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INTERNATIONAL JOURNAL of MATERNAL and CHILD HEALTH and AIDS ISSN 2161-864X (Online) ISSN 2161-8674 (Print) DOI: 10.21106/ijma.372

# ORIGINAL ARTICLE | HIV AND WOMEN EMPOWERMENT Women's Empowerment and HIV Testing Uptake: A Meta-analysis of Demographic and Health Surveys from 33 Sub-Saharan African Countries

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# ABSTRACT

**Background:** There is a growing body of evidence suggesting that women's empowerment can help achieve better health behaviours and outcomes. However, few have looked at the impact of women's empowerment on HIV testing in Sub-Saharan Africa (SSA). This study investigated the association between women's empowerment and HIV testing among women in 33 countries across SSA.

**Methods:** Cross-sectional data from the most recent Demographic and Health Surveys (2005-2018) of 33 countries in SSA were used. Confounder adjusted logistic regression analysis was completed separately for each of the 33 DHS datasets to produce the adjusted Odds Ratio (OR) for the association between women empowerment and HIV testing. The regression analysis strictly accounted for the three design elements (weight, cluster and strata) to produce an estimate representative of the respective countries. Finally, an Individual Participant Data (IPD) meta-analysis approach was used to statistically pool the effect of women empowerment on HIV testing.

**Results:** There was a wide variation in the percentage of women who were empowered among the countries studied, with only a few countries such as South Africa, Angola and Ghana having a high prevalence of negative attitudes toward wife beating. HIV testing was higher in Angola, Lesotho, Uganda and South Africa. While participation in one or two of the three decisions had been marginally associated with lower odds of HIV testing across the SSA regions (0.89; 95%CI: 0.83, 0.97); the corresponding prediction interval crossed the null. Being involved in the three decisions (0.92; 95%CI: 0.84, 1.00) and disagreement to wife-beating (0.99; 95%CI: 0.94, 1.05) had no statistical relationship with HIV testing uptake.

**Conclusion and Global Health Implications:** The two indirect indicators of women empowerment could not predict HIV testing uptake. Further studies are recommended to establish the nature of the relationship between HIV testing and women's empowerment that is measured through standard tools.

Key words: • HIV/AIDS prevention • Women • Empowerment • Gender equality • Global health • Sub-Saharan Africa

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## I. Introduction

## I.I. Background of the Study

Globally, an estimated 36.7 million people were living with HIV by the end of 2016, many of whom were women (51.6%).<sup>1,2</sup> According to the Joint United Nations Program on HIV/AIDS, one woman becomes infected with HIV every minute.<sup>3</sup> Differences in the number of new HIV infections between men and women are most pronounced in younger age groups; new infections were 44% higher in women aged 15-24 compared to men in the same age group.<sup>2,4</sup> HIV is the leading cause of death among women aged 30-49 and the third leading cause of death for women aged 15-29.<sup>5</sup>

Sub-Saharan Africa (SSA) accounts for 12% of the global population, yet 71% of the global burden of HIV infection is found within the region.<sup>6</sup> More specifically, 76% of the total people infected with HIV, 76% of the total new HIV infections, and 75% of the total HIV/AIDS related deaths recorded in 2015 occurred in SSA.<sup>1,2</sup> Young women bear a disproportionate burden of HIV infection. Of the 6.1 million people living with HIV in western and central Africa, 56% are women. In eastern and southern Africa, 19.4 million people are living with HIV and of those, 59% are women.<sup>1,2,6</sup> The number of new infections of HIV in SSA have decreased by 33% from an estimated 2.2 million in 2005 to an estimated 1.5 million in 2013.7 Despite this declining trend, HIV infections continue to pose a problem in the region.

The disproportionate impact of HIV infection on women can be attributable to biological, social, cultural, economic, and structural factors.<sup>8</sup> Within the Sub-Saharan region, women tend to play no part is sexual decision making as their needs and desires are not considered significant.<sup>9</sup> Women in the region are expected to respect the choices of their husband, even if this means accepting of polygamous relationships and cheating on the part of the husband.<sup>10</sup> Women who refuse sexual advances from their partners who reject the use of protection during sex may be subject to violence.<sup>9</sup> Those who are unable to negotiate for safer sex practices are more likely to be infected by their partner.<sup>11</sup> Late diagnosis of HIV and being unaware of one's HIV positive status has numerous negative impacts. Not knowing that one has HIV increases the likelihood that the virus will be transmitted to others.<sup>12</sup> Late diagnosis can also reduce an infected individual's lifespan through an increase in viral load and reduction of the body's CD4+ T-cell count.<sup>13</sup> Early diagnosis of HIV is essential in order for those infected with HIV to receive proper treatment and care, as well as limit the transmission of the infection to others.<sup>14</sup> Despite the host of negative outcomes that can be reduced with HIV testing, 80% of people from low- and middle-income countries have not been tested.<sup>15</sup>

For many women in Sub-Saharan Africa, fear of their partner's reaction is a major barrier to their uptake of HIV testing as some partners discourage testing and even require that women need their permission in order to get tested.<sup>16</sup> Literature has suggested that HIV prevention policies in SSA must consider women's lack of negotiating power and gender inequality as one of the root causes contributing to the spread of HIV in the region.<sup>17</sup> Several studies have identified the importance of women's empowerment to increase HIV testing and prevention.<sup>18,19</sup> The Sonagachi Project was a sustainable community intervention project in India that aimed to increase female sex workers' social power through increase economic opportunities, creation of a female sex worker's association and increased psychological empowerment and leadership.<sup>20</sup> This 12-year project saw an associated decrease in HIV/AIDS risk among female sex workers 20

### 1.2. Objective

There is a growing body of evidence suggesting that women's empowerment can help achieve better health outcomes. Achieving gender equality and empowering all women and girls are now recognized as powerful tools to enable accessibility to reproductive and sexual health care services for improved mother-andchild outcomes.<sup>21</sup> So far, few studies have attempted to show the influence of women's empowerment on HIV testing in Sub-Saharan Africa.<sup>18,22,23</sup> However, our study significantly extended and improved

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the existing body of evidence on the women's empowerment-HIV testing relationship. First, the two indicators of women's empowerment in this paper are created in accordance with the DHS guideline, making our findings largely comparable to other similar papers whose methodology is aligned well with the DHS statistics guideline. Second, the use of methodologically rigorous and statistically sound analysis approaches are crucial to produce findings that are of policy relevance. In this regard, the use of IPD meta-analysis allowed us to statistically estimate the nature of the relationship women's empowerment had with HIV testing in the context of SSA after first establishing the effect of women's empowerment on HIV testing in each country. Unlike most prior studies on this area, our selection of confounding variables has been sufficiently informed by epidemiological principles; that is, all variables in the model other than the two indicators of women empowerment are confounders that have a demonstrated association with both women's empowerment and HIV testing. This is important to get unbiased findings. Finally, given that there are only few studies on this increasingly important topic already, our findings are important to understand the role that women empowerment does play on the uptake of HIV testing for SSA women. To our knowledge, there is no meta-analysis study on this topic in the SSA region, yet findings that come from large sample sizes are important to accurately shed light on how women's empowerment affects HIV testing in the region.

# 2. Methods

# 2.1. Data Sources and Study Design

In the SSA, we were able to access 39 DHS datasets. For our study, the DHS datasets from 33 SSA countries were used: Angola (2015), Benin (2018), Burkina Faso (2010), Burundi (2017), Chad (2015), Comoros (2012), Congo (2012), DR Congo (2014), Cameroon (2010), Côte d'Ivoire (2012), Ethiopia (2016), Gabon (2012), Gambia (2013), Ghana (2014), Guinea (2018), Kenya (2014), Liberia (2013), Lesotho (2014), Madagascar (2008), Mali (2018), Mozambique (2011), Namibia (2013), Niger (2012), Rwanda (2015), Sao Tome et Principe (2009), Senegal (2017), Sierra Leone (2013), South Africa (2016), Swaziland (2005), Togo (2013), Uganda (2016), Zambia (2016), Zimbabwe (2015). The most recent datasets were selected for each country. Excluded datasets included Nigeria, Sudan, Malawi, Tanzania, and Central African Republic because these datasets did not contain either the response variable or predictor variables or both.

DHS is a nationally representative household survey conducted at regular time intervals to provide countries with updated information on different health topics such as maternal and child health, reproductive health, fertility, nutrition, mortality, and HIV/AIDS.<sup>24</sup> The United States Agency for International development (USAID) and each country's statistical agency conduct the survey with technical support from Inner City Fund (ICF) International. Methodology and methods for DHS are described in detail in the final DHS report of each country. Concisely, it follows a two-stage stratified cluster sampling design. Big geographic areas, the enumeration area (EA), are selected in the first stage through the Probability Proportional to Size (PPS) approach,<sup>24</sup> where a relatively larger EA is more likely to be selected than a smaller EA. In the second stage, a pre-calculated (28 to 30) number of households are selected from each EA. In the selected household, eligible participants (women aged 15 to 49 years and men 15 to 59 years) were interviewed about a wide range of topics using questionnaires that are comparable across countries. In Namibia DHS, data was collected for women aged between 15 to 64 years, and analyses was restricted to women age 15 to 49 years so that our analysis became similar in all DHS data included in this paper. For all 33 countries, the Individual Recode file (or women's recode file) was used to complete our analysis. To capture some useful information on health topics that would be of relevance in a particular country only, country specific questions were also included in the model questionnaire.

# 2.2. Study Variables

The independent variable for the study is women empowerment. Following the DHS data analysis guidelines,<sup>25</sup> women empowerment was measured using two indicators: decision making on three

specific topics and disagreement with five reasons justifying wife-beating. For the first indicator, surveyed women were asked to report on participation in decision making regarding own health care (person who usually makes decisions on health care for yourself?), large household purchases (person who usually makes decisions on making major household purchases?), and visits to family or relatives (person who usually makes decisions on visits to your family or relatives?). Each of these decisions was changed into a binary variable with a value of I and 0, where I indicated the woman participated in decision making on that particular decision alone, or jointly with her husband. Finally, a three-category variable was formed out of the three binary variables with values 0 (no empowerment), I-2 (moderate empowerment) and 3 (high empowerment). Prior evidence followed the same method of creating this variable.<sup>26</sup>

Women were asked if they agree that a husband is justified in beating his wife for the following reasons: a) burning food b) arguing with him c) going out without telling him d) neglecting the children and e) refusing to have sexual intercourse with him. If the woman disagreed to all of these reasons, they were assumed to be empowered. Therefore, an overall binary variable was created with a value of I and 0, where I indicated disagreement to all of the reasons, and 0 indicated she disagreed with only 4 or fewer reasons. These two indirect indicators of women's empowerment were treated as separate exposure variables of HIV testing, and were associated with HIV testing separately.

HIV testing in the past 12 months was our response or outcome variable. In our analysis, potential confounding factors in the model were accounted for to determine the relationship between women empowerment and HIV testing. The following variables were included as confounders: age in years (15-19, 20-29, 30-39, 40-49); education (none, primary, secondary, higher); wealth (poorest, poorer, middle, richer and richest); employment for cash (employment for cash vs. not); regular media exposure (exposed to one or more of the following media at least once a week: reading newspaper or magazine, listening radio, and watching TV vs. not); and residence (rural vs. urban). Our analysis was restricted to women who were currently married at the time of survey administration.

## 2.3. Statistical Analysis

First, confounder adjusted logistic regression analysis was completed separately for each of the 33 DHS datasets to produce an adjusted odds ratio (OR) for the women empowerment-HIV testing association. The regression analysis strictly accounted for the three design elements (weight, cluster and strata) to produce an estimate that was representative of the respective countries. Second, meta-analysis to statistically summarize the effect of women empowerment on HIV testing was carried out through the Individual Participant Data (IPD) approach.<sup>27</sup> The IPD meta-analysis has increasingly become an important alternative to the traditional Aggregate Data (AD) meta-analysis. This method of analysis offers researchers an important amount of control over the quality of the data to be analysed thereby boosting quality of evidence produced from the study. Meta-analysis using the IPD approach is unlikely to be affected by publication bias which is one of the most common limitations of AD meta-analysis.<sup>27</sup>

The country specific OR was pooled using a random effect model to enable generalization of findings to a setting the countries in the analysis represent. The random effect model was chosen over the fixed effect alternative because of dissimilarities between the 33 countries where many factors could affect the findings (i.e. culture). Furthermore, the random effect model allows researchers to assume that the true effect sizes (ORs in this study) vary randomly cross studies in the analysis. The inversevariance approach was used to estimate weights for each study that were later used to produce the summary effect size. Unlike in the fixed effect model, the random effect model takes the between-study variability into account in the estimation of weights for each individual study. The between-study variability was estimated through the non-iterative, non-parametric methods of moments (MoM) estimator of DerSimonian and Laird.<sup>28</sup> The effect of the country-level factors on the pooled effect estimates using sub-group analysis were investigated. The following country-level factors were considered: survey year, sample size, region and country's income category. Analysis was completed in STATA v 14. The *metan stata module* was used for the meta-analysis. The report of findings was organized based on the Preferred Reporting of Items for Systematic Review and Meta-analysis for Individual Participant Data (PRISMA-IPD) guidelines and PRISMA flow chart.<sup>29</sup>

## 2.4. Ethical Approval

Ethical permissions were not required for this study since DHS datasets are publicly available. Ethical procedures were the responsibility of the institutions that commissioned, funded, or managed the surveys.All DHS surveys are approved by ICF international as well as an Institutional Review Board (IRB) in the respective country to ensure that protocols are in compliance with the U.S. Department of Health and Human Services regulations for the protection of human subjects. The dataset were extracted from MEASURE DHS website at http://dhsprogram.com/data/available-datasets.cfm.

## 3. Results

# 3.1. Women's Empowerment and HIV Testing Distribution by Countries

Table I presents percentage of women who are empowered in the SSA countries according to the two measures of women's empowerment, and the proportion of women who tested for HIV. There was large variation in the number of women who were empowered across the countries studied. Among the studied countries, South Africa, Madagascar, Liberia, Lesotho, Angola, Namibia, Rwanda, Zimbabwe and Ethiopia had relatively higher percentage of women empowered in terms of participating in the three decision topics. The percentage of women who disagreed to all of the five wife-beating questions varied considerably from 0% in Chad to more than 94% in South Africa. We also showed huge between country disparity in terms of HIV testing, where the highest prevalence was in South Africa with nearly 76% and the lowest was in Senegal with nearly 32%. See table I for details.

# 3.2. Association of Women Empowerment and HIV Testing Uptake

The association between the two indicators of women's empowerment and HIV testing uptake in

each country, together with the pooled effect of women's empowerment on HIV testing in SSA is presented in Figures 1-3 and Table 2. The association of women's participation in decision making and their disagreement to wife-beating with HIV testing uptake was observed in 14 of the studied countries. Women empowerment was associated with higher odds of HIV testing in only five countries: Lesotho, South Africa, Niger, Namibia, and Sao Tome et Principe. In the remaining nine countries, there was a negative relationship between empowerment and HIV testing, where empowerment was associated with lower odds of testing for HIV. Most of the statistically significant associations were between decision making and HIV testing; attitude towards wife beating was associated with HIV testing in only six countries (See Figures 1-3).

In the meta-analysis, compared to women who responded *no* to all of the three questions pertaining to the three different decisions, women who stated that they participated in making one or two decisions had marginally lower odds of HIV testing (0.89; 95%Cl: 0.83, 0.97), though the prediction interval crossed the null (Figure 1). However, there was no statistically significant association between HIV testing and participation in all of the three decisions (0.92; 95%Cl:0.84, 1.00; Figure 2) and attitude towards wife beating (0.99; 95%Cl:0.94, 1.05; Figure 3).

Figure I shows the random-effects meta-analysis of the effect of having participated in one or two decisions related to women's own health, visiting family or relatives and large household purchases on HIV testing. Country specific estimates are presented on the left side, and the overall OR is presented at the bottom of the graph. The prediction interval for a future study is displayed for overall.

Figure 2 displays the effect of having participated in three decisions related to women's own health, visiting family or relatives and large household purchases on HIV testing. Country specific estimates are presented on the left side, and the overall OR is presented at the bottom of the graph. The prediction interval for a future study is displayed for overall.

Figure 3 highlights the effect of wife beating attitude on HIV testing. Country specific estimates

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Country	Decision making (1 or 2) %	Decision making (3) %	Wife beating attitude %	HIV testing %
Angola	28.1	65.4	71.4	71.6
Burkina Faso	40.0	31.8	60.3	58.0
Benin	36.5	36.3	65.4	46.9
Burundi	26.7	60.3	38.8	49.2
DR Congo	40.0	33.6	23.0	47.6
Côte d'Ivoire	34.1	23.7	48.5	47.6
Cameroon	46.7	23.8	51.0	43.6
Gabon	43.7	44.4	47.0	56.7
Ghana	31.7	61.6	70.0	39.4
Gambia	44.4	39.3	37.0	41.6
Guinea	32.5	30.4	28.0	60.0
Kenya	34.5	56.0	55.5	71.3
Comoros	30.5	34.9	57.0	43.5
Liberia	25.0	66.2	56.0	47.9
Lesotho	31.6	65.4	66.8	74.9
Madagascar	23.5	74.3	66.3	34.0
Mali	26.7	10.4	17.7	54.0
Mozambique	36.2	49.4	74.4	68.3
Niger	31.9	12.3	37.5	41.1
Namibia	19.2	75.3	67.9	68.0
Rwanda	27.8	65.7	60.0	52.7
Sierra Leone	23.5	45.8	29.6	39.8
Senegal	29.7	14.0	48.9	31.7
Swaziland	45.4	37.6	76.9	59.7
Chad	44.0	17.6	0.0	59.3
Togo	44.8	29.4	68.0	39.6
Uganda	35.6	51.0	50.7	73.2
Zimbabwe	24.6	72.0	61.7	70.7
Congo	52.0	28.5	38.0	45.3
Sao Tome et Principe	37.3	47.3	76.7	50.0
Ethiopia	19.0	70.6	33.0	57.5
Zambia	34.3	53.9	50.3	68.8
South Africa	9.9	87.5	94.4	75.7

Table 1: Summary of percentage of women empowerment and HIV testing uptake, by country

Decision making I or 2 refers to women who participated in one or two of the three decision topics, namely large household purchase, visit to family or relative and own health care alone or with her partner. Decision making 3 indicates women who participated alone or jointly with her partner on all of the three-decision topic mentioned above. Wifebeating attitude refers to the proportion of women who disagreed to all of the five" is wife-beating justified if " questions: (a) burning food, (b) arguing with him, (c) going out without telling him, (d) neglecting the children, and (e) refusing to have sexual intercourse with him.

are presented on the left side and the overall OR are presented at the bottom of the graph. The prediction interval for a future study is displayed for overall.

We further carried out sub-group meta-analysis to see whether the overall pooled estimate changes

by different groups (Table 2). We completed the sub-group analysis for survey year, sample size, geographical region and country's income. While geographical region and country's income data are standard and known classifications, the survey year

			%
Country	Year	OR (95% CI)	Weight
Angola	2015	0.67 (0.34, 1.30)	1.26
Benin	2018	0.81 (0.59, 1.11)	3.96
Burkinafaso	2010	1.07 (0.88, 1.29)	6.44
Burundi	2017	0.88 (0.74, 1.05)	6.85
COte d'Ivoire	2012	0.92 (0.69, 1.23)	4.40
Cameroon	2010	0.76 (0.55, 1.04)	3.92
Chad	2015	0.76 (0.37, 1.57)	1.11
Comoros	2012	1.09 (0.52, 2.33)	1.04
Congo	2014	1.26 (0.77, 2.05)	2.14
DR Congo	2014	1.09 (0.75, 1.58)	3.20
Ethiopia	2016	0.56 (0.31, 1.01)	1.57
Gabon	2012	1.09 (0.49, 2.42)	0.93
Gambia	2013	0.79 (0.48, 1.28)	2.13
Ghana	2014	0.63 (0.39, 0.99)	2.31
Guinea	2018	0.57 (0.39, 0.84)	3.07
Kenva	2014	0.62 (0.44, 0.86)	3.68
Lesotho	2014	2.55 (1.04, 6.26)	0.75
Liberia	2013	0.55 (0.31, 0.98)	1.64
Madagascar	2008	0.74 (0.13, 4.25)	0.21
Mali	2018	1.20 (0.86, 1.69)	3.64
Mozambique	2011	0.84 (0.47, 1.49)	1.64
Namibia	2013	1.16 (0.55, 2.41)	1.07
Niger	2012	0.92 (0.67, 1.26)	3.96
Rwanda	2015	0.81 (0.65, 1.00)	5.87
Sao Tome e Principe	2009	0.86 (0.45, 1.63)	1.36
Senegal	2017	0.96 (0.77, 1.18)	5.92
Sierraleone	2013	0.79 (0.63, 0.99)	5.63
South Africa	2016	1.82 (0.56, 5.86)	0.45
Swaziland	2005	0.63 (0.30, 1.33)	1.05
Τοαο	2013	0.91 (0.72, 1.16)	5.36
Uganda	2016	1.19 (0.99, 1.43)	6.63
Zambia	2014	1.02 (0.81, 1.29)	5.49
Zimbabwe	2015	1.01 (0.53, 1.96)	1.32
Overall (I-squared = 3	6.3%, p = 0.021)	0.89 (0.83, 0.97)	100.00
with estimated predicti	ve interval	. (0.68, 1.18)	
NOTE: Weights are fro	om random effects analysis		
	.1 1	10	
	lower odd of HIV testing higher odd of HIV testing		

Figure 1: Forest plot showing the effect of having participated in one or two decisions related to women's own health, visiting family or relatives and large household purchases on HIV testing

is the time of administration of the respective DHS and sample size was arbitrarily classified. A similar approach has been used in prior work.<sup>30</sup> In the series of subgroup analyses, we found no evidence of differentials in the pooled association group.

## 4. Discussion

This study investigated the influence of women empowerment on the uptake of HIV testing in the context of the sub-Saharan Africa (SSA) region. The absence of high-quality evidence on the topic was the motivation behind understanding whether women's empowerment consistently predicts higher odds of testing for HIV in SSA, by considering the substantial diversity of the region in terms of ethnicity, culture and religion.

In 58% of the countries included in the analysis, women empowerment had no statistically significant

O	No on			70
Country	Year		OR (95% CI)	Weight
Angola	2015	• · · · · · · · · · · · · · · · · · · ·	0.75 (0.38, 1.49)	1.47
Benin	2018		0.97 (0.71, 1.31)	4.22
Burkinafaso	2010		1.52 (1.17, 1.97)	4.85
Burundi	2017	-	0.85 (0.73, 1.00)	6.46
COte d'Ivoire	2012	•	0.87 (0.63, 1.19)	4.07
Cameroon	2010 —	•	0.73 (0.52, 1.04)	3.72
Chad	2015	- • · · · · · · · · · · · · · · · · · ·	0.79 (0.34, 1.79)	1.05
Comoros	2012 —	•	0.88 (0.40, 1.94)	1.15
Congo	2014		1.11 (0.66, 1.85)	2.26
DR Congo	2014 —	• · · ·	0.74 (0.50, 1.09)	3.26
Ethiopia	2016	•	1.01 (0.58, 1.77)	2.01
Gabon	2012		1.12 (0.49, 2.59)	1.05
Gambia	2013	•	0.91 (0.60, 1.38)	3.01
Ghana	2014		0.53 (0.35, 0.83)	2.88
Guinea	2018	•	0.89 (0.59, 1.37)	2.97
Kenya	2014	⊨=ar	0.64 (0.46, 0.90)	3.85
Lesotho	2014	• • • • • • • • • • • • • • • • • • •	3.02 (1.24, 7.34)	0.94
Liberia	2013 —	↓ ↓ ↓	0.71 (0.41, 1.21)	2.11
Madagascar	2008	•	0.89 (0.16, 4.83)	0.28
Mali	2018		1.19 (0.79, 1.76)	3.16
Mozambique	2011		0.67 (0.39, 1.11)	2.21
Namibia	2013		1.13 (0.55, 2.32)	1.35
Niger	2012 -		0.91 (0.59, 1.39)	2.90
Rwanda	2015	<b></b>	0.84 (0.68, 1.05)	5.51
Sao Tome e Principe	2009 —	• • · · · · · · · · · · · · · · · · · ·	0.86 (0.48, 1.55)	1.87
Senegal	2017	<b>_</b>	1.08 (0.85, 1.38)	5.12
Sierraleone	2013		0.73 (0.60, 0.87)	6.01
South Africa	2016		<b>-</b> 3.05 (1.00, 9.25)	0.62
Swaziland	2005		0.63 (0.31, 1.27)	1.39
Togo	2013		1 14 (0 89 1 47)	4 99
Uganda	2016		1.06 (0.89, 1.26)	6.20
Zambia	2014		0.91 (0.73, 1.14)	5.42
Zimbabwe	2015		1 09 (0 58 2 06)	1 65
Overall (I-squared = 4	7.6% p = 0.001)		0.92 (0.84 1.00)	100 00
with estimated predicti	ve interval	ř I	. (0.65, 1.30)	.00.00
NOTE: Weights are fro	om random effects analysis	1		
	I			
	.1	1	10	
	lower add of HIV teatin	a higher odd of UIV/ testing		

Figure 2: Forest plot showig the effect of having participated in three decisions related to women's own health, visiting family or relatives and large household purchases on HIV testing

relationship with HIV testing. In the remaining countries, there was an association between uptake of HIV test and indicators of women empowerment, with most associations being negative. Available studies link women's empowerment with uptake of HIV testing<sup>18,22,23</sup>. In those studies, empowerment of women has been measured through commonly used variables like wealth and education, preventing us

from making direct comparisons with our findings. However, little is known about the nature of the relationship between women's empowerment as measured by participation in decision making and attitude towards wife-beating and HIV testing. Although the primary aim of this study was to show the influence of women's empowerment on HIV testing in the SSA region as whole, our country

Angola       2015       0.68 (0.51, 0.93)       2.48         Benin       2018       1.21 (0.95, 1.53)       3.32         Burundi       2017       0.92 (0.82, 1.03)       5.96         COte d'Ivoire       2012       0.89 (0.72, 1.13)       3.53         Cameroon       2010       0.99 (0.72, 1.13)       3.53         Comoros       2012       0.99 (0.72, 1.13)       3.53         Comoros       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.80         Gabon       2012       0.98 (0.66, 1.17)       2.65         Ghana       2014       0.97 (0.78, 1.51)       2.05         Lesotho       2014       1.05 (0.83, 1.13)       4.98         Liberia       2013       0.97 (0.78, 0.57)       6.86 (0.66, 1.38)       1.47         Maii       2018       0.97 (0.78, 0.57)       6.08       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2013       0.97 (0.78, 0.97)	Country	Year			OR (95% CI)	% Weight
Angola 2015 Benin 2018 Burkinafaso 2010 Burkinafaso 2010 Cote d'Usivier 2017 Cote d'Usivier 2012 Cote d'Usivier 2012 Comoros 2012 Comoros 2012 Comoros 2014 Congo Congo 2014 Congo 2015 Congo 2013 Congo 2014 Congo 2014 Congo 2014 Congo 2014 Congo 2014 Congo 2014 Congo 2014 Congo 2014 Congo 2014	Annels	0045				0.40
bernin       2018       1.21 (0.93, 1.53)       3.52         Burkinafaso       2010       1.03 (0.86, 1.23)       5.96         COte d'Ivoire       2012       0.89 (0.72, 1.13)       3.53         Comoros       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.79         Ethiopia       2016       0.97 (0.74, 1.28)       2.79         Ethiopia       2013       0.86 (0.66, 1.17)       2.65         Gamana       2014       0.97 (0.74, 1.28)       2.79         Ethiopia       2013       0.88 (0.66, 1.17)       2.65         Gambia       2013       0.88 (0.66, 1.17)       2.65         Gambia       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.15 (0.81, 1.60)       2.66         Nadagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2015       0.82 <td>Angola</td> <td>2015</td> <td></td> <td></td> <td>0.68 (0.51, 0.93)</td> <td>2.48</td>	Angola	2015			0.68 (0.51, 0.93)	2.48
Burknamaso       2010       1.03 (0.86, 1.23) 4.43         Burknamaso       2017       0.89 (0.72, 1.13) 3.53         Comeroon       2010       0.99 (0.72, 1.13) 3.53         Comoros       2012       1.03 (0.84, 1.67) 1.21         Congo       2014       0.97 (0.74, 1.28) 2.80         DR Congo       2014       0.97 (0.74, 1.28) 2.80         Gabon       2012       0.88 (0.66, 1.17) 2.05         Gamibia       2013       0.88 (0.66, 1.17) 2.65         Ghana       2014       0.97 (0.83, 1.31) 3.59         Guinea       2014       1.15 (0.81, 1.64) 1.97         Liberia       2013       1.16 (0.85, 1.60) 2.31         Mai       2018       0.88 (0.56, 1.88) 1.34         Magagascar       2008       0.87 (0.78, 0.97) 6.08         Sao Tome e Principe       2009       0.87 (0.78, 0.97) 6.08         Sao Tome e Principe       2016       0.95 (0.84, 1.07) 5.78         Swaziland       2016       0.97 (0.79, 1.19) 3.91	Benin	2018			1.21 (0.95, 1.53)	3.32
Bullondi       2017       0.92 (0.52, 1.03)       5.96         Côte d'Ivoire       2012       0.98 (0.72, 1.13)       3.53         Cameroon       2010       0.99 (0.72, 1.13)       3.53         Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.80         Gabon       2012       1.00 (0.79, 1.27)       3.34         Gabon       2013       0.88 (0.66, 1.17)       2.65         Ganha       2014       0.97 (0.83, 1.31)       4.98         Lesotho       2014       1.05 (0.84, 1.31)       3.59         Guinea       2013       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.15 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2013       0.88 (0.56, 1.38)       1.34         Namibia       2013       0.81 (0.49, 0.31)       2.69         Namibia       2014       0.81 (0.49, 0.3	Burkinataso	2010			1.03 (0.86, 1.23)	4.43
Concervence       2012       0.99 (0.72, 1.13)       3.53         Cameroon       2010       0.99 (0.72, 1.13)       3.53         Comoros       2012       1.03 (0.64, 1.67)       1.21         Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       0.97 (0.74, 1.28)       2.79         Ethiopia       2016       1.07 (0.76, 1.51)       2.05         Gamoin       2012       0.88 (0.66, 1.17)       2.65         Ghana       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.57 (1.12, 2.20)       2.10         Niger       2012       1.57 (1.12, 2.20)       1.07         Sao Tome e Principe       2009       .88 (0.67,	Burundi	2017			0.92 (0.82, 1.03)	5.96
Cameroon 2010 Comoros 2012 Congo 2014 Congo 2014 Congo 2014 DR Congo 2014 DR Congo 2014 Cabon 2012 Gabon 2012 Gambia 2013 Gambia 2013 Guinea 2018 Kenya 2014 Liberia 2013 Madagascar 2008 Madagascar 2008 Madagascar 2008 Madagascar 2008 Maximbia 2013 Mozambia 2013 Mozambia 2013 Mozambia 2013 Mozambia 2013 Matagascar 2008 Marine 2014 Liberia 2013 Madagascar 2008 Marine 2013 Madagascar 2008 Marine 2014 Liberia 2013 Madagascar 2008 Marine 2013 Madagascar 2008 Marine 2013 Matagascar 2008 Marine 2013 Matagascar 2008 Marine 2013 Matagascar 2008 Marine 2013 Matagascar 2014 Liberia 2013 Matagascar 2008 Marine 2013 Marine 2013 Niger 2012 Marine 2013 Niger 2012 Marine 2015 South Africa 2016 Sub Africa 2016 Sub Africa 2016 Sub Africa 2016 Comore e Principe 2009 Sub Africa 2016 Comore 2013 Comore e Ar.1%, p = 0.002) With estimated predictive interval NOTE: Weights are from random effects analysis Mozembia 2015 Comore dd of HIV testima bigher odd of HIV testima	COte d'Ivoire	2012			0.89 (0.72, 1.13)	3.53
Comoros       2012       1.03 (0.64, 1.67)       1.21         Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2014       1.00 (0.79, 1.27)       3.34         Gabon       2012       1.07 (0.76, 1.51)       2.05         Gambia       2013       0.88 (0.66, 1.17)       2.65         Ghana       2014       1.05 (0.84, 1.31)       3.59         Guinea       2013       0.97 (0.78, 1.51)       2.05         Kenya       2014       1.05 (0.84, 1.31)       3.59         Liberia       2013       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2013       0.61 (0.46, 0.81)       2.69         Namibia       2015       0.87 (0.78, 0.77)       0.88 (0.67, 1.33)       3.77         Searcal       2016       0.81 (0.49, 1.35)       1.10       0.89 (0.77, 1.04)       5.07         Soar Tome e Principe       2009       1.61 (1.09, 2.37)       1.70       0.88 (0.56, 1.38)       3.34         Mozambiau       2015       0.87 (0.78, 1.33)       3.77       5.68       0.87 (0.78, 1.33)	Cameroon	2010			0.90 (0.72, 1.13)	3.53
Congo       2014       0.97 (0.74, 1.28)       2.80         DR Congo       2016       0.94 (0.71, 1.28)       2.79         Ethiopia       2016       1.00 (0.79, 1.27)       3.34         Gabon       2012       0.88 (0.66, 1.17)       2.65         Ghana       2014       0.88 (0.66, 1.17)       2.65         Ginea       2018       1.05 (0.84, 1.31)       3.59         Guinea       2014       0.97 (0.78, 1.97)       4.88         Lesotho       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       0.97 (0.83, 1.13)       4.98         Liberia       2013       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2013       0.61 (0.46, 0.81)       2.69         Namibia       2013       0.61 (0.46, 0.81)       2.69         Namibia       2013       0.61 (0.46, 0.81)       2.69         Namibia       2013       0.61 (0.46, 0.81)       2.69         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       0.89 (0.77, 1.04)       5.77         Subt Africa       2016       0.91 (0.	Comoros	2012			1.03 (0.64, 1.67)	1.21
DR Congo 2014 Ethiopia 2016 Gabon 2012 Gambia 2013 Gambia 2013 Gambia 2013 Guinea 2014 Lesotho 2014 Liberia 2013 Madagascar 2008 Namibia 2013 Madagascar 2008 Namibia 2013 Madagascar 2008 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Niger 2012 Niger 2012 Senegal 2017 Sierraleone 2013 Sierraleone 2013 Sierraleone 2013 Uganda 2016 Swaziland 2005 Swaziland 2005 Swaziland 2005 Corr 1, 10, 10, 20, 20, 10, 20, 20, 20, 20, 20, 20, 20, 20, 20, 2	Congo	2014			0.97 (0.74, 1.28)	2.80
Ethiopia 2016 Gabon 2012 Gabon 2012 Gambia 2013 Guinea 2014 Lesotho 2014 Lesotho 2014 Liberia 2013 Madagascar 2008 Mazambique 2011 Niger 2012 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2013 Namibia 2014 Liberia 2015 Sao Tome e Principe 2009 Sance Principe 2009 Sance 2017 Sierraleone 2013 South Africa 2016 Swaziland 2005 Togo 2013 Uganda 2016 Zambia 2014 Liberia 2016 Swaziland 2016 Swaziland 2016 Swaziland 2016 Swaziland 2016 Swaziland 2016 Caster Control of HIV testing bidfer odd of HIV testin	DR Congo	2014			0.94 (0.71, 1.23)	2.79
Gabon       2012       1.07 (0.76, 1.51)       2.05         Gambia       2013       0.88 (0.66, 1.17)       2.65         Guinea       2018       1.27 (0.89, 1.80)       1.98         Kenya       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2013       1.66 (0.86, 0.81)       2.69         Namibia       2013       1.61 (0.46, 0.81)       2.69         Namibia       2015       0.88 (0.66, 1.17)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.81 (0.49, 1.35)       1.11         Togo       2013       0.81 (0.49, 1.35)       1.10         Togo       2013       0.81 (0.49, 1.35)       1.10         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zimbabwe       2016       0.97 (0.79, 1.	Ethiopia	2016			1.00 (0.79, 1.27)	3.34
Gambia 2013 Ghana 2014 Guinea 2018 Kenya 2014 Lesotho 2014 Liberia 2013 Madagascar 2008 Marilia 2018 Maii 2018 Maximbia 2013 Namibia 2014 Composition 2.31 Composition	Gabon	2012			1.07 (0.76, 1.51)	2.05
Ghana       2014       1.05 (0.84, 1.31) 3.59         Guinea       2018       1.27 (0.89, 1.80) 1.98         Kenya       2014       0.97 (0.83, 1.13) 4.98         Lesotho       2014       1.15 (0.81, 1.64) 1.97         Liberia       2013       1.16 (0.85, 1.60) 2.31         Madagascar       2008       1.22 (0.79, 1.85) 1.47         Mali       2011       0.88 (0.56, 1.38) 1.34         Mozambique       2011       0.61 (0.46, 0.81) 2.69         Namibia       2012       1.34 (1.01, 1.78) 2.68         Rwanda       2015       0.87 (0.78, 0.97) 6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37) 1.70         Senegal       2017       1.08 (0.87, 1.33) 3.77         Sierraleone       2013       0.91 (0.74, 1.12) 3.86         Uganda       2016       0.95 (0.84, 1.07) 5.78         Zambia       2014       0.91 (0.74, 1.12) 3.86         Uganda       2014       0.91 (0.74, 1.12) 3.86         Virth estimated predictive interval       0.97 (0.79, 1.19) 3.91         NOTE: Weights are from random effects analysis       0.97 (0.79, 1.24)         NOTE: Weights are from random effects analysis       0.97 (0.79, 1.24)	Gambia	2013			0.88 (0.66, 1.17)	2.65
Guinea       2018       1.27 (0.89, 1.80)       1.98         Kenya       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2011       0.61 (0.46, 0.81)       2.69         Namibia       2013       1.57 (1.12, 2.20)       2.10         Niger       2017       1.34 (1.01, 1.78)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       0.91 (0.74, 1.12)       3.81         Uganda       2014       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       (0.79, 1.24)       (0.79, 1.24)         NOTE: Weights are from random effect	Ghana	2014			1.05 (0.84, 1.31)	3.59
Kenya       2014       0.97 (0.83, 1.13)       4.98         Lesotho       2014       1.15 (0.81, 1.64)       1.97         Liberia       2013       1.16 (0.85, 1.60)       2.31         Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2013       0.68 (0.56, 1.38)       1.34         Mozambique       2011       0.61 (0.46, 0.81)       2.69         Namibia       2013       1.57 (1.12, 2.20)       2.10         Niger       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       0.91 (0.74, 1.12)       3.86         Uganda       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00       . (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10       10	Guinea	2018	_ <del></del>		1.27 (0.89, 1.80)	1.98
Lesotho 2014 Liberia 2013 Madagascar 2008 Mali 2018 Mozambique 2011 Niger 2012 Rwanda 2015 Sao Tome e Principe 2009 Sao Tome e Principe 2009 Sao Tome e Principe 2009 Sao Tome e Principe 2017 Sierraleone 2013 South Africa 2016 Swaziland 2005 Swaziland 2015 Swaziland 2015 Swaziland 2016 Uganda 2016 Cyantia 2014 Line (L-squared = 47.1%, p = 0.002) with estimated predictive interval NOTE: Weights are from random effects analysis Lesotho 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	Kenya	2014			0.97 (0.83, 1.13)	4.98
Liberia 2013 Madagascar 2008 Maii 2018 Mozambique 2011 Namibia 2013 Niger 2012 Rwanda 2015 Sao Tome e Principe 2009 Sao Tome e Principe 2009 Sao Tome e Principe 2009 Sao Tome e Principe 2017 Sierraleone 2013 South Africa 2016 Swaziland 2005 Togo 2013 Uganda 2016 Swaziland 2015 Swaziland 2005 Togo 2013 Uganda 2016 Jat (1.1, 2, 2.20) 2.10 1.34 (1.01, 1.78) 2.68 0.87 (0.78, 0.97) 6.08 1.61 (1.09, 2.37) 1.70 0.89 (0.77, 1.04) 5.07 0.89 (0.77, 1.04) 5.07 0.89 (0.77, 1.04) 5.07 0.91 (0.74, 1.12) 3.86 Uganda 2016 Zambia 2014 Zimbabwe 2015 Overall (I-squared = 47.1%, p = 0.002) with estimated predictive interval NOTE: Weights are from random effects analysis Interval NOTE: Weights are from random effects analysis	Lesotho	2014			1.15 (0.81, 1.64)	1.97
Madagascar       2008       1.22 (0.79, 1.85)       1.47         Mali       2018       0.88 (0.56, 1.38)       1.34         Mozambique       2011       0.61 (0.46, 0.81)       2.69         Namibia       2013       1.57 (1.12, 2.20)       2.10         Niger       2012       1.34 (1.01, 1.78)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       .       .         NOTE: Weights are from	Liberia	2013	-++		1.16 (0.85, 1.60)	2.31
Mali       2018       0.88 (0.56, 1.38)       1.34         Mozambique       2011       0.61 (0.46, 0.81)       2.69         Namibia       2012       1.57 (1.12, 2.20)       2.10         Niger       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       . (0.79, 1.24)       . (0.79, 1.24)         NOTE: Weights are from random effects analysis       . (0.79, 1.24)       . (0.79, 1.24)	Madagascar	2008			1.22 (0.79, 1.85)	1.47
Mozambique       2011       0.61 (0.46, 0.81)       2.69         Namibia       2013       1.57 (1.12, 2.20)       2.10         Niger       2012       1.34 (1.01, 1.78)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00       . (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10       10	Mali	2018	•		0.88 (0.56, 1.38)	1.34
Namibia       2013       1.57 (1.12, 2.20)       2.10         Niger       2012       1.34 (1.01, 1.78)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00       . (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10       10	Mozambique	2011 -	• I		0.61 (0.46, 0.81)	2.69
Niger       2012       1.34 (1.01, 1.78)       2.68         Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00       . (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10       10	Namibia	2013			1.57 (1.12, 2.20)	2.10
Rwanda       2015       0.87 (0.78, 0.97)       6.08         Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.91 (0.74, 1.12)       3.86         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10	Niger	2012			1.34 (1.01, 1.78)	2.68
Sao Tome e Principe       2009       1.61 (1.09, 2.37)       1.70         Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10	Rwanda	2015	-		0.87 (0.78, 0.97)	6.08
Senegal       2017       1.08 (0.87, 1.33)       3.77         Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47, 1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       10       10	Sao Tome e Principe	2009	1	-	1.61 (1.09, 2.37)	1.70
Sierraleone       2013       0.89 (0.77, 1.04)       5.07         South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       (0.79, 1.24)	Senegal	2017			1.08 (0.87, 1.33)	3.77
South Africa       2016       1.41 (0.70, 2.83)       0.62         Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       1       10	Sierraleone	2013	-		0.89 (0.77, 1.04)	5.07
Swaziland       2005       0.81 (0.49, 1.35)       1.10         Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       10         Image: the sting       10	South Africa	2016		_	1.41 (0.70, 2.83)	0.62
Togo       2013       0.91 (0.74, 1.12)       3.86         Uganda       2016       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       (0.79, 1.24)         NOTE: Weights are from random effects analysis       1       10         Image: the stimated predictive interval interval       1       10	Swaziland	2005			0.81 (0.49, 1.35)	1.10
Uganda       2016       •••       0.95 (0.84, 1.07)       5.78         Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       ••       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       .       (0.79, 1.24)       .         NOTE: Weights are from random effects analysis       1       10         Image: state of the string       .       .       .         .1       1       10       .	Togo	2013			0.91 (0.74, 1.12)	3.86
Zambia       2014       1.11 (0.94, 1.29)       4.89         Zimbabwe       2015       0.97 (0.79, 1.19)       3.91         Overall (I-squared = 47.1%, p = 0.002)       0.99 (0.94, 1.05)       100.00         with estimated predictive interval       0.97 (0.79, 1.24)       10.00         NOTE: Weights are from random effects analysis       1       10         Image: state of the string       1       10	Uganda	2016			0.95 (0.84, 1.07)	5.78
Zimbabwe 2015 Overall (I-squared = 47.1%, p = 0.002) with estimated predictive interval NOTE: Weights are from random effects analysis I .1 .1 lower odd of HIV testing higher odd of HIV testing	Zambia	2014			1.11 (0.94, 1.29)	4.89
Overall (I-squared = 47.1%, p = 0.002)     0.99 (0.94, 1.05)     100.00       with estimated predictive interval     . (0.79, 1.24)       NOTE: Weights are from random effects analysis     I       I     1     10	Zimbabwe	2015			0.97 (0.79, 1.19)	3.91
with estimated predictive interval (0.79, 1.24) NOTE: Weights are from random effects analysis I .1 lower odd of HIV testing higher odd of HIV testing	Overall (I-squared = 4	7.1%, p = 0.002)	<b></b>		0.99 (0.94, 1.05)	100.00
NOTE: Weights are from random effects analysis I I I .1 1 1 10 I I I I I I I I I I I I I I I I I	with estimated predict	ve interval	I		. (0.79, 1.24)	
I I .1 1 10 Iower odd of HIV testing higher odd of HIV testing	NOTE: Weights are fro	om random effects analysis				
lower odd of HIV testing higher odd of HIV testing		1	1	1		
		lower odd of HIV te	sting higher o	dd of HIV testing		

Figure 3: Forest plot showing the effect of wife beating attitude on HIV testing

specific analysis showed that in some SSA countries, women's empowerment is associated with lower odds of HIV testing, which is at odds with available similar prior studies.<sup>18,31</sup> Similar to our findings however, attitude towards wife-beating had shown no effect on HIV testing when controlling for the effect of other empowerment variables<sup>18</sup>. That being said, whether the observed association is by chance, spurious or real deserves future context specific studies in the SSA region. The overall pooled estimate showed that being involved in one or two of the three areas of the decision-making indicator of women empowerment had odds of HIV testing that were slightly lower than one. However, the corresponding prediction interval included one, indicating HIV testing was not different between women who participate in one or two decisions and women who do not participate in any decisions. Furthermore, participation in all of the three decisions and disagreement with all of the five

	One o	r two decisio	suc		Th	ree decisions			Attitude 1	towards wife bea	ating	
	Overall OR (95% CI)	PI (95% CI)	*	12	Overall OR (9% CI)	PI OR (95% CI)	¥	<b>1</b> 2	Overall OR (95% CI)	PI OR (95% CI)	*	<b>1</b> 2
Survey year												
2015-2018	0.89 (0.77, 1.03)	0.60, 1.33	12	53.1*	0.96 (0.87,1.05)	0.82, 1.12	12	9.6	0.96 (0.89, 1.04)	0.78, 1.18	=	41.3
2012-2014	0.89 (0.79, 1.01)	0.65, 1.24	15	34.6	0.86 (0.75, 0.99)	0.57, 1.30	15	47*	1.02 (0.95, 1.10)	0.85, 1.22	15	28.7
2005 - 2011	0.94 (0.81,1.09)	0.76, 1.16	9	0	0.87 (0.59,1.28)	0.27, 2.85	9	70.9*	0.97(0.76, 1.23)	0.45, 2.10	9	74*
Income category									1			
Low income	0.89 (0.81,0.99)	0.66,1.21	8	42.7*	0.94 (0.84, 1.05)	0.67, 1.31	18	48.2*	0.96 (0.90, 1.03)	0.78, 1.19	17	45.9*
Lower-middle	0.88 (0.75,1.02)	0.59, 1.30	12	40.3	0.85 (0.71, 1.01)	0.52, 1.38	13	49.6*	1.00 (0.91, 1.09)	0.78, 1.27	12	38.3
Upper-middle	1.23 (0.75,2.01)	0.05, 29.83	S		I.4 (0.80, 2.43)	0.01,131.5	3	19.6	1.31 (1.01, 1.71)	0.15, 11.4	3	19.4
Sample size												
1754-6453	0.90 (0.76, 1.07)	0.64, 1.27	, I2	61	0.96 (0.76, 1.22)	0.49, 1.90	12	52.6*	1.07 (0.96, 1.19)	0.81, 1.41	12	
6750-9824	0.86 (0.77,0.97)	0.65, 1.15	`12	32.4	0.87 (0.80, 0.95)	0.79, 0.97	12	0	0.93 (0.84, 1.03)	0.68, 1.29	13	62.2*
10754-11903	0.94 (0.78,1.13)	0.53, 1.67	S	56.8	0.94 (0.78, 1.14)	0.52, 1.71	5	60.9*	1.01 (0.90, 1.13)	0.74, 1.37	5	39.9
12448-19036	0.89 (0.66,1.20)	0.26,2.99	4	65*	0.89 (0.54, 1.46)	0.1,8.22	4	84.5*	0.99 (0.89, 1.10)	0.49, 1.98	3	0
Region												
South-central Africa	0.67 (0.34,1.30)	NA	-	NA	0.75 (0.38, 1.49)	NA	_	NA	0.68 (0.50, 0.92)	NA	_	NA
West Africa	0.86 (0.77,0.96)	0.65, 1.15	12	39	0.93 (0.79, 1.08)	0.55, 1.56	13	<b>*99</b>	1.01 (0.94, 1.09)	0.85, 1.20	13	25.1
East Africa	0.85 (0.69, 1.05)	0.47, 1.53	7	65.4*	0.88 (0.77, 1.00)	0.66, 1.17	7	28.5	0.93 (0.88, 0.99)	0.86. 1.00	7	0
Equatorial Africa	1.09 (0.78, 1.53)	NA	S	0	0.80 (0.56, 1.13)	NA	з	0	0.98 (0.83, 1.16)	0.33, 2.93	3	0
Southern Africa	1.09 (0.82, 1.45)	0.58, 2.06	9	23.6	0.19 (0.79, 1.79)	0.37, 3.87	9	59.4*	0.12 (0.96, 1.30)	0.77, 1.61	9	34.8
South east Africa	0.84 (0.47, 1.50)	NA	-	NA	0.67 (0.40, 1.13)	NA	_	NA	0.61 (0.46, 0.81)	NA	_	NA
Central Africa	0.81 (0.50, 1.32)	NA	2	0	0.84 (0.52, 1.35)	NA	2	NA	0.61(1.09, 2.37)	NA	_	NA
NA=Not Available; PI=Predi decision topics, namely large topic mentioned above. Wife (d) neglecting the children, at	ctive interval which is ine household purchase, visit- beating attitude refers to nd (e) refusing to have sex	estimable for < 3 str t to family or relati the proportion of w xual intercourse wit	udies; J <sup>2</sup> i ve and ov vomen wl th him	s * indicate vn health c: 10 disagree	s significance at p-value - are alone or with her partu d to all of the five " is wif	<ul> <li>&lt; 0.05; k= number of si ner. Three decisions ind îe-beating justified if "</li> </ul>	tudies. C licates w question	ne or two d omen who ] s: (a) burnii	ecisions refers to women w participated alone or jointly ag food, (b) arguing with hi	ho participated in one or with her partner on all c m, (c) going out without	two of t f the thr telling h	he three se decision im,

Table 2: Results of subgroup analyses

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questions regarding reasons justifying wife beating had no statistical association. The prediction intervals, which included one, supported this conclusion, indicating that ORs of any future studies will fall in the intervals that crossed the null value. Our subgroup analyses similarly confirmed the absence of any association between women's empowerment and HIV testing uptake. This showed that though the women's empowerment-HIV testing relationship was tested in smaller groups, we still observed the same conclusion that no statistical association was observed between them. Apart from few country specific prior studies mentioned above, lack of meta-analysis studies on the women's empowerment and HIV testing relationship in the SSA region prevents us from discussing our findings within the context of available literature. Additional studies are recommended to further examine whether participation of women in different health and household related decisions alone or jointly with their partner, and disapproval with all the five questions justifying wife beating, are related with the odds of HIV test uptake. Especially important are studies which are meant to develop standard tools to measure women's empowerment accurately in community-based surveys. While decision making power on certain matters and attitudinal change towards wife beating are elements that could reflect women's empowerment, the concept of women empowerment may also include issues of socioeconomic status (i.e. employment, education). A tool that can effectively measure women empowerment is one that is comprehensive and includes all relevant elements. In the absence of such a standard measurement tool, it is difficult to properly evaluate the extent of contribution women empowerment has on HIV test uptake. Prior studies revealed that these two indicators of women empowerment are positively related with HIV testing.<sup>26</sup> However, comparison of findings from this study is greatly hampered by the absence of similar pooled studies on the women empowerment-HIV testing relationship.

### 4.1. Limitations

The study has a few strengths. The adoption of the IPD meta-analysis approach in this study elevated the quality of evidence as it allowed similar analysis

strategies in each of the individual countries, which substantially reduced between-study variations in the effect size measured. The approach also allowed sufficient control over the data, something that the traditional meta-analysis technique does not.

# 5. Conclusion and Global Health Implications

The study showed that women empowerment, as proxied by the two indicators, could not be a predictor of HIV testing uptake in the Sub-Saharan African region. Before concluding on the lack of predictive power of women empowerment on the uptake of testing for HIV in the region, further studies are required to produce concrete evidence on the issue. The meta-analysis revealed that future studies on the women empowerment-HIV testing association could produce results that may not be statistically significant. Qualitative studies are recommended to better understand this important issue.

## **Compliance with Ethical Standards**

Conflicts of There Interest: are no conflicts of interest disclose regarding to this study. Financial Disclosure: None. Funding/Support: None. Ethics Approval: Ethics approval was not required since the data is available to the public domain. Acknowledgements: We acknowledge the MEASURE DHS for making the dataset available to the public domain for free.

## **Key Messages**

- There was a wide variation in the percentage of women who were empowered among the countries studied, with only a few countries like South Africa, Angola and Ghana having high prevalence of negative attitudes toward wife-beating.
- Women's participation in decision making and ability to oppose husband's wife-beating behaviours were not necessarily associated with higher odds of HIV testing uptake.
- Future studies are needed to establish the nature of the relationship between HIV testing and women's empowerment that can be measured through standard tools.

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