
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21 52 Three measures of women's autonomy were relatively strongly related to use of maternal  
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23 53 healthcare services in the Southern African region. Women who made decisions on  
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25 54 household income, who opposed sexual violence, and who made decisions on major  
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27 55 household purchases were nearly 50% more likely to use both  $\geq 4$  ANC and SBA.  
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31 56 Weaker associations in other African regions are unlikely to be explained by differences in  
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33 57 women's education or household wealth, as we adjusted for these variables. The  
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35 58 explanation is probably related to differences in economic development and culture across  
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37 59 countries in SSA.<sup>51-53</sup> A qualitative study in Zambia found that factors leading to delivery  
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39 60 at home rather than at a clinic included: lack of female autonomy, the influence of husbands  
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41 61 and parents, perceived low quality of clinic-based services, and positive attitudes towards  
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43 62 traditional birth attendants.<sup>28</sup> Jayachandran showed that the level of female autonomy  
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45 63 tended to be higher in countries with higher GDP per capita.<sup>53</sup> Economic development is  
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47 64 also associated with better education for men and women and higher quality health  
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49 65 services.  
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3 67 One unexpected finding in our study is that women with higher autonomy on some  
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5 68 measures in Chad, Mali and Senegal were less likely to utilise either  $\geq 4$  ANC or SBA than  
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8 69 women with less autonomy. These results are consistent with some previous research in  
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10 70 Malawi and Mali.<sup>25 54</sup> In a study in Malawi it was found that women with higher autonomy  
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12 71 were less likely to be accompanied by their male partners to ANC services.<sup>25</sup> In Mali,  
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14 72 Upadhyay and colleagues found that women who had higher autonomy towards sexual  
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16 73 violence tended to have more children, perhaps because higher fertility is regarded as a  
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18 74 sign of autonomy.<sup>54 55</sup> Another explanation for the inverse associations that we observed  
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20 75 might be that more empowered women in Chad, Mali and Senegal might be more likely to  
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22 76 successfully refuse to use maternal healthcare services that they perceive to be  
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24 77 inadequate.<sup>56-60</sup>

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29 78 The strengths of our study are that we used nationally representative DHS surveys from  
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31 79 countries across SSA in addition to utilisation of four separate measures of female  
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33 80 autonomy. One of the limitations is that DHS surveys are cross-sectional studies where  
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35 81 autonomy is measured after the relevant pregnancy has occurred. Longitudinal studies  
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37 82 measuring women's autonomy before pregnancy and then following women through to the  
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39 83 end of the pregnancy, assessing utilisation of maternal healthcare services, would provide  
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41 84 higher quality evidence about the causal relationship between autonomy and  $\geq 4$  ANC and  
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43 85 SBA. Also, we did not study as separate variables the four recommended ANC timings –  
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45 86 first visit 8-12 weeks, second visit 24-26 weeks, third visit 32 weeks, and the fourth visit  
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47 87 36-38 weeks.<sup>5</sup> Another limitation is the measurement of autonomy. Despite many  
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49 88 definitions and measures of women's autonomy, no measure can capture its true complex  
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51 89 meaning.<sup>10 19 22 24 46</sup> Women's autonomy remains a multifaceted concept which varies  
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53 90 between cultures and societies, even within the same country.<sup>8 54</sup> Poor measurements of  
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55 91 autonomy may explain why we found such weak associations between autonomy and use  
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57 92 of maternal healthcare services. The DHS provides useful indicators of autonomy for  
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59 93 comparison across countries, but further in-depth research into cultural differences

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3 94 concerning the meaning of autonomy is needed for a better understanding of women's  
4 95 autonomy and its association with maternal healthcare.

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## 9 97 **CONCLUSION**

11 98 The overall goal of this study was to examine the association between women's autonomy  
12 99 and the utilisation of maternal healthcare services –  $\geq 4$  ANC visits and delivery by SBA –  
13 100 across 31 SSA countries. We found weak associations at both regional and country level.  
14 101 The exception was the Southern Africa region where associations between women's  
15 102 autonomy and the utilisation of maternal healthcare services were reasonably strong.  
16 103 Further research on women's autonomy is needed in SSA to inform gender and health  
17 104 policies concerning utilisation of maternal healthcare services. Moreover, additional  
18 105 research is required into the inverse associations between some countries where women  
19 106 with higher autonomy on some measures were less likely to use maternal healthcare  
20 107 services.

## 35 108 **Contributors**

38 109 The concept was initiated by CC, who also collected the data, produced the tables and  
39 110 figures and wrote the first draft. All authors contributed to the study design and review of  
40 111 the manuscript with vital input from KA and RGC. KA contributed significantly to the  
41 112 statistical analyses. JN provided critical contributions to the paper.

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51 114 No funding to declare.

## 54 115 **Competing interests**

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2  
3 116 The authors have no competing interests to declare.  
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6 117 **Ethical approval**  
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8  
9 118 This study is based on publicly available DHS data. CC was granted access to the data by  
10  
11 119 the MEASURE DHS/ICF International, Rockville, Maryland, USA.  
12  
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14 120 **Data sharing statement**  
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16 121 The data used in this study are freely accessible to the public at the DHS website  
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18 122 <https://www.dhsprogram.com/Data/>.  
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3 304 **Figure 1:** The association between women's autonomy (opposing domestic violence) and  
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5 305 utilisation of  $\geq 4$  ANC visits in 31 Sub-Saharan African countries, 2010-2016  
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8 306 **Figure 2:** The association between women's autonomy (opposing domestic violence) and  
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12 308 **Figure 3:** The association between women's autonomy (decisions making on spending of  
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14 309 household income) and utilisation of  $\geq 4$  ANC visits in 31 Sub-Saharan African  
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16 310 countries, 2010-2016  
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19 311 **Figure 4:** The association between women's autonomy (decision making on major  
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21 312 household purchases) and utilisation of  $\geq 4$  ANC visits in 31 Sub-Saharan African  
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23 313 countries, 2010-2016.  
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26 314 **Figure 4:** The association between women's autonomy in opposing sexual violence and  
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28 315 utilisation of  $\geq 4$  ANC visits in 31 Sub-Saharan African countries, 2010-2016  
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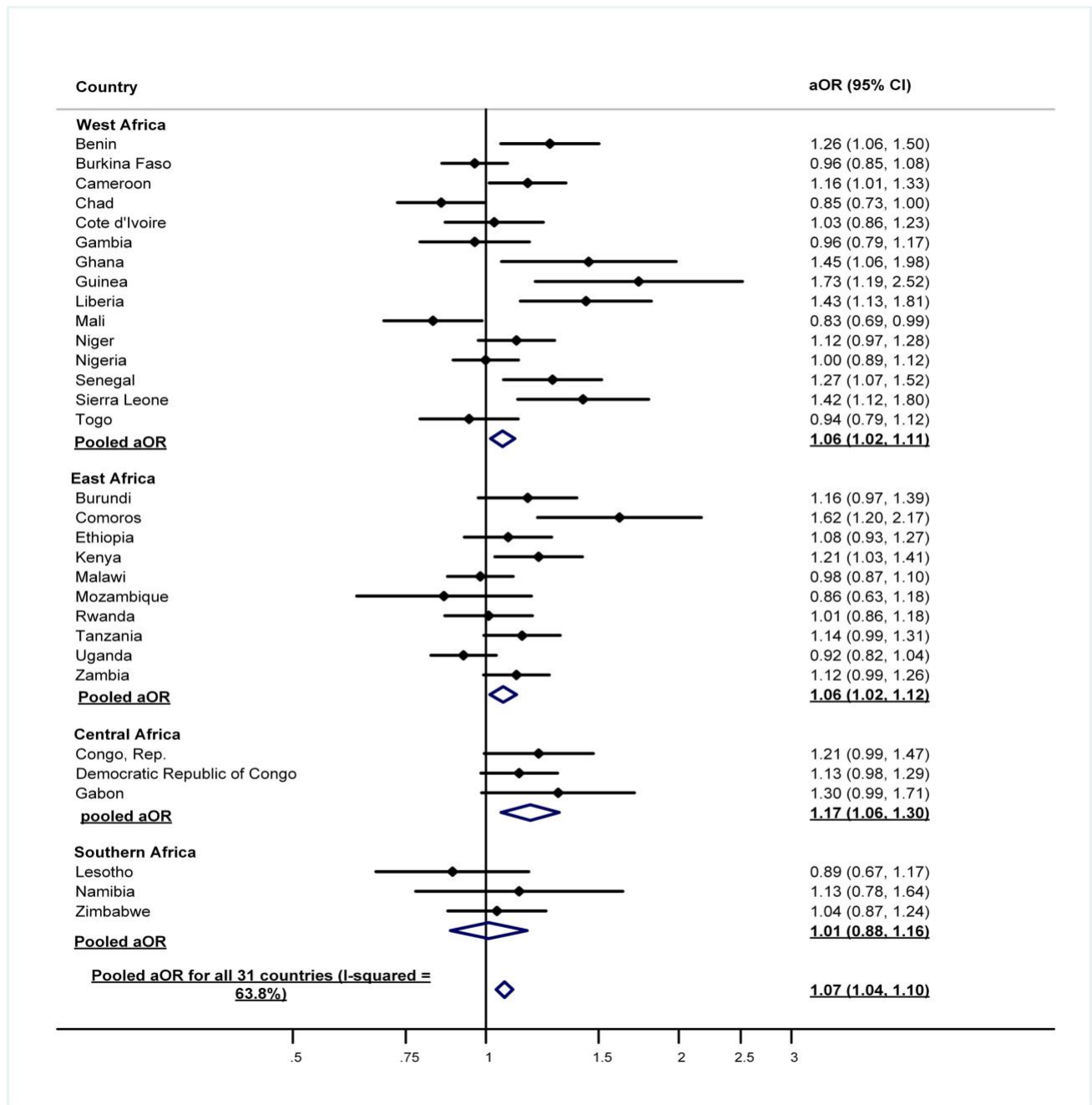
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31 316 **Figure 5:** The association between women's autonomy (opposing domestic violence) and  
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33 317 utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016  
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37 319 household income) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-  
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42 321 **Figure 7:** The association between women's autonomy (decision making on major  
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44 322 household purchases) and utilisation of SBA in 31 Sub-Saharan African countries, 2010-  
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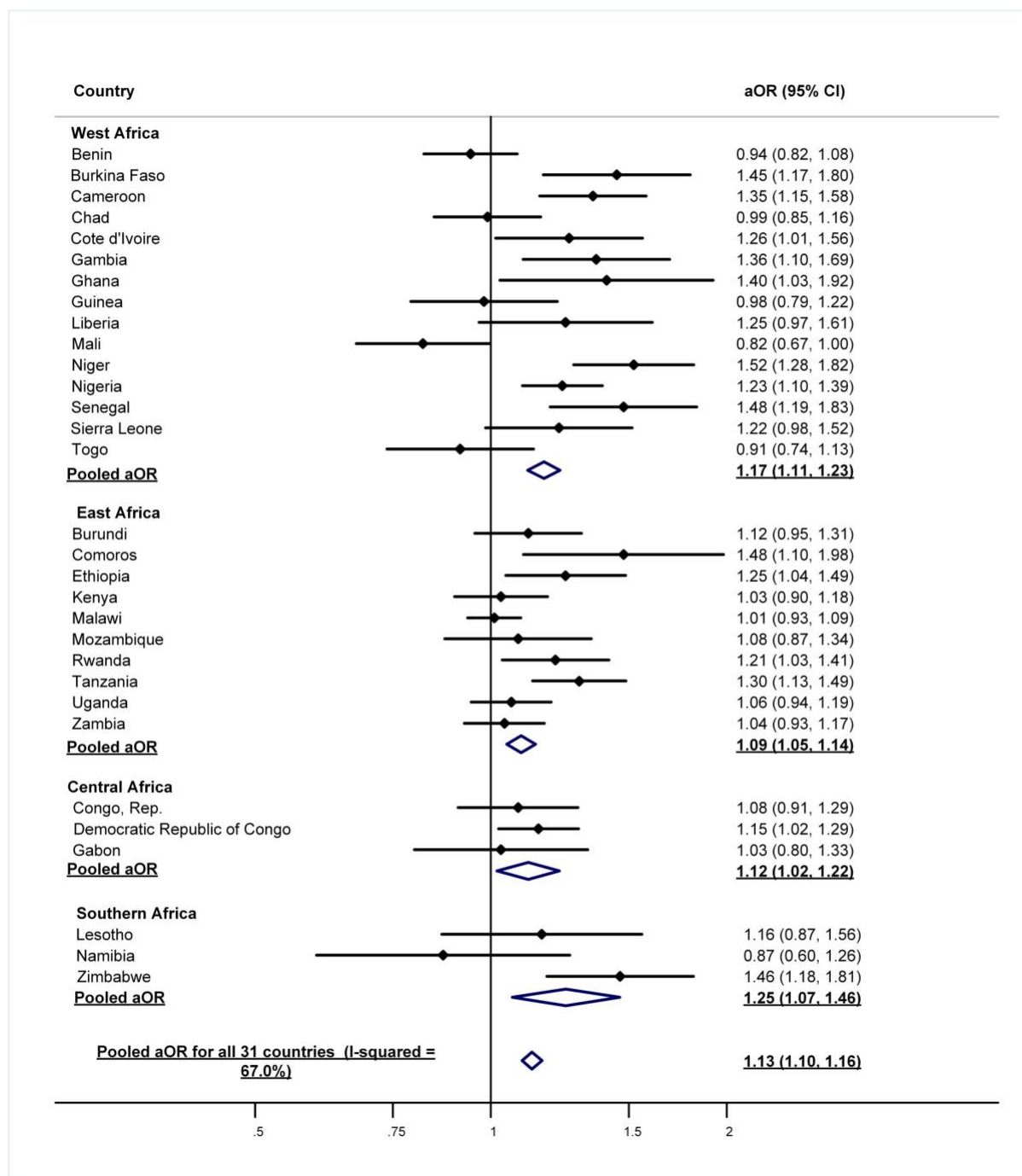
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49 324 **Figure 8:** The association between women's autonomy (opposing sexual violence) and  
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51 325 utilisation of SBA in 31 Sub-Saharan African countries, 2010-2016.  
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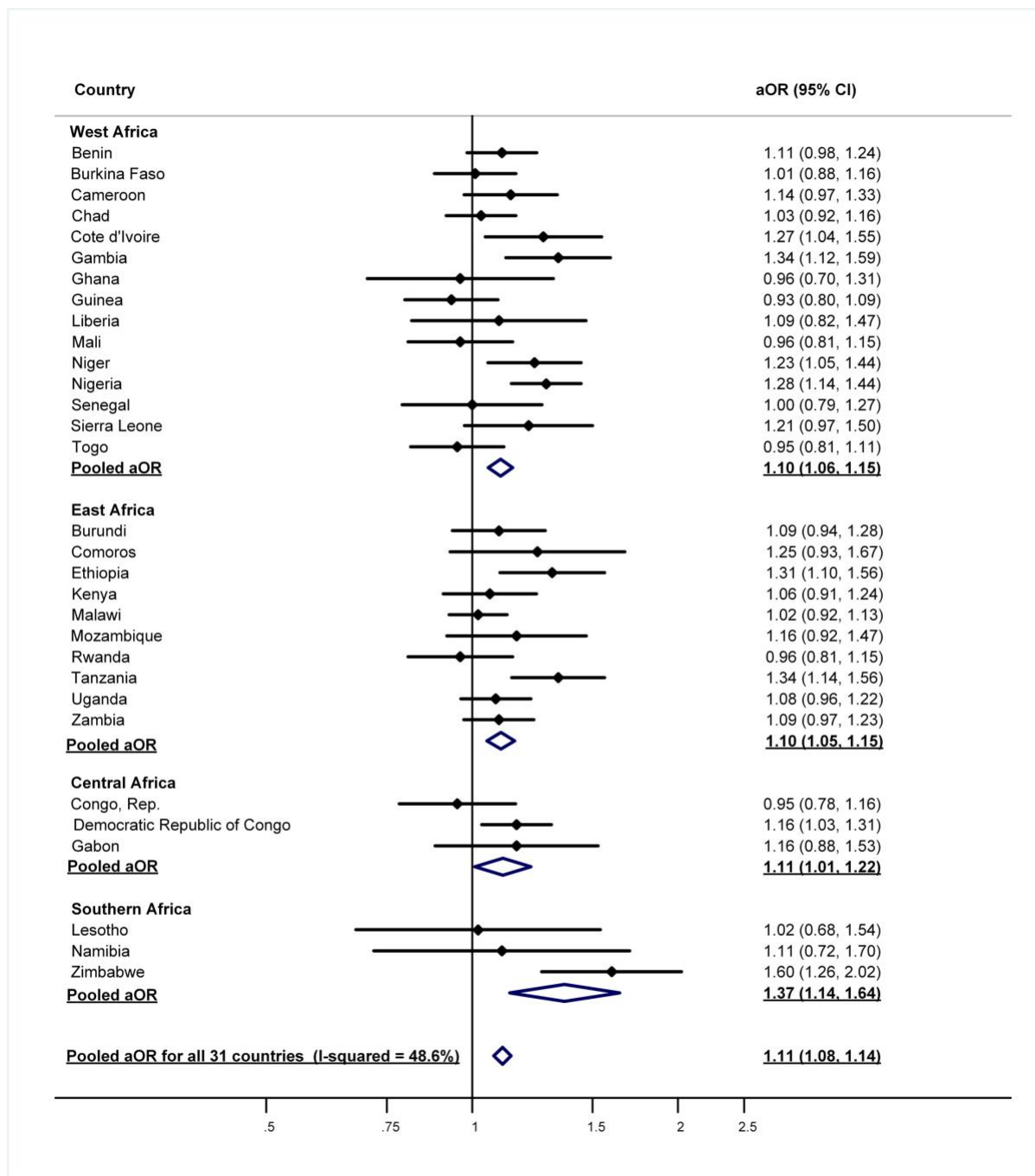
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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



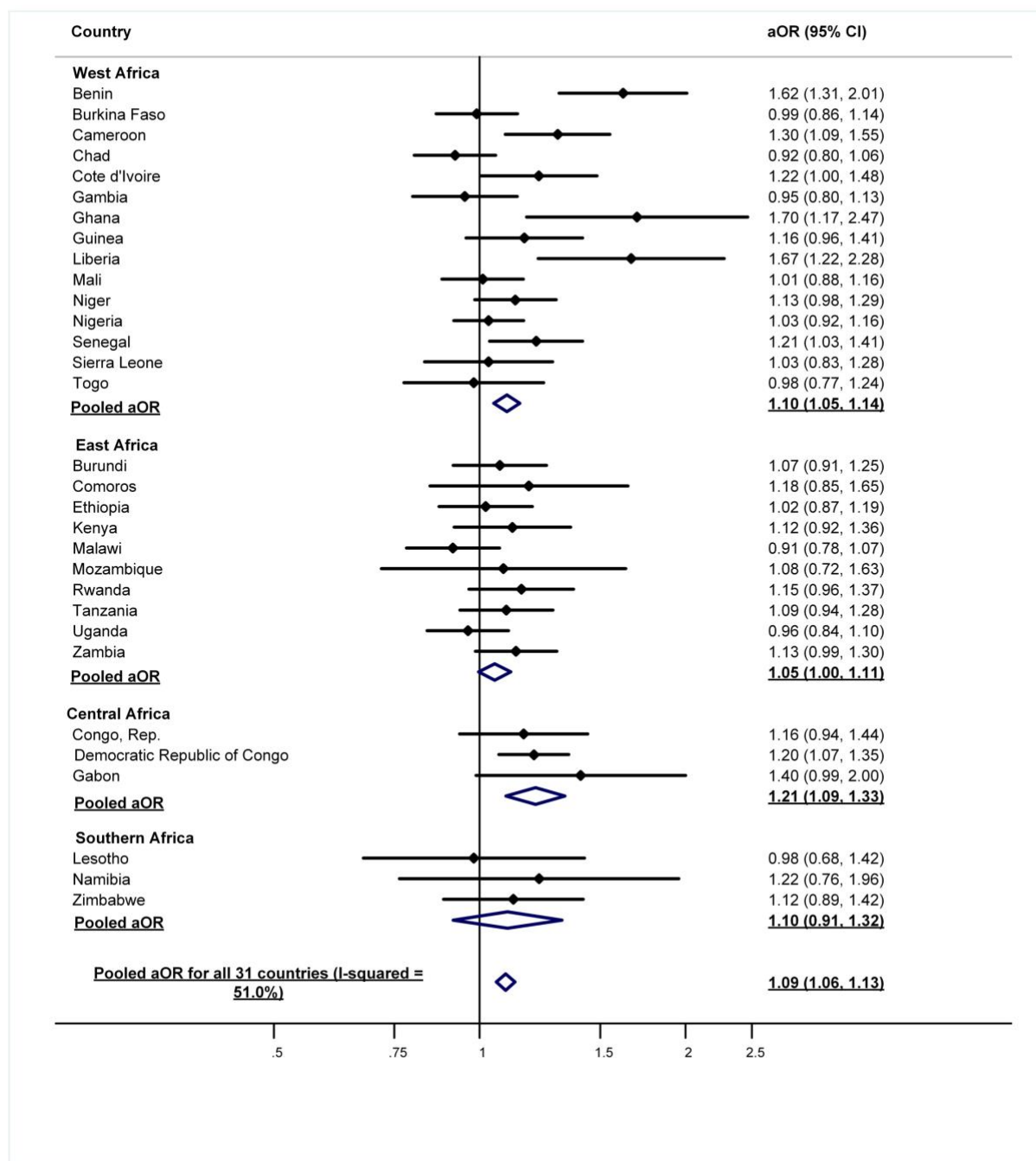
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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



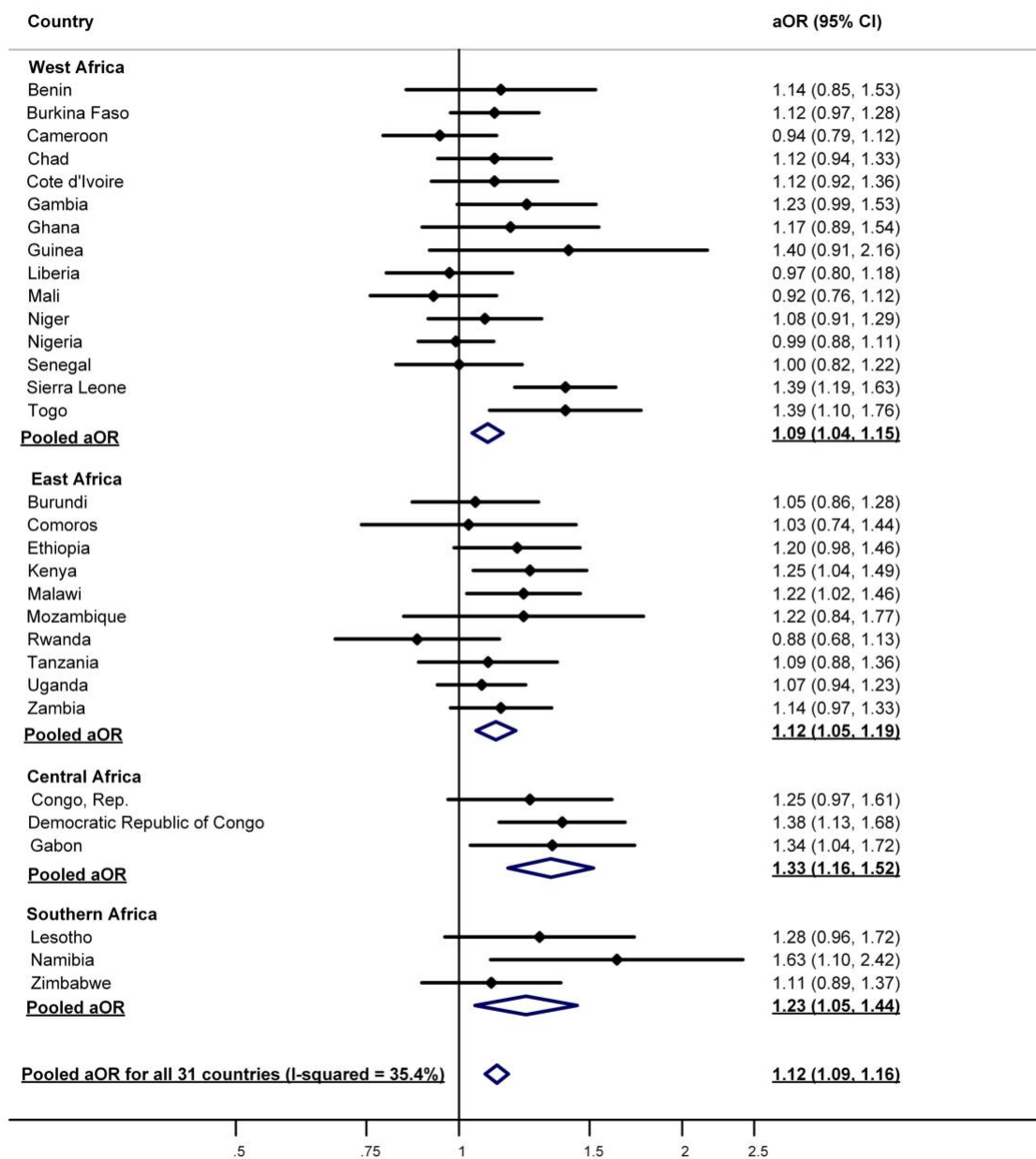
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

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



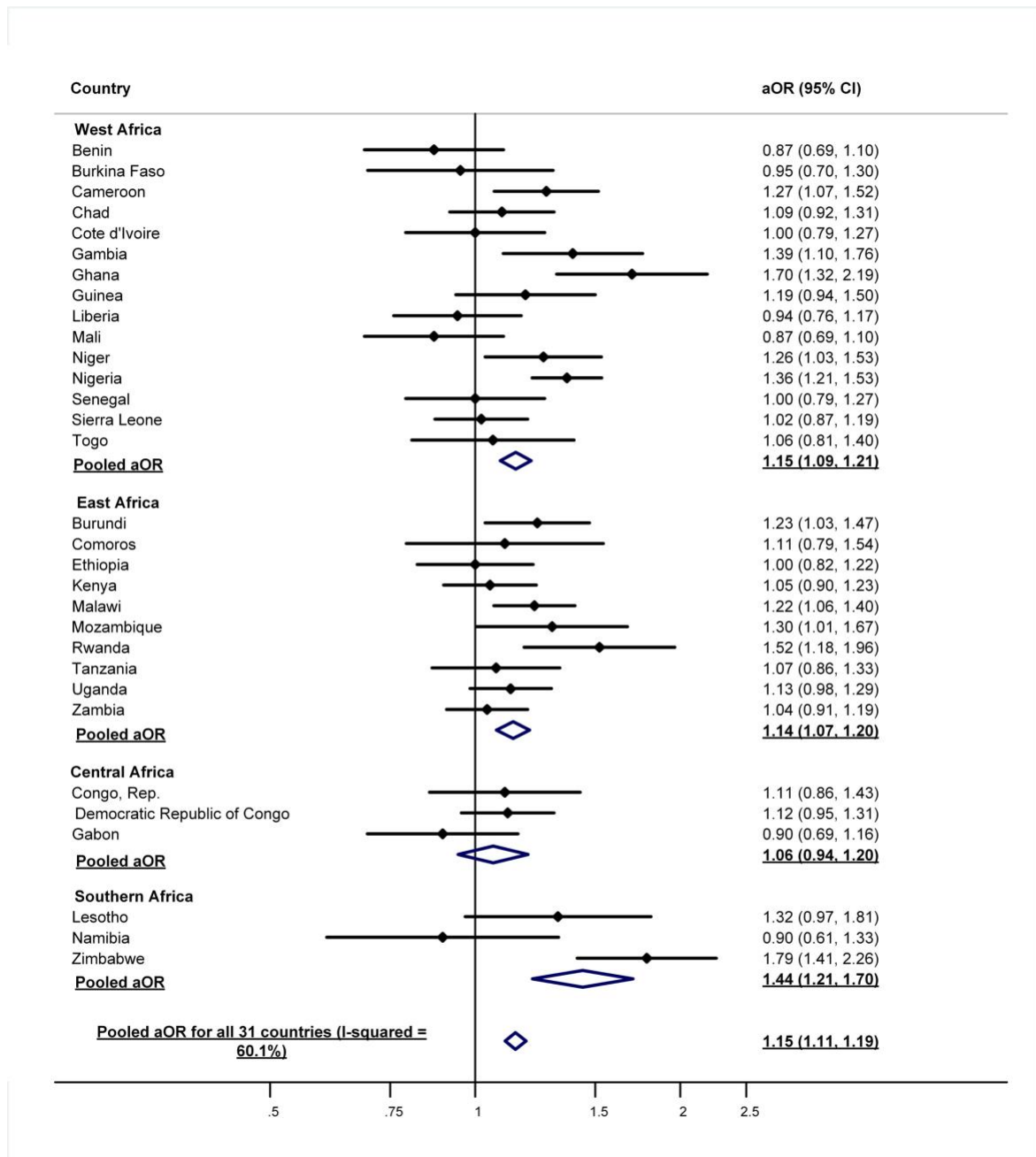
aOR = adjusted odd ratios for: place of residence, women age at married or cohabitation, education attainment, household wealth index, and working status

**Figure 4: The association between women autonomy in opposing sexual violence and utilisation of  $\geq 4$  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

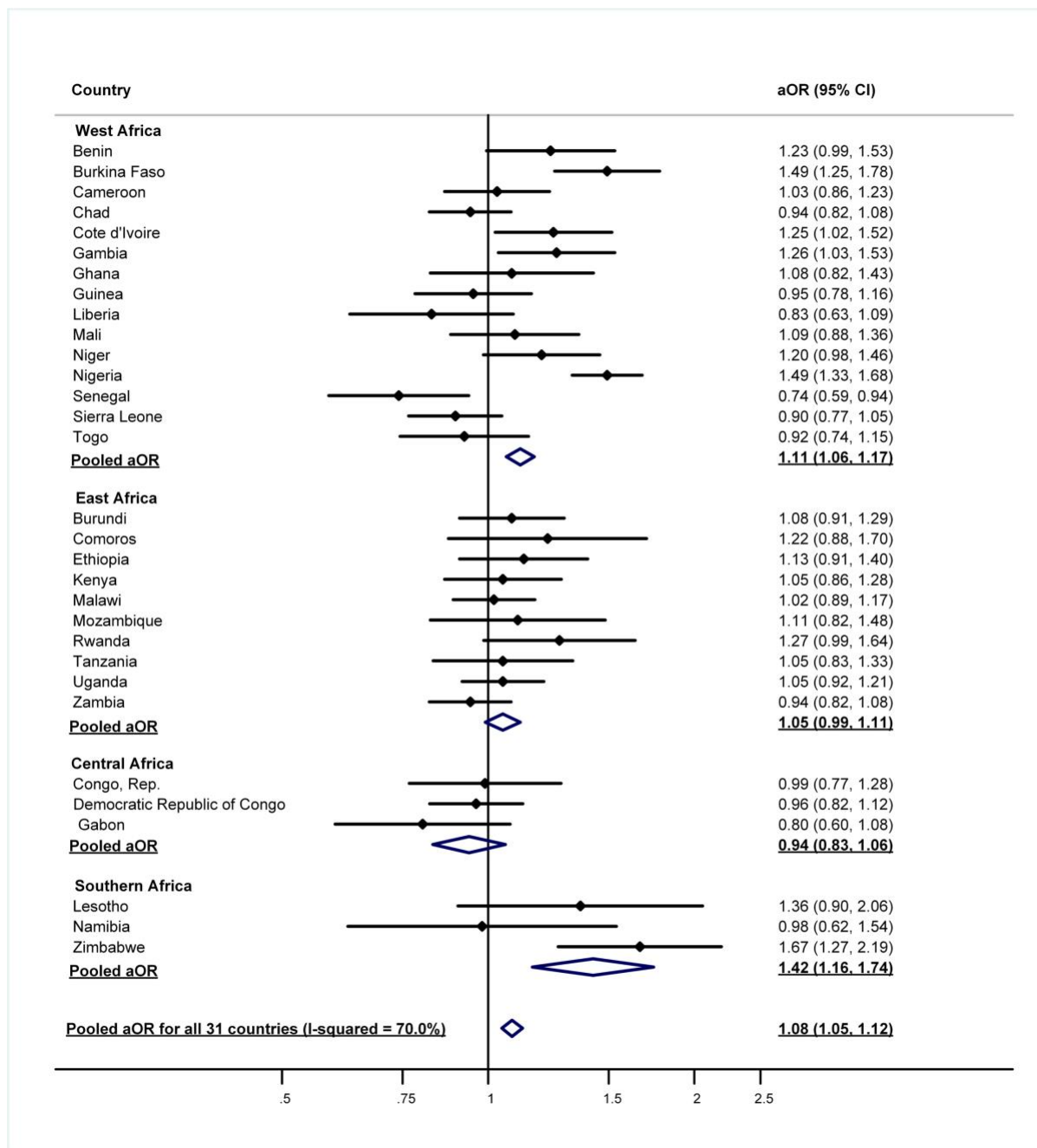
**Figure 5: The association between women autonomy (opposing domestic violence) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.**



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

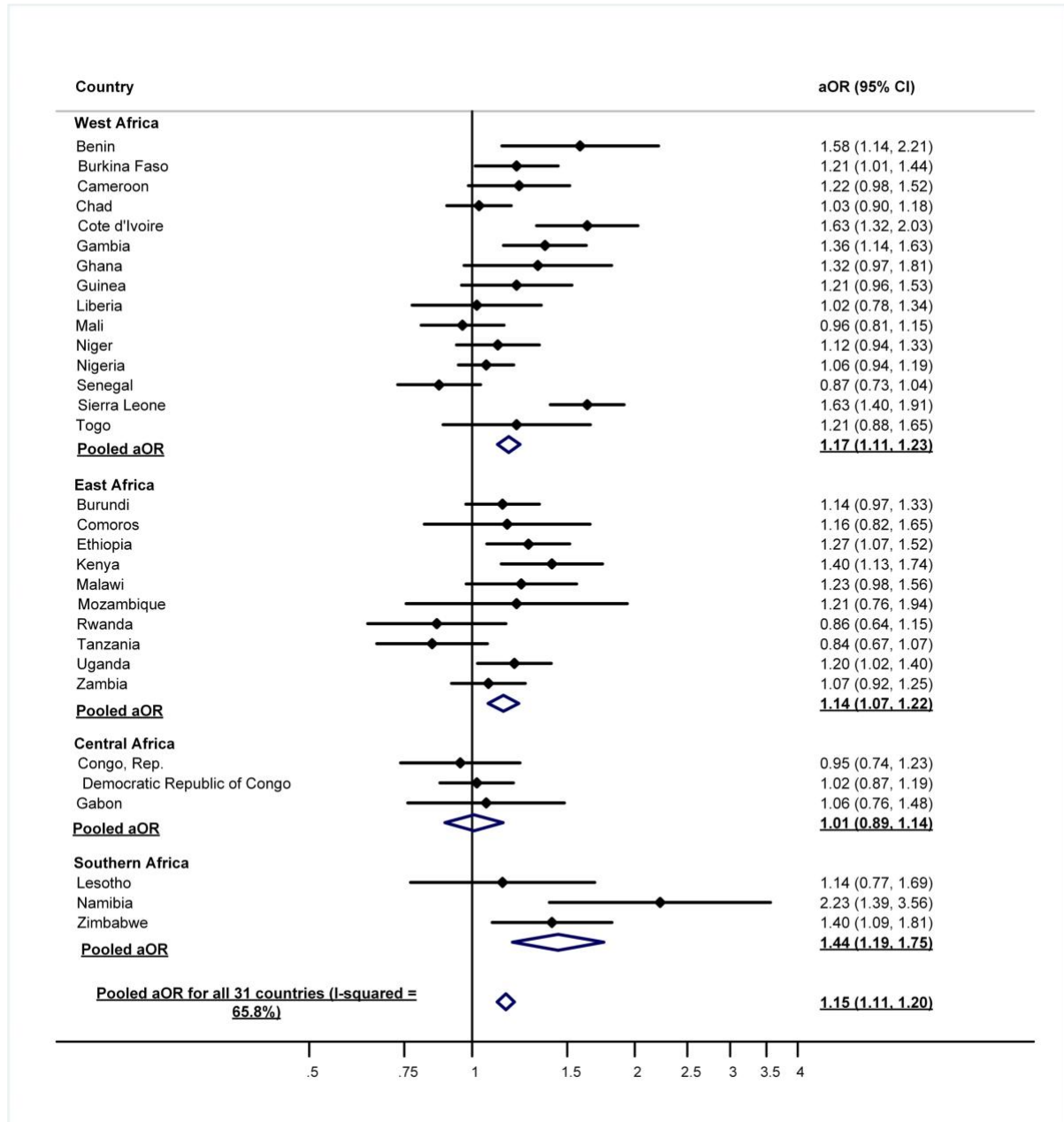
**Figure 6: The association between women autonomy (decisions making on spending of household income) and utilisation of SBAs in 31 sub-Saharan African countries, 2010-2016.**





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.
<b>Title and abstract</b>	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
<b>Introduction</b>			
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
<b>Methods</b>			
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
<b>Results</b>			
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, line 182
		(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
<b>Discussion</b>			
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	Page 17-18 lines 35-80
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 20, line 100-110
<b>Other information</b>			
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