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To cite this article: Bola Lukman Solanke PhD, Emmanuel O. Amoo PhD & Adenike Esther Idowu PhD (2017): Improving postnatal checkups for mothers in West Africa: A multilevel analysis, Women & Health, DOI: [10.1080/03630242.2017.1292343](https://doi.org/10.1080/03630242.2017.1292343)

To link to this article: <http://dx.doi.org/10.1080/03630242.2017.1292343>



Accepted author version posted online: 07 Feb 2017.  
Published online: 07 Feb 2017.



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## Improving postnatal checkups for mothers in West Africa: A multilevel analysis

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### ABSTRACT

This study examined multilevel factors related to postnatal checkups for mothers in selected West African countries. The study analyzed data from Demographic and Health Surveys (DHS) for five West African countries: Sierra Leone (2013), Cote d'Ivoire (2012), Guinea (2012), Niger (2012), and Liberia (2013). The weighted sample sizes were 2125 (Cote d'Ivoire), 2908 (Guinea), 1905 (Liberia), 5660 (Niger), and 3754 (Sierra Leone). The outcome variable was maternal postnatal checkups. The explanatory variables were community and individual/household characteristics. With the use of Stata 12, the chi-square statistic and multilevel mixed-effects logistic regression were applied. More than two-thirds of respondents in Guinea and Niger did not receive a postnatal checkup after their last birth, while in Cote d'Ivoire, Liberia, and Sierra Leone, more than half of respondents received a postnatal checkup after their last childbirth. Community characteristics accounted for the following variations in postnatal checkups: 33.9% (Cote d'Ivoire), 37.2% (Guinea), 27.0% (Liberia), 33.5% (Niger), and 37.2% (Sierra Leone). Community factors thus had important relations to use of postnatal care in West Africa. Interventions targeting more community variables, particularly community education and poverty, may further improve postnatal care in West Africa.

### ARTICLE HISTORY

Received 14 July 2016  
Revised 12 December 2016  
Accepted 16 January 2017

### KEYWORDS

Checkup; childbirth;  
maternal health; multilevel;  
postnatal; West Africa

## Introduction

Globally, maternal mortality declined by 45% between 1990 and 2013, but remains a public health issue in sub-Saharan Africa (World Health Organization [WHO] 2014). In most of the sub-Sahara African countries, the causes of maternal mortality are preventable direct obstetric complications, which remain dominant causes of maternal deaths due to weak health delivery systems and low use of available maternal health services (Adjiwanou and LeGrand 2014). Research evidence over the years has

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indicated that money for treatment, lack of male partner's involvement, lack of education, place of residence, women's autonomy, and poverty are some of the factors that have been associated with low use of maternal health services in sub-Saharan Africa (Akunga, Menya, and Kabue 2014; Obiyan and Kumar 2015; Woldemicael 2010). Contemporary research aiming to improve understanding of factors related to use of maternal health services has increasingly adopted multi-level approaches due to the increasing recognition that both individual and community characteristics are related to use of maternal health services in different social contexts.

In a multicountry study (Magadi, Agwanda, and Obare 2007), the individual characteristic of maternal age was the most important factor related to use of services, contrary to findings in another multicountry study that community factors, such as female autonomy and fertility norms, were more strongly related to the use of maternal health services than individual characteristics (Stephenson et al. 2006). This finding was buttressed by similar findings from a number of studies conducted across developing countries (Aremu, Lawoko, and Dalal 2011; Babalola 2014; Babalola and Fatusi 2009; Gage 2007; Kruk et al. 2010; López-Cevallos and Chi 2009; Sepehri et al. 2008). Findings in an Indian study (Jat, Ng, and Sebastin 2011), however, contrasted with earlier evidence that household factors, namely household socioeconomic status, were more strongly associated with use of maternal health services than community factors. More recent multilevel studies have reinforced the important role that community factors, such as poverty concentration, community type, family size norm, and distance to facility, play in use of maternal health services across developing countries (Babalola 2014; Mekonnen et al. 2015; Ononokpono and Odimegwu 2014; Ononokpono et al. 2013; Sagna and Sunil 2012; Speizer, Story, and Singh 2014).

However, in spite of numerous multilevel studies exploring factors related to use of maternal health services, we observed three gaps. First, fewer multicountry studies have been conducted compared with studies that have focused on individual countries. Second, most of the existing multicountry studies have not analyzed postnatal checkups for mothers, particularly among women who had home deliveries. Virtually, all of these studies focused on antenatal care, place of delivery, and assistance during delivery (Adjiwanou and LeGrand 2014; Magadi, Agwanda, and Obare 2007; Stephenson et al. 2006). Third, postnatal checkups have been mostly analyzed in single-country studies (Assaf and Winter 2015; Ononokpono and Odimegwu 2014; Rai, Singh, and Singh 2012; Worku, Yalew, and Afework 2013). The present study attempted to fill these gaps by exploring multilevel factors related to postnatal checkups for mothers in five West African countries, namely Sierra Leone, Cote d'Ivoire, Guinea, Liberia, and Niger.

West Africa was selected for the study because within sub-Saharan Africa, maternal mortality is highest in this region.

The five countries were selected for analysis because they have the highest levels of maternal mortality ratios (MMRs) in West Africa, with MMRs of 1100 in Sierra Leone, 720 in Cote d'Ivoire, 650 in Guinea, 640 in Liberia, and 630 in Niger per 100,000 live births (WHO 2014). All of the selected countries are low-income countries, but various efforts to improve maternal health care have been implemented in these countries, including free essential obstetrical care (Assaf and Winter 2015; Global Health Check 2012; Greenwell and Winner 2014; Lee et al. 2011; Ouattara, HOUNGbedji, and Koudou 2013), that are now yielding marginal results. Further improvement could be attained if interventions consolidated identified individual risk factors and targeted more factors at the community level. The objective of the study was thus to examine the multilevel factors related to postnatal checkups for mothers with home deliveries in the selected countries.

It is important to analyze postnatal checkups for mothers because research evidence has indicated that substantial complications occur shortly after birth. Maternal and neonatal deaths are also highest shortly after birth (WHO & United Nations Children and Education Fund [UNICEF] 2013). Postnatal checkups for mothers provide an additional opportunity for nursing mothers to receive appropriate education for handling maternal and newborn health challenges and complications in the postpartum period. Nevertheless, poor health delivery systems in many developing countries undermine coverage of postnatal care, but in recognition of the poor health delivery systems in many developing countries, the WHO recommended implementation of home visitation programs to boost postnatal care for mothers and newborns (WHO 2009). Though, some countries, such as Rwanda, Nigeria, Nepal, Malawi, and Bangladesh, have adopted the home visit approach, many countries in West Africa, including the countries studied in this project, have yet to adopt the WHO/UNICEF recommended home visits as a national policy and strategy (Maternal and Child Health Integrated Programme [MCHIP] and Save the Children 2014).

## Methods

### *Data source and sample design*

This study analyzed secondary data extracted from Demographic and Health Surveys (DHS) for five West African countries, namely Sierra Leone, Cote d'Ivoire, Guinea, Niger, and Liberia. The authorization to analyze the datasets was obtained from MEASURE/DHS. . The surveys in Cote d'Ivoire, Guinea, and Niger were conducted in 2012, while the surveys in Liberia and Sierra Leone were conducted in 2013. The survey samples are nationally

representative with similar questionnaires and survey methodology used in the selected countries. Selections of samples in the surveys were based on a two-staged sampling procedure. The first stage involved selection of the primary sampling units (clusters); the second stage involved the selection of households through systematic random sampling (ICF International 2012). Eligible men aged 15–59 years and women aged 15–49 years were either permanent residents or visitors to the household the night preceding the survey. Participation rates were very high in the DHS. For instance, the response rate for women was 98% in Liberia and 97% in Sierra Leone. All interviews were conducted after obtaining informed consent from the respondents. Detailed descriptions of the sample design for each survey have been published elsewhere (ICF International 2012; Liberia Institute of Statistics and Geo-Information Services (LISGIS) et al 2014; Statistics Sierra Leone [SSL] & ICF International 2014; Institut National de la Statistique and ICF International 2013; Institut National de la Statistique and ICF International 2012; Institut National de la Statistique, UNICEF and ICF International 2012). All the survey data were weighted by cluster size.

The total population of women covered in each survey was not analyzed. Women who did not have a child in the last 5 years preceding the survey were excluded from analysis because they had no response to childbirth or postnatal care issues, and women whose last live birth occurred in a health facility were not included because they probably received postnatal checkups after delivery in the health facility. This exclusion reflected the approach of DHS Statistics (Rutstein and Rojas 2006). The weighted sample sizes were 2125 (Cote d'Ivoire), 2908 (Guinea), 1905 (Liberia), 5660 (Niger), and 3754 (Sierra Leone).

## **Variables**

The outcome variable in this study was postnatal checkups for mothers. This was generated from information on the respondents' checkup after delivery of the last birth in the 5 years preceding the survey. The responses to this variable were divided into two categories: "received postnatal checkup," which was given the value of "1" when the postnatal checkup was received within 48 hours of delivery or conducted by a skilled health provider; and "did not receive postnatal checkup," which was given the value of "0" when the postnatal checkup was not received at all, received after 48 hours of delivery, or not received from a skilled health provider. Skilled health provider was defined as doctor, nurse, midwife, and auxiliary nurse/midwife.

The explanatory variables were divided into two sets. The community variables were community education level of women, community poverty level, community median size of households, community type (rural or urban), and community perception of distance to health facility. With the

exception of community type, other community variables were generated from individual variables through aggregation. To generate a community variable, a cutoff point was first determined (for instance attained minimum of secondary education), after which individuals meeting the cutoff point for the variable were aggregated and sorted by cluster (primary sampling unit used in the DHS surveys). The variable was then divided into two or three groups to indicate whether the proportions were low or high or low, moderate or high in the community. Community education level of women and community poverty level were divided into three categories, while community median size of households and community perception of distance to health facility were divided into two categories. Community education measured the proportion of women in the community who had secondary education. Community poverty level measured the proportion of women who were in the poorest or poor groups. Community median size of households measured proportions of households with family size of more than six members. Community perception of distance to health facility measured the proportion of women who perceived distance to a health facility as not a big problem for using health care. To include or retain variables in the multilevel model, the study was guided by the literature on the association of each variable with use of maternal health-care services (Babalola 2014; Mekonnen et al. 2015; Ononokpono and Odimegwu 2014; Ononokpono et al. 2014; Adjiwanou and LeGrand 2014; Sagna and Sunil 2012; Stephenson et al. 2006).

Additionally, individual and household characteristics were included, specifically women's education level, women's employment status, maternal age, number of children ever born to the woman, access to mass media, women's autonomy, partner's education level, household wealth, number of antenatal care visits, and type of marriage. Data on access to mass media were generated from the combination of the frequencies of women reporting reading the newspaper, listening to radio, and watching television. Women who had no access to any of the media outlets were grouped as "no" access, while those who used any of the outlets once per week were grouped as "low" access. Others who used all the outlets more than once per week were grouped as "moderate" access. Maternal age was regrouped into three categories: teenager (15–19 years), young adult (20–24 years), and adult (25 years or older). Women's autonomy was generated from three variables, namely decision-making concerning her own health, purchase of large household items, and visits to friends and relatives. Each variable was first categorized to indicate whether the woman participated solely/jointly with her male partner or did not participate in the decision, after which a composite variable was created to measure women's level of autonomy. Women who participated solely/jointly with male partner in at least one of the decisions were grouped as "high" autonomy, while those who did not participate in any of the decisions were grouped as "low" autonomy. Antenatal care visits were

categorized as follows: no antenatal visit, one to three visits, and four or more visits. These categories were based on the WHO recommendation that all pregnant women should have at least four antenatal visits before delivery (WHO & UNICEF 2013). Type of marriage was categorized into monogamy and polygamy, with the number of other wives of the male partner as the basis for the categories. These variables have been associated with use of maternal health services in previous studies (Babalola 2014; De Allegri, Ridde, Louis, Sarker, Tiendrebéogo, Yé, et al 2011).

### **Statistical analysis**

We used Stata 12 to perform statistical analyses across three levels. At the univariate level, we used frequency distributions to describe the individual/household and community characteristics of respondents. At the bivariate level, we used the chi-square statistic to examine the relationship between the explanatory and outcome variables. Statistical significance was set at 5%. At the multivariate level, we applied the multilevel mixed-effects logistic regression to examine the relation of factors at the two levels to the outcome variable. The justification for use of this technique was the need to account for clustering in the sample design. A two-level model was specified as follows:

$$y_{ij} = \beta_0 X_{0ij} + \beta_1 X_{1ij} + U_j X_{0ij} + \varepsilon_{ij}$$

where

$y_{ij}$  was postnatal checkup of the  $i$ th woman in the  $j$ th community

$\beta_0, \beta_1$  were the fixed effects

$U_j, \varepsilon_{ij}$  were the random effects

Two models were fitted using the Stata *xtmelogit* command (StataCorp 2011). In performing mixed-effects logistic regression, an empty model is usually first fitted to show the magnitude of variation in the outcome variable without the covariates. Other models with the inclusion of the explanatory variables are then fitted. Model 1 was fitted based on the individual/household characteristics. Model 2 was fitted based on both individual/household and community variables. We used the variance inflation factor (VIF) to examine collinearity of variables. Across the countries, mean VIFs confirmed the absence of substantial collinearity (the largest VIF was less than 30). The study measured the fixed effects using logistic regression to compute odds ratios and measured random effects using intraclass correlation (ICC) (Merlo et al. 2016). The ICC shows the variation in postnatal checkups for mothers due to community characteristics. The higher the ICC, the more relevant were the community characteristics for understanding individual variation in postnatal checkups for mothers. The ICC was calculated as follows:

$\frac{\sigma_{ui}^2}{\sigma_{ui}^2 + [\frac{n-2}{3}]}$  where  $\sigma_{ui}^2$  was the variance at the community level (Merlo et al. 2016). We, however, expressed the ICC as a percentage. Diagnostic checking on the fitted models was performed using the log-likelihood test and the Akaike's information criterion (AIC) obtained by the Stata *estat ic* command (StataCorp 2011).

## Results

### *Sample sociodemographic characteristics*

More than two-thirds of sampled women in the studied countries, except in Liberia, had no formal education (Table 1). Among educated women in all the countries, primary education was the dominant educational level. Unemployment among the respondents was highest in Niger (78.8%) and lowest in Guinea (16.8%). The proportion of unemployed women was also substantial in Liberia (41.8%). Across the countries, the majority of the respondents were 25 years or older. Except in Liberia, the majority of respondents had five or more children, but in all the studied countries, more than a quarter of the women had between three and four children. The proportions of women without access to mass media were highest in Sierra Leone and Cote d'Ivoire. However, more than one-third of women in Guinea and Liberia had moderate access to the mass media.

The distribution of respondents by level of autonomy showed that nearly two-thirds of respondents in Liberia had a high level of autonomy, while more than half of the respondents in Guinea and Sierra Leone also had a high level of autonomy. The proportions of respondents with a high level of autonomy in Cote d'Ivoire and Niger were also substantial though lower than the proportions in the other countries. Partner's level of education among the respondents was similar across most countries studied. In all the countries except Liberia, more than two-thirds of respondents' partners had no formal education. Among partners who were educated, secondary education was the dominant educational level attained in Liberia and Sierra Leone, while primary education was dominant in the other countries. Household wealth among the respondents was unevenly distributed across the studied countries, with the majority of the households belonging to the poorest and poor wealth groups.

The proportions of respondents who received first postnatal checkups within 2 days after delivery and the proportions of respondents who received postnatal checkups from skilled health providers were lowest in Guinea and Niger (Table 1). Likewise, the proportions of respondents who did not receive a postnatal checkup were highest in Guinea and Niger. The proportion of respondents who attended at least four antenatal visits was highest in



**Table 1.** Percentage distribution of respondents by individual/household sociodemographic characteristics in selected West African countries.

Characteristic	Cote d'Ivoire <i>n</i> = 2125	Guinea <i>n</i> = 2908	Liberia <i>n</i> = 1905	Niger <i>n</i> = 5660	Sierra Leone <i>n</i> = 3754
<b>Women's education</b>					
None	74.0	86.3	49.6	89.8	74.9
Primary	21.0	9.4	30.6	7.6	13.0
Secondary	4.8	4.0	19.4	2.4	11.7
Higher	0.2	0.3	0.4	0.2	0.4
<b>Women's employment status</b>					
Unemployed	28.5	16.8	41.8	78.8	19.7
Employed	71.5	83.2	58.2	21.2	80.3
<b>Maternal age (years)</b>					
15–19	10.2	11.1	9.8	7.2	9.1
20–24	21.7	21.7	23.9	20.2	19.1
25 or older	68.1	67.2	66.3	75.6	71.8
<b>Number of children ever born</b>					
Less than 3	35.2	34.6	37.4	23.0	33.2
3–4	28.7	27.0	28.3	26.0	29.7
5+	36.1	38.4	34.3	51.0	37.1
<b>Access to mass media</b>					
None	50.3	36.9	34.0	37.7	50.0
Low	18.8	26.9	30.2	29.3	18.0
Moderate	30.9	36.2	35.8	33.0	32.0
<b>Women's autonomy</b>					
Low	56.7	46.0	29.9	58.0	39.4
High	43.3	54.0	70.1	42.0	60.6
<b>Partner's education</b>					
None	67.5	78.9	39.9	87.5	77.4
Primary	20.5	10.1	19.7	8.4	6.6
Secondary	10.9	8.5	36.9	3.5	13.3
Higher	1.1	2.5	3.5	0.6	2.7
<b>House wealth index</b>					
Poorest	36.6	30.3	31.6	23.5	25.3
Poor	24.5	27.0	25.6	22.2	23.4
Middle	23.7	22.0	21.7	22.2	23.2
Rich	10.8	15.5	14.1	20.9	16.8
Richest	4.4	5.2	7.0	11.2	11.3
<b>Timing of first postnatal checkup</b>					
More than two days	48.5	81.3	54.0	79.8	44.2
Within two-days	51.5	18.7	46.0	20.2	55.8
<b>Provider of first postnatal checkup</b>					
Skilled provider	28.0	11.0	16.0	13.5	18.7
Unskilled provider	72.0	89.0	84.0	86.5	81.3
<b>Postnatal checkups for mothers</b>					
Did not receive postnatal checkup	40.8	77.9	50.0	75.6	40.1
Received postnatal checkup	59.2	22.1	50.0	24.4	59.9
<b>Number of antenatal visits</b>					
None	17.6	21.4	8.8	20.0	15.2
1–3 visits	58.7	35.2	24.1	52.1	13.3

*(Continued)*

**Table 1.** (Continued).

Characteristic	Cote d'Ivoire <i>n</i> = 2125	Guinea <i>n</i> = 2908	Liberia <i>n</i> = 1905	Niger <i>n</i> = 5660	Sierra Leone <i>n</i> = 3754
4 or more visits	23.6	43.4	67.1	27.9	71.5
Type of marriage					
Monogamy	57.7	46.4	66.0	62.2	51.0
Polygyny	42.3	53.6	34.0	37.8	49.0

Source: Based on 2012 DHS in Cote d'Ivoire, Guinea and Niger, and 2013 DHS in Liberia and Sierra Leone

**Table 2.** Percentage distribution of respondents by community characteristics in selected West African countries.

Characteristic	Cote d'Ivoire <i>n</i> = 2125	Guinea <i>n</i> = 2908	Liberia <i>n</i> = 1905	Niger <i>n</i> = 5660	Sierra Leone <i>n</i> = 3754
Community education level of women <sup>a</sup>					
Low	56.7	59.1	35.8	57.3	32.7
Moderate	29.6	23.5	22.4	25.8	35.9
High	13.7	17.4	41.7	16.9	31.4
Community type					
Urban	17.5	13.8	40.1	7.4	19.6
Rural	82.5	86.2	59.9	92.6	80.4
Community poverty level <sup>b</sup>					
Low	33.0	31.6	39.2	28.9	33.3
Moderate	32.5	34.0	33.4	35.8	35.3
High	34.5	34.4	27.4	35.3	31.4
Community median size of households <sup>c</sup>					
Low	53.5	56.5	59.9	49.7	53.9
High	46.5	43.5	40.1	50.3	46.1
Community perception of distance to health facility <sup>d</sup>					
Low	51.4	na	41.1	51.6	48.9
High	48.6	na	58.9	48.4	51.1

<sup>a</sup>Community education level of women proportion of women who had secondary education

<sup>b</sup>Community poverty-level proportion of women in poorest or poor household groups

<sup>c</sup>Community median size of household proportion in household with seven or more members

<sup>d</sup>Community perception of distance to health facility proportion who perceived distance to health facility as not a big problem;

Perception of distance to health facility not available in Guinea DHS

Sierra Leone, but lowest in Cote d'Ivoire. In all the countries, except Guinea, monogamy was the dominant type of marriage.

Community education level of women was lowest in Guinea and highest in Liberia (Table 2). In all the studied countries, the majority of the respondents were rural based. The proportion of women who lived in communities with high poverty level was lowest in Liberia compared with the other studied countries. Except in Niger, higher proportions of respondents lived in communities with low median size of households. More than half of respondents in Liberia and Sierra Leone lived in communities with a high proportion of women who perceived that distance to a health facility was not a big problem in using health care.

### ***Bivariate analysis***

In all the studied countries, women's education was significantly positively associated with postnatal checkups for mothers (Table 3). A higher proportion of mothers with secondary educational attainment than those with less education received postnatal checkups in all the countries. Employment status and postnatal checkups were positively associated in Guinea and Niger, but negatively associated in Cote d'Ivoire, Liberia, and Sierra Leone. Maternal age was negatively related to postnatal checkups in Liberia and Sierra Leone. In Cote d'Ivoire and Guinea, the relationships were mixed, but negative in Niger. The number of children ever born to a woman was significantly negatively associated with postnatal checkups for mothers, except in Liberia, where the relationship was mixed. Access to mass media was positively associated with postnatal checkups for mothers in all the studied countries.

Women's level of autonomy was positively related to postnatal checkups for mothers in all the countries except Liberia. In the four other countries, higher proportions of mothers received postnatal checkups if their level of autonomy was high compared to those whose autonomy was low. However, in Liberia, women's level of autonomy was negatively associated with postnatal checkups for mothers. Partner's education was significantly positively associated with postnatal checkups for mothers in all the studied countries. Household wealth was significantly positively associated with postnatal checkups for mothers in all the countries, except Guinea, where use of postnatal checkups was less when household wealth was in the middle category ( $p < 0.05$ ). Number of antenatal visits and postnatal checkups for mothers were significantly positively associated across the studied countries (Table 3). In Liberia and Niger, higher proportions of mothers received postnatal checkups if they were in polygamous unions compared to those in monogamous marriages. In other countries, higher proportions of mothers received postnatal checkups if they were in monogamous unions compared to those in polygamous unions.

All the community-level variables were significantly associated with postnatal checkups for mothers, with the exception of community median size of households in Cote d'Ivoire, Guinea, and Niger. Mothers who lived in communities, where more women had secondary education, had higher proportions reporting postnatal checkups. Likewise, the proportions of urban mothers who received postnatal checkups were higher compared with mothers in rural areas in all the countries. Community poverty level was also significantly negatively associated with postnatal checkups in all the countries, with mothers who lived in communities with low poverty levels receiving more postnatal checkups compared with mothers who lived in communities with high poverty levels. Community median size of

**Table 3.** Sociodemographic characteristics by percentage of mothers who received postnatal checkups in selected countries and chi-square statistic.

Characteristic	Cote d'Ivoire		Guinea		Liberia		Niger		Sierra Leone	
	Received checkup	$\chi^2$ -value	Received checkup	$\chi^2$ -value	Received checkup	$\chi^2$ -value	Received checkup	$\chi^2$ -value	Received checkup	$\chi^2$ -value
Women's education										
None	57.4		20.5		47.2		22.7		58.3	
Primary	63.5		27.3		50.0		36.5		61.3	
Secondary	67.4	21.8**	42.6	9.5*	56.3	11.9**	47.4	20.4*	68.2	13.4**
Higher					Omitted due to fewer cases					
Women's employment status										
Unemployment	61.7		21.9		51.6		22.1		61.9	
Employment	58.3	1.1***	22.1	3.0***	48.8	0.5***	32.6	27.9*	59.4	8.0**
Maternal age (years)										
15–19	59.9		22.1		49.3		25.9		59.4	
20–24	55.9		23.1		51.5		24.1		61.8	
25 or older	60.2	1.9***	21.8	1.2***	49.5	0.8***	24.3	0.2***	59.4	1.1***
Number of children ever born										
Less than 3	61.1		24.2		52.7		26.7		62.2	
3–4	58.5		18.4		53.4		25.1		59.6	
5+	57.8	5.6**	22.8	3.2**	44.1	4.1*	23.0	12.4*	58.0	6.1**
Access to mass media										
No access	54.1		15.8		43.6		17.1		55.3	
Low	60.9		20.5		48.2		23.0		63.0	
Moderate	66.6	6.8**	29.6	15.9**	57.5	4.3**	33.9	36.7*	65.2	5.1**
Women's autonomy										
Low	57.9		18.6		52.5		22.3		59.7	
High	61.0	1.7***	25.1	6.6**	48.9	6.1**	27.4	7.5**	59.9	4.1**
Partner's education										
None	57.1		20.4		48.5		22.5		58.3	
Primary	62.8		23.6		48.9		33.4		64.1	
Secondary	63.4		28.7		49.7		43.7		66.0	
High	80.8	5.2**	46.5	7.2**	75.7	3.4**	65.6	22.6*	64.2	12.5**

(Continued)



Table 3. (Continued).

Characteristic	Cote d'Ivoire		Guinea		Liberia		Niger		Sierra Leone	
	Received	$\chi^2$ -value	Received	$\chi^2$ -value	Received	$\chi^2$ -value	Received	$\chi^2$ -value	Received	$\chi^2$ -value
Household wealth										
Poorest	50.3		18.5		41.6		16.9		56.2	
Poorer	63.5		20.3		44.5		20.1		57.1	
Middle	59.9		17.6		57.5		24.5		58.5	
Richer	70.4		32.1		58.8		26.4		63.6	
Richest	78.6	6.3**	42.6	6.0**	66.4	3.5**	44.5	24.9*	71.1	3.5**
Number of antenatal visits										
No visit	42.0		12.6		38.6		10.2		45.8	
1–3 visits	61.3		19.7		41.0		25.6		51.3	
4 or more visits	67.0	12.6*	28.7	14.0*	54.7	10.3*	32.4	45.2*	64.5	19.8*
Type of marriage										
Monogamy	59.3		23.4		48.6		24.2		60.7	
Polygyny	59.1	1.0***	21.0	6.2**	52.6	5.2**	24.6	0.5***	59.0	5.0**
Community education level of women										
Low	38.7		19.6		46.0		21.9		52.8	
Moderate	58.3		21.3		41.4		23.7		62.3	
High	50.9	6.3**	27.6	3.9**	57.9	5.2**	32.2	11.7**	64.3	3.7**
Community type										
Urban	71.3		37.1		57.3		54.3		70.8	
Rural	56.7	14.2**	19.7	21.1*	45.1	6.2**	22.0	75.6*	57.2	14.1**
Community poverty level										
Low	67.5		29.9		59.1		34.7		66.6	
Moderate	56.7		15.6		31.1		21.2		57.2	
High	53.8	4.0**	21.4	3.8**	26.9	16.2**	19.1	13.8*	55.7	3.7**
Community median size of households										
Low	61.9		19.2		48.0		24.9		61.0	
High	56.1	1.8***	25.8	2.5***	52.9	7.1**	23.8	0.4***	58.6	4.0**
Community perception of distance to health facility										
Low	55.4		na	na	48.0		21.4		57.7	
High	63.3	8.1**	na	na	51.4	4.3**	27.5	5.5**	61.9	6.4**

Notes: \* $p < .001$ , \*\* $p < .05$ , \*\*\* $p > .05$  (not significant), na (variable not available in Guinea DHS)

households was negatively associated with postnatal checkups for mothers in Cote d'Ivoire, Niger, and Sierra Leone, but in Liberia and Guinea, positive associations were observed. In all four countries with availability of data on perception of distance to a health facility, community perception of distance to health facility was positively associated with postnatal checkups for mothers, indicating that mothers who lived in communities where distance was not perceived as a big problem in using health services reported receiving more postnatal checkups than women in other communities.

### **Multivariate analysis**

The variables included in the multivariate models were individual/household characteristics (education, age, employment, number of children ever born, access to mass media, and autonomy) and community characteristics (community education, poverty level, community type, perception of distance, and median size of households). In Model 1, educated mothers were more likely to receive postnatal checkups than uneducated mothers (Table 4). The relation of individual secondary education, however, was more significantly associated. For instance, in Cote d'Ivoire and Niger, mothers with a secondary education were more than twice as likely to have received a postnatal checkup as uneducated mothers. Likewise, mothers with a secondary education in Liberia were 49.3% more likely to receive a postnatal checkup than mothers in the reference category (OR = 1.493; CI: 1.155–1.931) and 41.5% more likely to receive a postnatal checkup than mothers in the reference category in Niger (OR = 1.415; CI: 0.995–2.023). In Liberia and Niger, employed women had significantly higher odds of receiving a postnatal checkup than unemployed women; the reverse was the case in Sierra Leone where employed women were 29.5% less likely to receive a postnatal checkup compared with unemployed women (OR = 0.705; CI: 0.595–0.836). Across the countries, except in Liberia, older mothers were more likely to receive postnatal checkups compared with younger women. The odds of reporting a postnatal checkup for mothers were lower among women who had three or more children. Access to mass media was significantly associated with postnatal checkups in all the studied countries with the odds being higher among women with moderate access to mass media compared with women with no access to mass media.

In Guinea and Niger, the odds of reporting a postnatal checkup were highest among women who had high autonomy than women who had low autonomy, but, in contrast, the odds were lower among women who had high autonomy in Sierra Leone. Except in Cote d'Ivoire, partner's education, like individual women's education, was significantly associated with use of postnatal checkups for mothers. In the four other countries, the likelihood of reporting a postnatal checkup was higher among women whose partners had



**Table 4.** Binary logistic odds ratios for fixed effects related to postnatal checkups for mothers in selected West African countries (Model 1).

Variable	Cote d'Ivoire			Guinea			Liberia			Niger			Sierra Leone			
	Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI		Odds ratio	95% CI		
<b>Women's education</b>																
None <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
Primary	1.337**	1.087-1.645		1.207***	0.926-1.573		1.247**	1.034-1.504		1.384**	1.091-1.755		1.121***	0.952-1.319		
Secondary	2.365*	1.870-2.991		2.097*	1.505-2.921		1.493**	1.155-1.931		1.415**	0.995-2.023		1.546*	1.280-1.867		
Higher							Omitted due to few cases									
<b>Women's employment status</b>																
Unemployed <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
Employed	1.076***	0.866-1.336		1.104***	0.886-1.376		1.309**	1.051-1.630		1.537*	1.283-1.841		0.705*	0.595-0.836		
<b>Maternal age (years)</b>																
15-19 <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
20-24	1.620**	1.155-2.275		1.114***	0.843-1.473		1.070***	0.768-1.490		1.006***	0.731-1.385		1.122***	0.888-1.417		
25+	1.778*	1.289-2.455		1.393**	1.017-1.909		1.050***	0.687-1.604		1.598**	1.146-2.228		1.309**	1.017-1.685		
<b>Number of children ever born</b>																
Less than 3 <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
3-4	0.676**	0.542-0.885		0.680*	0.538-0.858		0.811***	0.634-1.037		0.524*	0.419-0.656		0.814**	0.675-0.980		
5+	0.595*	0.468-0.755		0.797**	0.620-1.024		0.692**	0.525-0.910		0.447*	0.351-0.569		0.810**	0.671-0.980		
<b>Access to mass media</b>																
No access <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
Low	1.366**	1.041-1.792		1.1186***	0.920-1.530		0.959***	0.778-1.182		1.445*	1.175-1.778		1.362**	1.081-1.717		
Moderate	1.320**	1.034-1.684		1.600*	1.253-2.043		1.324**	1.069-1.639		2.166*	1.757-2.670		1.541*	1.264-1.878		
<b>Women's autonomy</b>																
Low <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
High	0.984***	0.802-1.208		1.371**	1.138-1.651		1.003***	0.788-1.278		1.276**	1.079-1.509		0.763**	0.656-0.889		
<b>Partner's education</b>																
None <sup>ref</sup>	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-	-
Primary	0.878***	0.705-1.092		1.342**	1.006-1.789		1.020***	0.819-1.270		1.472**	1.168-1.855		1.350**	1.078-1.690		
Secondary	1.143***	0.856-1.526		1.460**	1.109-1.923		1.004***	0.815-1.237		2.165**	1.583-2.960		1.365*	1.152-1.618		
High	1.238***	0.664-2.309		1.552**	1.014-2.376		1.968**	1.151-3.363		2.858**	1.501-5.441		1.378**	1.018-1.865		

(Continued)

Table 4. (Continued).

Variable	Cote d'Ivoire		Guinea		Liberia		Niger		Sierra Leone	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Household wealth										
Poorest <sup>ref</sup>	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-
Poor	1.399**	1.042-1.878	1.407**	1.035-1.912	1.179***	0.956-1.455	1.331**	1.028-1.725	1.017***	0.831-1.246
Middle	1.560**	1.152-2.113	1.307***	0.950-1.798	2.052*	1.563-2.693	1.404**	1.080-1.823	0.952***	0.751-1.207
Richer	1.951**	1.337-2.848	1.767**	1.204-2.593	2.324*	1.613-3.350	2.135*	1.619-2.817	1.375**	1.073-1.763
Richest	3.047*	1.869-4.968	2.794*	1.609-4.852	3.786*	2.469-6.380	3.889*	2.752-5.496	1.985*	1.474-2.673
Number of antenatal visits										
None <sup>ref</sup>	1.0000	-	1.000	-	1.000	-	1.000	-	1.000	-
1-3 visits	4.666*	3.334-6.531	3.293*	2.294-4.726	1.236***	0.907-1.685	3.813*	2.866-5.072	1.127***	0.833-1.524
4 or more visits	8.672*	5.873-12.805	6.160*	4.270-8.890	2.768*	2.041-3.752	6.023*	4.391-8.263	2.208*	1.764-2.763
Type of marriage										
Monogamy <sup>ref</sup>	1.000	-	1.000	-	1.000	-	1.000	-	1.000	-
Polygyny	0.791**	0.655-0.954	1.023***	0.852-1.230	1.049***	0.838-1.312	0.777***	0.667-0.904	0.715*	0.633-0.808

Notes: ref (reference category). \* $p < .001$ , \*\* $p < .05$ , \*\*\* $p > .05$  (not significant)



attained a secondary education. Likewise, the likelihood of reporting a postnatal checkup was consistently greater with increased household wealth in all the countries. Across the studied countries, the odds of reporting a postnatal checkup were highest among women who had four or more antenatal visits. For instance, in Guinea and Niger, mothers who had four or more antenatal visits were more than six times as likely to receive a postnatal checkup as mothers who had no antenatal visits. In Cote d'Ivoire, Niger and Sierra Leone, women in polygamous unions had significantly lower odds of receiving a postnatal checkup compared with women in monogamous unions.

In Model 2, with the inclusion of community-level variables, the relations of individual/household characteristics to the likelihood of postnatal checkups for mothers were maintained, though these were not statistically significant in some cases (Table 5). Improvement in level of community education was significantly related to the odds of postnatal checkups for mothers. For instance, in Sierra Leone, mothers in communities with a high proportion of women with a secondary education were nearly twice as likely to use postnatal checkups than mothers in communities with a low proportion of women with secondary education (OR = 1.960; CI: 1.128–3.408). In all the studied countries, rural women were less likely to use postnatal checkups compared with urban women. Likewise, with higher community poverty level, the odds of using postnatal checkups for mothers were lower across the five countries. In Cote d'Ivoire and Sierra Leone, the likelihood of reporting a postnatal checkup was significantly lower among women in communities with a high proportion of median size of households, but in Liberia and Niger, the odds were significantly higher. In four countries, the odds of having received postnatal checkups were higher among women who lived in communities with a high proportion of women who did not perceive distance to a health facility as a big problem.

The three models that were fitted were adequate for assessing the relation of the explanatory variables to the likelihood of reporting postnatal checkups for mothers (Table 6). The values of the log-likelihood and the AIC results consistently decreased as fitted models progressed from the empty model to Model 1 and Model 2, indicating that the fitted models were a better fit to the data. For instance, in Liberia, the AIC decreased from 2221.2 in the empty model to 2160.1 in Model 1 and to 2125.1 in Model 2 to indicate that as explanatory variables are added to each successive model, variations in postnatal checkups were reduced. Likewise, in all the studied countries, the log-likelihood test with varying values of the chi-square statistic confirmed the goodness of fit of the models ( $p < 0.05$ ). Results of the ICC confirmed two things. First, reasonable levels of variation in postnatal checkups were observed in the absence of the covariates in all the countries. This could be seen from the empty model. The variations were highest in Niger, with 53.8%, and lowest in Liberia with 36.2% indicating that in these countries,

**Table 5.** Binary logistic odds ratios for fixed effects related to postnatal checkups for mothers in selected West African countries (Model 2).

Variable	Cote d'Ivoire			Liberia			Niger			Sierra Leone		
	Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI	
Women's education												
None (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
Primary	1.337**	1.085-1.647	0.900-1.532	1.352**	1.010-1.662	1.010-1.662	1.555*	1.262-1.915	1.110***	0.944-1.304	1.110***	0.944-1.304
Secondary	2.364*	1.860-3.004	1.442-2.801	1.334**	1.039-1.712	1.039-1.712	1.652**	1.209-2.257	1.436**	1.207-1.710	1.436**	1.207-1.710
Higher				Omitted due to few cases								
Women's employment status												
Unemployed (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
Employed	1.064***	0.883-1.282	0.887-1.391	1.319**	1.060-1.641	1.060-1.641	1.479*	1.236-1.761	0.726*	0.614-0.857	0.726*	0.614-0.857
Maternal age (years)												
15-19 (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
20-24	1.621**	1.162-2.261	0.837-1.454	1.063***	0.763-1.481	0.763-1.481	1.022***	0.770-1.356	1.125***	0.892-1.418	1.125***	0.892-1.418
25+	1.740**	1.260-2.403	1.031-1.932	1.056***	0.687-1.623	0.687-1.623	1.350**	1.006-1.813	1.317**	1.017-1.704	1.317**	1.017-1.704
Number of children ever born												
Less than 3 (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
3-4	0.714**	0.567-0.900	0.549-0.877	0.813***	0.635-1.040	0.635-1.040	0.511*	0.399-0.655	0.802**	0.664-0.967	0.802**	0.664-0.967
5+	0.674**	0.525-0.866	0.639-1.061	0.694**	0.527-0.914	0.527-0.914	0.482*	0.376-0.617	0.794**	0.657-0.960	0.794**	0.657-0.960
Access to mass media												
No access (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
Low	2.388*	2.013-2.763	0.902-1.503	0.961***	0.781-1.184	0.781-1.184	1.388**	1.131-1.704	1.566*	1.235-1.985	1.566*	1.235-1.985
Moderate	1.371**	1.045-1.798	1.210-1.975	1.323**	1.069-1.637	1.069-1.637	2.017*	1.641-2.479	1.548*	1.279-1.873	1.548*	1.279-1.873
Women's autonomy												
Low (ref)	1.000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High	1.004***	0.817-1.232	1.143-1.659	1.019***	0.799-1.298	0.799-1.298	1.284**	1.087-1.517	0.790**	0.675-0.923	0.790**	0.675-0.923
Partner's education												
None (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
Primary	0.964***	0.764-1.217	0.999-1.778	1.006***	0.807-1.252	0.807-1.252	1.280**	1.010-1.622	1.311**	1.048-1.641	1.311**	1.048-1.641
Secondary	1.151***	0.863-1.537	1.010-1.909	0.969***	0.784-1.197	0.784-1.197	1.694*	1.225-2.343	1.323**	1.127-1.554	1.323**	1.127-1.554
High	1.286***	0.684-2.415	0.990-2.319	1.938**	1.144-3.282	1.144-3.282	1.228***	0.669-2.253	1.352**	0.999-1.830	1.352**	0.999-1.830
Household wealth												
Poorest (ref)	1.000	-	-	1.000	-	-	1.000	-	-	1.000	-	-
Poorer	1.476**	1.071-2.035	1.077-1.985	1.114***	0.900-1.379	0.900-1.379	1.296**	1.003-1.675	0.992***	0.798-1.233	0.992***	0.798-1.233
Middle	1.125***	0.820-1.543	1.045-1.949	1.742*	1.305-2.325	1.305-2.325	1.308**	1.007-1.697	0.952***	0.746-1.214	0.952***	0.746-1.214
Richer	1.795**	1.221-2.638	1.710-3.455	1.720**	1.143-2.590	1.143-2.590	1.662*	1.258-2.196	1.330**	1.010-1.750	1.330**	1.010-1.750
Richest	2.345**	1.421-3.870	3.120-8.167	2.680**	1.526-4.704	1.526-4.704	1.889**	1.311-2.723	1.372**	1.010-1.864	1.372**	1.010-1.864

*(Continued)*



Table 5. (Continued).

Variable	Cote d'Ivoire			Liberia			Niger			Sierra Leone		
	Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI	
Number of antenatal visits												
None (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
1-3 visits	4.663*	3.330-6.530	3.353*	1.249***	0.915-1.704	2.337-4.811	3.460*	2.615-4.578	1.121***	0.829-1.517	1.121***	0.829-1.517
4 or more visits	8.463*	5.732-12.495	6.345*	2.784*	2.052-3.779	4.399-9.151	5.337*	3.917-7.273	2.190*	1.750-2.740	2.190*	1.750-2.740
Type of marriage												
Monogamy (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
Polygyny	0.754**	0.623-0.913	1.047***	1.042***	0.832-1.304	0.870-1.259	0.838**	0.725-0.969	0.742*	0.655-0.841	0.742*	0.655-0.841
Community education level of women												
Low (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
Moderate	0.938***	0.681-1.291	1.507**	1.533**	1.119-2.1154	1.049-2.166	1.232***	0.771-1.968	1.714**	1.151-2.553	1.714**	1.151-2.553
High	1.604**	1.043-2.466	2.391*	1.690**	1.138-2.510	1.631-3.506	1.820**	1.221-2.712	1.960**	1.128-3.408	1.960**	1.128-3.408
Community poverty level												
Low (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
Medium	0.587***	0.208-1.654	0.786***	0.464***	0.264-0.816	0.543-1.136	0.766***	0.458-1.281	0.403*	0.315-0.516	0.403*	0.315-0.516
High	0.313**	0.102-0.962	0.706***	0.277*	0.145-0.528	0.438-1.139	0.567**	0.330-0.974	0.438*	0.342-0.562	0.438*	0.342-0.562
Community type												
Urban (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
Rural	0.779**	0.604-1.003	0.636**	0.732**	0.547-0.982	0.438-0.925	0.520**	0.298-0.905	0.822**	0.713-0.947	0.822**	0.713-0.947
Community median size of households												
Low (ref)	1.000	-	1.000	1.000	-	1.000	1.000	-	1.000	-	1.000	-
High	0.773**	0.601-0.993	0.901***	1.410**	1.097-1.813	0.694-1.169	1.612**	1.201-2.164	0.761**	0.585-0.999	0.761**	0.585-0.999
Community perception of distance to health facility												
Low (ref)	1.000	-	-	1.000	-	-	1.000	-	1.000	-	1.000	-
High	1.834**	1.253-2.686	-	1.501**	1.156-1.950	-	1.240**	1.043-1.475	1.492**	1.074-2.071	1.492**	1.074-2.071

**Table 6.** Multilevel logistic regression for random effects related to postnatal checkups for mothers in selected West African countries.

Parameter	Cote d'Ivoire			Guinea			Liberia			Niger			Sierra Leone		
	Empty Model	Model 1	Model 2	Empty Model	Model 1	Model 2	Empty Model	Model 1	Model 2	Empty Model	Model 1	Model 2	Empty Model	Model 1	Model 2
Community-level variance (SE)	2.63 (.41)	1.87 (.32)	1.69 (.29)	3.68 (.53)	2.02 (.31)	1.95 (.294)	1.87 (.28)	1.28 (.20)	1.22 (.19)	3.83 (.48)	1.94 (.26)	1.66 (.22)	2.49 (.33)	2.06 (.28)	1.95(.26)
ICC (%)	44.4	36.2	33.9	52.8	38.0	37.2	36.2	28.0	27.0	53.8	37.1	33.5	43.1	38.5	37.2
Log-likelihood	-1190.8	-1122.1	-1080.6	-1541.2	-1513.8	-1466.9	-1274.1	-1207.5	-1169.6	-3113.3	-3086.4	-3047.7	-1914.4	-1845.4	-1795.3
AIC	2755.7	2717.2	2690.3	3232.3	3163.7	3111.7	2221.2	2160.1	2125.1	5928.6	5815.9	5719.7	4562.9	4445.7	4382.6
Log-likelihood test	526.9*	393.7	256.3*	930.1*	605.3*	593.5*	448.2*	301.1*	256.3*	1090.2*	763.8*	476.8*	732.5*	563.7*	614.5*

Note: \**p* < .001.

and in the absence of the covariates, the extent of variations in postnatal checkups that could be attributed to community characteristics were 53.8% and 36.2%, respectively.

Second, the community characteristics were important factors related to postnatal checkups for mothers in all the countries. In Model 1 for Cote d'Ivoire, the community characteristics accounted for 36.2% of the variation in postnatal checkups for mothers, while it accounted for 33.9% in Model 2. Likewise, in Model 1 for Sierra Leone, the community characteristics accounted for 38.5% of variation in postnatal checkups for mothers, while it accounted for 37.2% in Model 2. In Guinea, it accounted for 38.0% in Model 1 and 37.2% in Model 2, while it accounted for 37.1% in Model 1 for Niger and 33.5% in Model 2. Likewise, in Model 1 for Liberia, the community characteristics accounted for 28.1% of variation in postnatal checkups for mothers, while it accounted for 27.0% in Model 2.

## Discussion

This study examined the multilevel factors associated with the use of postnatal checkups for mothers in five selected West African countries. We addressed some of the limitations of existing studies by providing additional information on factors related to the use of postnatal checkups for mothers in multiple country settings. The data analyzed were high quality from an internationally recognized demographic and health program, and the quality of our analyses and the findings were benchmarked with existing studies. Four basic issues emerged from the study.

First, we found that more than two-thirds of nursing mothers in Guinea and Niger, and more than one-third of nursing mothers in other countries who had home deliveries did not receive postnatal checkups. This has potentially serious implications not only for the health of the mothers, but also for the survival of the newborn in all the countries because research has provided sufficient evidence that the health of the newborn cannot be separated from the health of the mother (WHO 2009). This situation might be mitigated through renewed community sensitization to raise awareness further about the dangers of home delivery and the necessity of receiving postnatal checkups within 48 hours after birth when home delivery is inevitable. More community health workers could be employed and trained to organize such community sensitization. This initiative should, however, be supported with an increase in the numbers of qualified health personnel in public health institutions in the communities to reduce patronage of unskilled health providers by pregnant and nursing mothers.

Second, the study confirmed in all the five studied countries that individual/household characteristics, such as education, household wealth, maternal age, media exposure, antenatal care visits, women's autonomy, and

employment, were important factors related to the use of postnatal checkups for mothers, which is similar to previous findings on use of maternal health services (Akunga, Menya, and Kabue 2014; Obiyan and Kumar 2015; Woldemicael 2010). Population and health programs in each country should sustain focus on these characteristics, particularly women's education, employment, and household wealth. Education is a unique characteristic that improves awareness of the provision of postnatal care. With the low level of individual education found among respondents in the countries studied, expanding educational facilities to reach more women is imperative. In addition, it is important to devise means of using the mass media, particularly radio and television, to improve public awareness about existing postnatal care in the countries. Employment and household wealth are two key characteristics that may boost the use of postnatal care in the countries because both could provide women with economic opportunities to afford the cost of health care for health services that may not be free in public health institutions.

Third, we found higher use of postnatal checkups among women with high autonomy than women with low autonomy in Guinea and Niger. This is consistent with the finding in one study in relation to the use of antenatal and delivery care in Eritrea but contrasts with findings by the same study for Ethiopia (Woldemicael 2010). The likely reason for why postnatal checkups may be higher among women with high autonomy than among those with low autonomy is that high autonomy connotes that both the woman and her partner are jointly involved in decisions on maternal and child health issues. When both partners are involved in family decisions, the tendency is for reaching decisions that may promote family health more than when one partner is not involved in the decision. It is, therefore, important that additional attention is given to encourage male involvement further in maternal and child health-care issues. In the countries where high autonomy has not translated to increased use of postnatal checkups, further integration of maternal and child health issues into women's development programs may be needed to raise awareness about reproductive health issues that could hinder the productivity and well-being of women.

Fourth, the study results indicated that beyond individual/household characteristics, community factors were related to the use of postnatal checkups for mothers in all the five countries studied. Previous studies that focused on antenatal care, facility delivery, and assistance during delivery also found similar community factors to be related (Adjiwanou and LeGrand 2014; Babalola 2014; Babalola and Fatusi 2009; Magadi, Agwanda, and Obare 2007; Stephenson et al. 2006). This finding points to the need for policies and programs to increase attention to community contexts by developing more programs that will be implemented at

the community and not necessarily at the facility level. For instance, community health workers, who are available in all the studied countries, can be trained to provide postnatal care following home delivery in the community.

Our analyses were limited by some challenges. First, the use of cross-sectional data limited us to examining associations between the individual/community factors and postnatal checkups for mothers. We were not able to investigate the cause and effect relationships between the research variables. Second, the data analyzed were self-reported. However, we assumed that socially desirable responses and other inappropriate responses were greatly reduced by the DHS standard survey methodology. Third, one of the community variables (community perception of distance to a health facility) was not available in the Guinea DHS. This may have reduced the extent of variation in postnatal checkups associated with community factors in the multilevel analysis for Guinea. This, however, did not undermine the findings about factors associated with the use of postnatal checkups for mothers.

## Conclusion

The results of this study provide additional information that community factors are related to use of postnatal care in West Africa. Interventions targeting more community factors, particularly community education and poverty, may further improve the use of postnatal care in the sub-Saharan region. In addition, implementing the WHO and UNICEF recommendations on home visits represents a pragmatic initiative for improving postnatal care in West African communities. However, because cultural norms and health-seeking practices differ from community to community, the initiative requires modifications to become culturally acceptable and practical in all West African communities.

## Acknowledgments

We appreciate MEASURE/DHS for granting access to the datasets. We thank the University of the Witwatersrand, South Africa, for providing resources and facilities that enhance preparation of the manuscript. We also appreciate Professor Clifford Odimegwu, Dr. S. A. Adedini, and Dr. J. O. Akinyemi for providing tutorials and materials on multilevel modeling.

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## References

- Adjiwanou, V., and T. LeGrand. 2014. Gender inequality and the use of maternal healthcare services in rural sub-Saharan Africa. *Health & Place* 29:67–78. doi:10.1016/j.healthplace.2014.06.001.
- Akunga, D., D. Menya, and M. Kabue. 2014. Determinants of postnatal care use in Kenya. *African Population Studies* 28 (3):1447–59. doi:10.11564/28.
- Aremu, O., S. Lawoko, and K. Dalal. 2011. Neighborhood socioeconomic disadvantage, individual wealth status and patterns of delivery care utilization in Nigeria: A multilevel discrete choice analysis. *International Journal of Women's Health* 3:167–74. doi:10.2147/IJWH.
- Assaf, S., and R. Winter. 2015. *Trends in maternal health indicators in Sierra Leone, 2008–2013*. DHS Further Analysis Reports No. 97. Rockville, MD: ICF International.
- Babalola, S., and A. Fatusi. 2009. Determinants of use of maternal health services in Nigeria—Looking beyond individual and household factors. *BMC Pregnancy and Childbirth* 9:43. doi:10.1186/1471-2393-9-43.
- Babalola, S. O. 2014. Factors associated with use of maternal health services in Haiti: A multilevel analysis. *Rev Panam Salud Publica* 36 (1):1–9.
- De Allegri, M., V. Ridde, V. R. Louis, M. Sarker, J. Tiendrebéogo, M. Yé, et al. 2011. Determinants of utilisation of maternal care services after the reduction of user fees: A case study from rural Burkina Faso. *Health Policy* 99:210–18. doi:10.1016/j.healthpol.2010.10.010.
- Gage, A. J. 2007. Barriers to the utilization of maternal health care in rural Mali. *Social Science & Medicine* 65:1666–82. doi:10.1016/j.socscimed.2007.06.001.
- Global Health Check. 2012. Free healthcare initiative in Niger makes health gains but many challenges remain. [www.globalhealthcheck.org/?p=1060](http://www.globalhealthcheck.org/?p=1060) (accessed May 24, 2016).
- Greenwell, K. F., and M. Winner. 2014. *Infant survival outcomes in Guinea in light of improved maternal and child care: Further analysis of the 2005 and 2012 demographic and health surveys*. DHS Further Analysis Reports No. 96. Rockville, MD: Author.
- ICF International. 2012. *Survey organization manual for demographic and health surveys*. MEASURE DHS. Calverton, MD: Author. [http://dhsprogram.com/pubs/pdf/DHSM10/DHS6\\_Survey\\_Org\\_Manual\\_7Dec2012\\_DHSM10.pdf](http://dhsprogram.com/pubs/pdf/DHSM10/DHS6_Survey_Org_Manual_7Dec2012_DHSM10.pdf) (accessed July 13, 2016).
- Institut National de la Statistique (INS) [Niger], Unicef and ICF International. 2012. *Enquête démographique et de santé dans les zones d'intervention du Programme de Coopération de l'UNICEF au Niger, 2012*. Rockville, MD: Authors.
- Institut National de la Statistique and ICF International. 2012. *Enquete demographique et de sante et a indicateurs Multiples de Cote d'Ivoire 2011–2012*. Calverton, MD: Authors.
- Institut National de la Statistique and ICF International. 2013. *Enquete demographique et de sante et a indicateurs multiples (EDS-MICS 2012)*. Calverton, MD: Authors.
- Jat, T. R., N. Ng, and M. S. Sebastian. 2011. Factors affecting the use of maternal health services in Madhya Pradesh state of India: A multilevel analysis. *International Journal for Equity in Health* 10:59. doi:10.1186/1475-9276-10-59.
- Kruk, M. E., P. C. Rockers, G. Mbaruku, M. M. Paczkowski, and S. Galea. 2010. Community and health system factors associated with facility delivery in rural Tanzania: A multilevel analysis. *Health Policy* 97:209–16. doi:10.1016/j.healthpol.2010.05.002.
- Lee, P. T., G. R. Kruse, B. T. Chan, M. B. F. Massaquo, R. R. Panjabi, B. T. Dahn, and W. T. Gwenigale. 2011. An analysis of Liberia's 2007 national health policy: Lessons for health systems strengthening and chronic disease care in poor, post-conflict countries. *Globalization and Health* 7:37. doi:10.1186/1744-8603-7-37.



- Liberia Institute of Statistics and Geo-Information Services (LISGIS), Ministry of Health and Social Welfare [Liberia], National AIDS Control Program [Liberia] and ICF International. 2014. *Liberia Demographic and Health Survey 2013*. Monrovia, Liberia: Authors. <http://dhsprogram.com/pubs/pdf/FR291/FR291.pdf> (accessed July 13, 2016).
- López-Cevallos, D. F., and C. Chi. 2009. Health care utilization in Ecuador: A multilevel analysis of socio-economic determinants and inequality issues. *Health Policy and Planning* 1–10. doi:10.1093/heapol/czp052.
- Magadi, M. A., A. O. Agwanda, and F. O. Obare. 2007. A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: Evidence from Demographic and Health Surveys (DHS). *Social Science & Medicine* 64:1311–25. doi:10.1016/j.socscimed.2006.11.004.
- MCHIP & Save the Children. 2014. Postnatal care home visits: A review of the current status of implementation in five countries. [www.mchip.net/sites/default/files/Postnatal%20Care%20Home%20Visits.pdf](http://www.mchip.net/sites/default/files/Postnatal%20Care%20Home%20Visits.pdf) (accessed May 18, 2016).
- Mekonnen, Z. A., W. T. Lerebo, T. G. Gebrehiwot, and S. A. Abadura. 2015. Multilevel analysis of individual and community level factors associated with institutional delivery in Ethiopia. *BMC Research Notes* 8:376. doi:10.1186/s13104-015-1343-1.
- Merlo, J., P. Wagner, N. Ghith, and G. Leckie. 2016. An original stepwise multilevel logistic regression analysis of discriminatory accuracy: The case of neighbourhoods and health. *Plos ONE* 11 (4):e0153778. doi:10.1371/journal.pone.0153778.
- Obiyan, M. O., and A. Kumar. 2015. Socioeconomic inequalities in the use of maternal health care services in Nigeria: Trends between 1990 and 2008. *SAGE Open*. doi:10.1177/2158244015614070.
- Ononokpono, D. N., and C. O. Odimegwu. 2014. Determinants of maternal health care utilization in Nigeria: A multilevel approach. *Pan African Medical Journal* 17 (Supp 1):2. doi:10.11694/pamj.suppl.2014.17.1.3596.
- Ononokpono, D. N., C. O. Odimegwu, E. Imasiku, and S. Adedini. 2013. Contextual determinants of maternal health care service utilization in Nigeria. *Women & Health* 53 (7):647–68. doi:10.1080/03630242.2013.826319.
- Ononokpono, D. N., C. O. Odimegwu, E. N. S. Imasiku, and S. A. Adedini. 2014. Does it really matter where women live? A multilevel analysis of the determinants of postnatal care in Nigeria. *Maternal and Child Health Journal* 18:950–59. doi:10.1007/s10995-013-1323-9.
- Ouattara, A. F., C. A. Houngbedji, and B. G. Koudou. 2013. Free health care in public health establishments of Côte d'Ivoire: Born dead? *Occupational Medicine and Health Affairs* 1:3. doi:10.4172/2329-6879.1000114.
- Rai, R. K., P. K. Singh, and L. Singh. 2012. Utilization of maternal health care services among married adolescent women: Insights from the Nigeria Demographic and Health Survey, 2008. *Women's Health Issues* 22 (4):e407–e414. doi:10.1016/j.whi.2012.05.001.
- Rutstein, S. O., and G. Rojas. 2006. *Guide to DHS Statistics*. Calverton, MD: DHS & ORC Macro.
- Sagna, M. L., and T. S. Sunil. 2012. Effects of individual and neighborhood factors on maternal care in Cambodia. *Health & Place* 18:415–23. doi:10.1016/j.healthplace.2011.12.006.
- Sepehri, A., S. Sarma, W. Simpson, and S. Moshiri. 2008. How important are individual, household and commune characteristics in explaining utilization of maternal health services in Vietnam? *Social Science & Medicine* 67:1009–17. doi:10.1016/j.socscimed.2008.06.005.

- Speizer, I. S., W. T. Story, and K. Singh. 2014. Factors associated with institutional delivery in Ghana: The role of decision-making autonomy and community norms. *BMC Pregnancy and Childbirth* 14:398. doi:10.1186/s12884-014-0398-7.
- StataCorp. 2011. *Stata: Release 12: Statistical software*. College Station, TX: Author.
- Statistics Sierra Leone (SSL) and ICF International. 2014. *Sierra Leone Demographic and Health Survey 2013*. Freetown, Sierra Leone and Rockville, MD: Authors. <http://dhsprogram.com/pubs/pdf/FR297/FR297.pdf> (accessed July 13, 2016).
- Stephenson, R., A. Baschieri, S. Clements, M. Hennink, and N. Madise. 2006. Contextual influences on the use of health facilities for childbirth in Africa. *American Journal of Public Health* 96 (1):84–93. doi:10.2105/AJPH.2004.057422.
- Woldemicael, G. 2010. Do women with higher autonomy seek more maternal health care? Evidence from Eritrea and Ethiopia. *Health Care for Women International* 31 (7):599–620. doi:10.1080/07399331003599555.
- Worku, A. G., A. W. Yalew, and M. F. Afework. 2013. Factors affecting utilization of skilled maternal care in Northwest Ethiopia: A multilevel analysis. *BMC International Health and Human Rights* 13:20. doi:10.1186/1472-698X-13-20.
- World Health Organization (WHO). 2009. WHO/UNICEF joint statement on home visits for the newborn child: A strategy to improve survival. [www.unicef.org/health/files/WHO\\_FCH\\_CAH\\_09.02eng.pdf](http://www.unicef.org/health/files/WHO_FCH_CAH_09.02eng.pdf) (accessed May 18, 2016).
- World Health Organization (WHO). 2014. *Trends in maternal mortality: 190-1013. estimates by WHO, UNICEF, World Bank, UNFPA, The World Bank and the United Nations Population Division*. Geneva, Switzerland: Author.
- World Health Organization (WHO) and UNICEF. 2013. Accountability for maternal, newborn and child survival: The 2013 update, 2013. [http://countdown2015mnch.org/documents/2013/Report/Countdown\\_2013\\_Update\\_w\\_ithprofiles.pdf](http://countdown2015mnch.org/documents/2013/Report/Countdown_2013_Update_w_ithprofiles.pdf) (accessed May 9, 2016).