The Influence of Individual and Contextual Socioeconomic Status on Obstetric Care Utilization in the Democratic Republic of Congo: A Population-based Study

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ABSTRACT

Background: Maternal health care utilization continues to focus on the agenda of health care planners around the world, with high attention being paid to the developing countries. The devastating effect of maternal death at birth on the affected families is untold. This study examines the utilization of obstetric care in the Democratic Republic of Congo.

Methods: We have used the nationally representative data from the 2007. Democratic Republic of Congo Demographic and Health Survey. Multilevel regression analysis has been applied to a nationally representative sample of 6,695 women, clustered around 299 communities in the country.

Results: The results show that there are variations in the use of antenatal care and delivery care. Individual-level characteristics, such as women's occupation and household wealth status are shown to be associated with the use of antenatal care. Uptake of facility-based delivery has been seen to be dependent on the household wealth status, women's education, and partner's education. The effect of the neighborhoods' socioeconomic disadvantage on the use of antenatal care and facility-based delivery are the same. Women from highly socioeconomically disadvantaged communities, compared to their counterparts from less socioeconomically disadvantaged neighborhoods, are less likely to utilize both the antenatal services and healthcare facility for child delivery. The result of this study has shown that both individual and contextual socioeconomic status play an important role in obstetric care uptake.

Conclusion: Thus, intervention aimed at improving the utilization of obstetrics care should target both the individual economic abilities of the women and that of their environment when considering the demand side.

Keywords: Healthcare, obstetrics, socioeconomic, utilization, Congo DRC

INTRODUCTION

Yearly around half a million women worldwide die from pregnancy-related complications; a majority of whom are from

low-and-middle income countries.[1] Prompt access to and utilization of appropriate and good quality preventive medical care, before and during child birth, under the direct supervision of trained medical staff; have been seen to reduce maternal deaths.[2,3] Yet, maternal mortality ratios in most low-and-middle income countries keep rising. As a result, initiatives such as safe motherhood,[4,5] which is aimed at reducing maternal deaths arising from pregnancy-related complications has now become a top priority for many multilateral, bilateral, and governmental agencies. Despite these collaborative efforts, disparities in the utilization of reproductive health services, based on the socioeconomic status, are still large.[6] Several measures of socioeconomic status, the most important of which is financial constraints, keep preventing these women from obtaining appropriate medical attention,[7] during one of the most critical period of their lives.

Even as the effect of the socioeconomic position (SEP) on the access to and utilization of obstetric care among women of reproductive age in most countries in low, the middle income countries may be essentially the same. The situation would be completely different in a country such as the Democratic Republic of Congo, a country of nearly 71 million people, just recovering from a long period of internal war. The devastating effect of internal war such as loss of life, human displacement, and deplorable healthcare facilities,[8] together with chronic lack of skilled medical personnel; have further worsened access to appropriate healthcare.[9,10] In addition, the presence of concentrated poverty as a result of disturbance to human economic activities and loss of bread winners is highly noticeable.[11]

Although many studies in sub-Saharan Africa have focused on socioeconomic determinants and utilization of obstetrics care, these studies are limited to exploring the individual SEP and have yet to examine the influence of the contextual socioeconomic characteristics. Evidence suggests that the level of economic development of the neighborhood; can operate through concentrated poverty, lack of formal education, joblessness, and living in rural areas, as a neighborhood socioeconomic disadvantage and prevent access to and utilization of quality medical care.[12-15] For instance, the neighborhoods' socioeconomic disadvantage has been well-associated with lack of access to and inadequate utilization of prenatal care.[16,17]

To explore the situation further, and for the first time in the Democratic Republic of Congo, based on the first nationally representative demographic and health survey; this study reports the effect of the proximal and socioeconomic disadvantage neighborhood, on obstetric care utilization, using the multilevel modeling technique.[18-20] The use of the multilevel modeling techniques that incorporate the hierarchical effect of the data structure would provide a greater insight into the effect of the socioeconomic status on obstetric care use at more than one level; and ease the proper interpretation of the result.

METHODS

Data source

The data analyzed in the study was part of the 2007 Democratic Republic of Congo Demographic and Health Surveys (EDS-RDC),[21,22] conducted from January to August 2007. The EDS-RDC demographic and health survey was funded by the United States Agency for International Development (USAID), Department for International Development (DFID), United Nations Children's Fund (UNICEF), United Nations Population Fund (UNFPA), and the World Bank, with technical assistance from the global Demographic and Health Surveys project (MEASURE DHS) of Macro International Inc. The survey was a nationally representative sample and used a multi-stage stratified cluster sampling procedure for sample collection. Face-to-face interviews using a semi-structured questionnaire were conducted, to obtain information on various demographic and health characteristics from the respondents in the selected households. The full details of the methods and procedure used in data collection in the EDS-RDC Demographic Health surveys has been published elsewhere.[23] The study population for this analysis were 6,695 women, aged between 15 and 49 years, nested within 299 communities across all the 11 provinces of the country.

Ethical considerations

This study is a secondary analysis of an existing survey data and is without any information that could be used to identify the respondents. The survey instrument received ethical permission from the National Ethics Committee in the Ministry of

Planning of the Congo Democratic Republic and the institutional review board of ORC Macro Inc.

Measures

Outcome variables

The main outcome variable in this study was whether a woman had used antenatal care and had institutional-assisted delivery for the most recent live birth or not. The women were specifically asked if they had attended antenatal care in a healthcare setting and subsequently delivered their most recent child in a healthcare facility, under the supervision of qualified healthcare personnel.

Explanatory variables

These are individual and community-level variables at both levels 1 and 2, as listed in Table 1. The contextual socioeconomic status was referred to as the neighborhood socioeconomic status. This was operationalized as a neighborhood socioeconomic disadvantaged index, using the principal component analysis (PCA),[24] as described in Table 1. The index allowed for the categorization of neighborhoods into both the least disadvantaged and most disadvantaged, based on the socioeconomic characteristics.

Statistical analysis

A multilevel logistic modeling technique was used in order to account for the hierarchical structure of the DHS data and the binary response of our outcome variable.

Multilevel logistic regression modeling

We specified a three-level multilevel logistic model as follows,

$$\text{logit}(\pi ijk) = \log[\pi ijk/(1-\pi ijk)] = \text{calis0} + \beta Xijk + u0jk + v0k \quad (1)$$

Where π_{ijk} is the probability of a woman *I*, residing in community *j*, in region k, having had antenatal care and having delivered the most recent child in a health facility, staffed with qualified health care personnel. The parameters on the right hand side of the equation X_{ijk} and β_0 are fixed parts and are basically estimating the vectors attributable to the explanatory coefficients at both the individual and community levels. The last two vectors u_{0jk} and v_{0k} are the random effects that denote unobserved factors at both the women and community levels, respectively.

Model specification

The three level models contained the following:

Table 1: Definitions of individual and contextual characteristics of the respondents

Variables individual-level	Definition
Woman's age (years)	Classified into three (15 – 24, 25 – 34, 35+) years
Woman's education	Classified as (no education, primary, secondary, and higher)
Woman's occupation	Classified as (not working, manual, professional)
Partner's education	Classified as (no education, primary, secondary, and Higher)
Partner's occupation	Classified as (not working, manual, professional)
Parity	categorized as (between 1 and 3, and 4+)
Household wealth Neighborhood level	The household wealth index was constructed using PCA, based on an individual respondent's households' possession of durable items. The indices were further classified into quartiles as first, second, third, fourth, and fifth, representing (poorest, poorer, middle, richer, richest)
Place of residence	Rural or urban
Neighborhood socioeconomic disadvantage index	Principal component analysis of: The proportion of respondents residing in rural areas, and the proportion of respondents who were jobless; the proportion of respondents living below the poverty level (below 20% quintile), and the proportion of respondents who were uneducated

Model 1 (the empty model), had no explanatory variable included. Model 2 (individual characteristic model), control for a set of individual-level explanatory variables at the level of the woman and households. Model 3 (community model), systematically adjust for both individual and community-level variables.

Measure of association

This is otherwise known as fixed effects. This estimates the association between the likelihood of a woman having attended antenatal care and the healthcare facility for delivery. The explanatory variables are expressed as odds ratio (OR) and standard errors (SE).

Measure of variation

This is otherwise known as 'random effects' and is expressed as variance partition coefficient (VPC) and proportional change in variance (PCV).[18,19]

The VPC measures the likelihood of a positive response to the outcome variable that is attributable to the community level. The entire analysis was performed based on the logit link function in STATA 11.0 for windows (Stata Corp, Inc., TX, USA). All parameters were estimated using the adaptive Gaussian quadrature (AGQ) maximum likelihood estimator.

RESULTS

In all, in this study, a total of 6,695 women who were part of the participants of the 2007 Democratic Republic of Congo demographic and health surveys were analyzed. Utilization of both the services was evenly distributed based on the sociodemographic factors and demographic characteristics, as shown in Table 2.

Multilevel analyses

The fixed effects (measure of association) and the random intercepts for the use of antenatal services and delivery care are presented in Table 3. For the utilization of antenatal care Model[a] (Empty model), there was significant variation in the log likelihood of using antenatal care across the neighborhoods (τ=1.19, P=0.001). As indicated by the intra-community correlation coefficient, based on the estimated variance component, 26% in the variability of using antenatal care services could be attributed the community-level factors. Despite controlling other bio-demographic and community-level characteristics in Models 1 and 2, respectively, the variation remained significant. Model 2, in Table 2, added the woman's individual level characteristics, as can be seen from Table 3. The log odds of using antenatal care by women who were in professional occupation and for those who were manual workers were 52% (OR=1.52; SE=0.18) and 21% (OR=1.21; SE=0.14) higher when compared with those of the women who were not working.

Relative to women whose partners were not working and those whose partners were into manual work, they had 27% (OR=0.73; SE=0.16) less likelihood of using antenatal care services. As shown by the proportional change in variance, 8.4% of the variability in the log odds of receiving antenatal care across the communities was due to the various individual-level factors. Model 3, additionally controlled for the community-level factors. Independent of other factors, women living in highly socioeconomic disadvantaged neighborhoods had 46% lower log odds of using antenatal care services compared to those from less socioeconomic disadvantaged neighborhoods. The intra-community correlation coefficient (τ=1.07, P=0.001), showed that 24% in the variability of using antenatal care services could be attributed to community-level factors. The proportional change in variance showed that 10% of the variability in use of antenatal care across communities was explained by individual-level factors and community-level factors in Models 2 and 3, respectively.

Similarly, Table 3, shows the result of modeling the effects of individual and neighborhood socioeconomic disadvantage on the odds of using the healthcare facility for delivery. Our empty model shows that 38% variability in log likelihoods of facility attended delivery is attributed to community-level factors. The variation remains constant even after controlling all other community-level characteristics. Successive addition of other variables at the level of women and household in Model 2, shows that the log likelihood of delivery at a healthcare facility, under the supervision of healthcare personnel, increases relatively with increasing household wealth status. The result specifically shows that relative to women from poorer households, women from the richest household have almost five times the log odds of utilizing the healthcare facility for child birth. Also compared to women with no education, women with higher education were 5% more likely to have delivered their child in a healthcare facility under the supervision of qualified health professionals. As shown by the estimates from the intra-community correlation coefficient (τ=1.74, P=0.001), almost 35% variability in the log odds of child delivery at a healthcare facility is due to women's other individual-level factors at the level of the household. A 12% estimate of the proportional change in variability of facility delivery observed around the community was explained by the women's individual level variables.

Model 3, for the utilization of healthcare facility for delivery additionally added the community-level variables in addition to individual level variables. The intra-community correlation coefficient remained significant, despite controlling for various individual- and

Table 2: Summary of sociodemographic profiles of 6,695 consenting women based on obstetric services utilization

	Antenatal		Delivery	
	Yes (%)	**No (%)**	**Yes (%)**	**No (%)**
Women's age (years)				
15–24	1,890 (31.0)	199 (33.1)	1,395 (31.8)	694 (30.1)
25–34	2,804 (46.0)	235 (39.2)	1,995 (45.5)	1,044 (45.2)
35+	1,401 (23.0)	166 (27.7)	996 (22.7)	571 (24.7)
Parity				
4+	3,488 (57.2)	331 (55.2)	2,436 (55.5)	1,383 (60.0)
1–3	2,607 (42.8)	269 (44.8)	1,950 (44.5)	926 (40.0)
Women's education				
No education	18 (0.3)	1 (0.2)	18 (0.4)	1 (0.04)
Primary	1,771 (29.1)	270 (45.0)	1,081 (24.7)	960 (41.6)
Secondary and higher	4,306 (70.7)	329 (54.8)	3,287 (78.8)	1,348 (58.4)
Women's occupation				
Not working	1,295 (21.3)	142 (23.7)	1,034 (23.6)	403 (17.5)
Manual	3,706 (60.8)	403 (67.2)	2,411 (55.0)	1,698 (73.5)
Professional	1,094 (18.0)	55 (9.2)	941 (21.5)	208 (9.0)
Partner's education				
No education	214 (3.5)	11 (1.8)	207 (4.7)	18 (0.8)
Primary	733 (12.0)	100 (16.7)	487 (11.1)	346 (15.0)
Secondary and higher	5,148 (84.5)	489 (81.5)	3,692 (84.2)	1945 (84.2)
Partner's occupation				
Not working	1,043 (17.1)	64 (10.7)	824 (18.0)	283 (12.3)
Manual	3,579 (58.7)	449 (74.8)	2,310 (52.7)	1718 (74.4)
Professional	1,473 (24.2)	87 (14.5)	1,252 (28.5)	308 (13.3)
Place of residence				
Rural	4,330 (71.0)	505 (84.2)	2,781 (63.4)	2,054 (89.0)
Urban	1,765 (29.0)	95 (15.8)	1,605 (36.6)	255 (11.0)
Wealth index				
Poorest	1,607 (26.4)	231 (38.5)	918 (20.9)	920 (39.8)
Poorer	1,502 (24.6)	173 (28.8)	962 (21.9)	713 (30.9)
Middle	1370 (22.5)	114 (19.0)	1,014 (23.1)	470 (20.4)
Richer	1300 (21.3)	66 (11)	1,169 (26.7)	197 (8.5)
Richest	316 (5.2)	16 (2.7)	323 (7.4)	9 (0.4)
Neighborhood economic status				
High	3,099 (50.8)	211 (35.2)	2,529 (57.7)	1,528 (66.2)
Low	2,996 (49.2)	389 (64.8)	1,857 (42.3)	781 (33.8)

community-level variables. The model fitting showed that 34% variability in the log odds of facility-based delivery was attributed to community-level factors. The effect of the household wealth factor on the utilization of the health facility for child birth remained significant and increased with an increasing wealth index. In addition, the result further showed that compared to women living in rural areas, those living in urban areas were 24% more likely to have delivered their child in a health facility. Also, compared to women whose partners were not working, those married to partners in a professional occupation were 8% more likely to have delivered at a health facility; similarly compared with women with no education, women with secondary or higher education were 11% more likely to have delivered at a healthcare facility.

Relative to those women residing in a low socioeconomic disadvantaged neighborhood,

Table 3: Multilevel model estimates of individual socio-economic, demographic and contextual socio-economic correlates of obstetric care utilization presented as odds ratios and standard errors

Variables	Model 1[a] OR (SE)	Model 2[b] OR (SE)	Model 3[c] OR (SE)	Model 1[a] OR (SE)	Model 2[b] OR (SE)	Model 3[c] OR (SE)
Measure of association						
Women's age in years						
35+ (ref)		1.00	1.00		1.00	1.00
15 – 34		1.42 (0.16)***	1.40 (0.16)*		2.15 (0.12)	1.08 (0.12)
25 – 34		1.47 (0.12)**	1.45 (0.12)***		1.03 (0.09)	1.04 (0.09)
Parity						
4+ (ref)		1.00	1.00		1.00	1.00
1-3		0.88 (0.12)	0.87 (0.13)*		1.23 (0.10)**	1.24 (0.21)**
Women's education						
No education (ref)		1.00	1.00		1.00	1.00
Primary		0.77 (1.09)	0.74 (1.09)		1.04 (1.10)*	0.68 (1.10)
Secondary and Higher		1.39 (1.10)	1.35 (1.10)		1.04 (1.10)*	1.11 (1.10)*
Partner's education						
No education (ref)		1.00	1.00		1.00	1.00
Primary		0.85 (0.39)	0.85 (0.39)		0.56 (0.31)	0.57 (0.31)
Secondary and Higher		0.93 (0.36)	0.94 (0.36)		0.62 (0.29)	0.62 (0.29)
Women's occupation						
Not working (ref)		1.00	1.00		1.00	1.00
Manual		1.21 (0.14)*	1.34 (0.14)*		0.64 (0.10)***	0.68 (0.10)***
Professional		1.52 (0.18)**	1.55 (0.18)**		0.93 (0.31)	0.93 (0.13)
Partner's occupation						
Not working (ref)		1.00	1.00		1.00	1.00
Manual		0.73 (0.16)*	0.74 (0.16)		0.81 (0.1)*	0.82 (0.10)*
Professional		0.97 (0.19)	0.94 (0.19)		1.12 (0.12)	1.08 (0.12)*
Wealth index						
Poorest (ref)		1.00	1.00		1.00	1.00
Poorer		0.98 (0.12)	0.93 (0.12)		1.06 (0.09)	1.04 (0.09)
Middle		1.13 (0.19)	1.04 (0.14)		1.25 (0.11)**	1.20 (0.10)
Richer		1.13 (0.19)*	1.13 (0.20)		1.99 (0.14)***	1.77 (0.14)***
Richest		1.38 (0.36)	1.08 (0.38)		5.47 (0.45)***	4.21 (0.41)***

those women who were residents of a highly socioeconomic disadvantaged neighborhood were 48% less likely to have delivered at a health facility. The result of the final model further showed that almost 15% variability in the log likelihood of having child birth at a health facility was due to both individual and community-level variables.

DISCUSSION

The main goal of this study was to examine the association between the individual and contextual socioeconomic status and obstetrics care utilization among women in the Democratic Republic of Congo. Our study is the first population-based study in the study setting, to confirm using nationally representative data, that residing in a highly socioeconomic disadvantaged neighborhood is associated with less likelihood of using antenatal and delivery care. The finding relating to the effects of contextual socioeconomic factors on the utilization of delivery and antenatal care use is new in sub-Saharan Africa. The result shows that after controlling all other individual bio-demographic and socioeconomic characteristics, women from richer households are more likely to have delivered their child at a healthcare facility. This finding reverberates what has been reported in other studies.[25,26]

This study documents that a woman's occupation is associated with the use of antenatal care services and a partner's occupation favors the use of a health facility for child birth. These findings are consistent with those of many others.[27-30] This study also complements other studies,[31-33] to document the positive effects of women's education on the utilization of the health facility for child birth. Another important finding from this study is the effect of living in an urban area on the utilization of facility-based delivery services. This corroborates the findings that have been reported earlier.[27]

The findings that emerge from this study are novel and of importance from a policy perspective. The findings document that both individual and contextual socioeconomic factors are important for availing both antenatal and delivery care among women, in the Congo Democratic Republic. As the country is at a stage of recovery and implementation of several health policies, information from this study may serve as a guideline to policy makers and health planners, to target intervention in the area where people in most need reside. Specifically, the economic part of the demand side of the utilization of maternal care in general, should be jointly considered along with the supply side.

The drawback in our study is our use of household possessions as our measure of socioeconomic status. Even as this may draw criticism, the methodology has been accepted by the World Bank and several other researchers[21,24,34] as the best means of estimating household wealth in low- and medium-income countries, where there is a paucity of data on income and expenditure. This fact, not withstanding, our study is nationally representative and covers the entire country. Thus, allowing for a conclusion to be drawn from the effect of the socioeconomic status on women in the Democratic Republic of the Congo, and how this affected their utilization of obstetrics care.

CONCLUSION

Based on the result of this analysis, there are socioeconomic differentials in the use of obstetric care services in Democratic Republic of Congo. An effort to improve maternal care utilization in a resource-limited setting and a country in transition such as the Democratic Republic of Congo, should address the combined role of individual and neighborhood socioeconomic characteristics. Additionally, on the demand side, adequate staffing of the healthcare facilities by professional trained health workers would further encourage the utilization of health facilities.

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