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ORIGINAL RESEARCH

Neighborhood socioeconomic disadvantage, individual wealth status and patterns of delivery care utilization in Nigeria: a multilevel discrete choice analysis

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Background: High maternal mortality continues to be a major public health problem in most part of the developing world, including Nigeria. Understanding the utilization pattern of maternal healthcare services has been accepted as an important factor for reducing maternal deaths. This study investigates the effect of neighborhood and individual socioeconomic position on the utilization of different forms of place of delivery among women of reproductive age in Nigeria.

Methods: A population-based multilevel discrete choice analysis was performed using the most recent population-based 2008 Nigerian Demographic and Health Surveys data of women aged between 15 and 49 years. The analysis was restricted to 15,162 ever-married women from 888 communities across the 36 states of the federation including the Federal Capital Territory of Abuja.

Results: The choice of place to deliver varies across the socioeconomic strata. The results of the multilevel discrete choice models indicate that with every other factor controlled for, the household wealth status, women's occupation, women's and partner's high level of education attainment, and possession of health insurance were associated with use of private and government health facilities for child birth relative to home delivery. The results also show that higher birth order and young maternal age were associated with use of home delivery. Living in a highly socioeconomic disadvantaged neighborhood is associated with home birth compared with the patronage of government health facilities. More specifically, the result revealed that choice of facility-based delivery is clustered around the neighborhoods.

Conclusion: Home delivery, which cuts across all socioeconomic strata, is a common practice among women in Nigeria. Initiatives that would encourage the appropriate use of healthcare facilities at little or no cost to the most disadvantaged should be accorded the utmost priority.

Keywords: delivery care, maternal health services utilization, multilevel discrete choice, Nigeria, socioeconomic disadvantaged, neigborhood, health policy

Introduction

Although maternal mortality is a worldwide problem, the difference in maternal death between the poor and rich regions is noticeable.[1] Of the estimated half a million pregnancy-related maternal deaths that occur worldwide, nearly all are in low- and middle-income countries.[2] Most of these deaths are due to direct obstetric causes such as hemorrhage, sepsis, and hypertensive disorders,[3] and are avoidable. This situation is particularly more critical in sub-Saharan Africa (SSA), where weakened health

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167

systems, poor health-seeking behavior, and abject poverty[4,5] have continued to fuel the increase. Nigeria has continued to witness a high maternal mortality ratio, with substantial variation across its regions.[6,7] According to one estimate, Nigeria has around 1100 deaths per 100,000 live births,[8] which makes the country a leading contributor to total global maternal deaths.[2] As in many other developing countries, the cause of maternal death in Nigeria is the same.[9,10] Skilled attended delivery in a medical facility has been well established as an effective means to reduce maternal mortality.[11,12] Despite this, in Nigeria use of reproductive health services remains low, and home delivery among women of child bearing age is widespread.[13]

The positive association between individual socioeconomic position (SEP) and utilization of health service is well established in the literature.[14] This association also holds true for the choice of place of delivery. However, there is evidence suggestive of significant variation in access to, and utilization of, care based on level of socioeconomic development of the neighborhood.[15] In the context of maternal reproductive health, and in some developed countries, living in socioeconomically disadvantaged neighborhoods has consistently been linked with inadequate prenatal care use,[16] and various birth outcomes.

While the influence of socioeconomically disadvantaged neighborhoods on maternal care use has been widely documented in affluent countries, there is a paucity of knowledge on such studies, particularly in Nigeria and SSA as a whole. Although, studies have been conducted in Nigeria to examine the determinants of choice of place to deliver,[17–21] most of these studies are limited in scope, and have yet to examine the influence of neighborhood socioeconomic characteristics on the alternative choices made by women nationally. In examining the situation further, this study draws from the Andersen's behavioral model for utilization of healthcare services,[22] and characterizes the influence of individual SEP and level of socioeconomic development of the neighborhood on the choice of place of delivery among women in Nigeria.

Material and methods

The data utilized in this study are based on the Nigerian Demographic and Health Survey (NDHS) conducted in 2008. The NDHS surveys are a series of nationally representative cross-sectional household survey of ever-married women aged 15 to 49 years, and are normally conducted in most low- and middle-income countries by ICF Macro, with financial sponsorship from the United States Agency for International Development (USAIDs).[23] The 2008 NDHS consist of 36,000 households across the 6 regions of the country, including the Federal Capital Territory Abuja. The sample is made up of 888 primary sampling units (PSUs) selected through a 2-stage stratified sampling technique. From each PSU, which sometimes is used as a proxy for communities or neighborhoods,[24] a random sample of women aged 15 to 49 years was selected and interviewed using a face-face approach with the aid of a semistructured questionnaire. Detailed information on the design and method used in data collection in NDHS surveys has been published elsewhere.[25] This study is restricted to 15,162 consenting women of reproductive age from 888 communities who had participated in the 2008 NDHS.

Ethical considerations

The collection of data used in this study follows the declaration of Helsinki.[26] The institutional review board documentation was duly obtained from both the Nigerian authority and ICF Macro Inc. Access to these data was obtained through Measure DHS and the Nigerian National Population Commission.

Study variables
Dependent variables

This study considered 3 dependent variables of the choice of place of delivery of the most recent live birth among women who had participated in the survey. The locations of the most recent live birth were classified into: (1) Government hospital, which comprised any healthcare facility maintained by government both at local and national level; (2) Private, which comprised any birth that took place at a private clinic owned by an individual, nongovernmental or religious organization; (3) Home, for birth delivery which occurred at home.

Independent variables

The independent variables used in this study are described in Table 1. For the purpose of this study, we used a neighborhood socioeconomic disadvantage index as a measure of socioeconomic development of the communities in which each woman resides. The index was developed using principal component analysis,[27] based on 4 variables as shown in Table 1. Scores from this continuous index, with a mean value of 0 and standard deviation of 1, were then used to categorize socioeconomic disadvantage into 2 categories (lower and higher). A higher score on this index denotes most socioeconomically disadvantaged neighborhoods and a lower score implies least socioeconomic disadvantaged neighborhoods.

Table 1 Definitions and measures of individual- and neighborhood-level variables used in the study

Variables	Measures
Individual-level variables	
Woman's age (years)	Categorized as (15–24, 25–34, 35+) years
Woman's education	Categorized as (no education, primary, secondary, higher)
Woman's occupation	Categorized as (not working, manual, professional)
Partner's education	Categorized (no education, primary, secondary, higher)
Place of residence	Rural or urban
Health insurance coverage	Yes or no
Parity categorized as (between 1–3, 4+)	
Household wealth index	Household wealth index was constructed based on possession of durable items such as; radio-set, refrigerator, television, and motorcar, quality of dwelling such as floor type or roof type, using PCA. This resulting index was then grouped as (poorest, poorer, middle, richer, richest)
Neighborhood-level variables	
Physician-provided community prenatal care	Categorized as (low or high)
Geographic regions	Categorized as (1) North Central, (2) North East, (3) North West, (4) South East, (5) South South, and (6) South West
Region of residence	Categorized as (not working, manual, professional)
Neighborhood socioeconomic disadvantage index	The index was composed of: Proportion of respondents living in rural areas; proportion of respondent who were unemployed; proportion of the respondent living below the poverty level (<20% quintile); and proportion of respondent who are uneducated. The resulting index was grouped as (low or high)

Abbreviation: PCA, principal component analysis.

This classification has been used in many studies, where the focus is on the effect of area economic disadvantage on health and health outcome.[28,29]

Statistical analysis

We applied the multilevel discrete choice modeling technique, after taking into consideration the multiple options for the choice of place of delivery and the clustered structure of our data where women are nested within households, and in turn nested in communities.[30–32] We modeled individual woman's choice of delivery place and quantified the effects of individual measure of socioeconomic status and neighborhood socioeconomic disadvantage on the choices made. Following the general discrete choice modeling approach, we took home delivery as one of the dependent categories as our reference. Next, we estimated a set of $t-1$ logistic regressions on the two remaining choices of delivery place and contrasted each one of these against home delivery. Using a logit link function, we specified a 2-level multilevel discrete choice model as shown in equation 1:

$$\log\left(\frac{\pi_{ij}^{(s)}}{\pi_{ij}^{(t)}}\right) = \beta_{0j}^{(s)} + \beta_{1j}^{(s)}x_{1ij} + \beta_{2j}^{(s)}x_{2ij}. \quad (1)$$

A separate set of intercepts was estimated for the reference and for both government and private hospital as shown

by the subscript s, where π_{ij} is the probability of delivery at either government or private hospital i, for a pregnant woman j, and $\beta_{0j}^{(s)}$ is a parameter associated with the fixed part of the model. Such that, for every 1-unit increase in X (a set of predictor variables) there is a corresponding effect on the probability of choosing category s (ie, private or government) relative to the reference t. To capture the extent by which choice of different options of place of delivery (s), which are contrast specific, varies randomly at the individual woman's level, we used intraclusters correlation (ICC) as our measure of random effects.[33] This is illustrated in equation 2:

$$\rho = \frac{\tau}{\tau + \pi^2/3} \quad (2)$$

In this equation, τ denotes the estimated variance. Data analyses were conducted using MLwiN version 2.02 software.[30] The statistical significance of the explanatory variables was estimated using Wald statistics, with all results at 5% alpha level considered significant. The results of the fixed (measure of association) effects were presented as odds ratio (OR) at their 95% confidence intervals (95% CIs).

Results

Of the 15,162 women who had participated in the survey and whose data were analyzed in this study, 46% were aged

Table 2 Sociodemographic and economic profiles of women, by place of delivery according to Nigerian Demographic and Health Surveys 2008

Variables	Total N (%)	Home N (%)	Government N (%)	Private N (%)
Age (years)				
35+	4193 (27.6)	3007 (71.7)	792 (18.9)	394 (9.4)
25–34	6986 (46.1)	4787 (68.5)	1441 (20.6)	758 (10.9)
15–24	3983 (26.3)	3058 (76.8)	643 (16.1)	282 (7.1)
Parity				
1–3	6923 (45.6)	4566 (66.0)	1520 (22.0)	837 (12.0)
4+	8239 (54.4)	6286 (76.3)	1356 (16.4)	597 (7.3)
Education level				
No education	8483 (55.9)	7587 (69.9)	710 (24.9)	186 (12.9)
Primary	3402 (22.5)	2168 (19.9)	804 (27.9)	430 (29.9)
Secondary/higher	3277 (21.6)	1097 (10.1)	1362 (47.3)	818 (57.0)
Partner's education				
No education	6947 (45.8)	6270 (90.3)	532 (7.7)	145 (2.0)
Primary	3087 (20.4)	2095 (67.9)	626 (20.3)	366 (11.9)
Secondary/higher	5128 (33.8)	2487 (48.5)	1718 (33.5)	923 (18.0)
Health insurance				
No	14988 (98.8)	10825 (72.2)	2786 (18.6)	1377 (9.2)
Yes	174 (1.2)	27 (15.5)	90 (51.7)	57 (32.8)
Woman's occupation				
Not working	4871 (32.1)	3912 (80.3)	687 (14.1)	272 (5.6)
Manual	5158 (34.0)	3728 (72.3)	927 (17.9)	503 (9.8)
Professional	5133 (33.8)	3212 (62.6)	1262 (24.6)	659 (12.8)
Household wealth				
Poorest	4511 (29.7)	4163 (92.3)	240 (5.3)	108 (2.4)
Poorer	3902 (25.7)	3293 (84.4)	428 (10.9)	181 (4.6)
Middle	2996 (19.7)	2094 (69.9)	635 (21.2)	267 (8.9)
Richer	2269 (14.9)	1011 (44.6)	873 (38.5)	385 (16.9)
Richest	1484 (9.7)	291 (19.6)	700 (47.2)	493 (33.2)
Region				
North Central	3055 (20.2)	1809 (59.2)	838 (27.4)	408 (13.4)
North East	3734 (24.7)	3222 (86.3)	467 (12.5)	45 (1.2)
North West	4648 (30.6)	4268 (91.8)	345 (7.4)	35 (0.8)
South East	794 (5.2)	342 (43.1)	191 (24.1)	261 (32.9)
South West	1423 (9.4)	803 (56.4)	392 (27.5)	228 (16.1)
South South	1508 (9.9)	408 (27.0)	643 (42.6)	457 (30.4)
Place of residence				
Urban	3461 (22.8)	1609 (46.5)	1184 (34.2)	668 (19.3)
Rural	11701 (77.1)	9243 (78.9)	1692 (14.5)	766 (6.55)
Community antenatal				
Low	7579 (49.9)	7106 (93.7)	378 (5.0)	95 (1.3)
High	7583 (50.1)	3746 (49.4)	2498 (32.9)	1339 (17.7)
Neighborhood economic disadvantage				
Low	6538 (43.2)	3299 (50.4)	2129 (32.6)	1110 (17.0)
High	8624 (56.8)	7553 (87.6)	747 (8.7)	324 (3.7)

25 to 34 years, almost (56%) having no formal education. Most of these women (98%) had no form of health insurance and (26%) were from poorer households. Out of the total population, 71% gave birth at home and almost one-third were manual workers.

Multilevel discrete choice modeling

Table 3 presents the parameter estimates of multilevel discrete choice modeling.

Women with secondary or higher education and at least primary education were more likely to use government health facilities than choose home delivery for child birth than women with no formal education (OR 2.43; 95% CI 2.28, 2.58; OR 1.26; 95% CI 1.11, 1.42). Similarly, women whose partners had secondary and higher education and at least primary education were more likely to use government facilities than choose home delivery than women whose partners had no formal education (OR 1.41; 95% CI 1.28,

Table 3 Multilevel discrete choice analysis of neighborhood and individual socioeconomic determinants of place of delivery based on 2008 Nigerian Demographic and Health Surveys presented as odds ratios at 95% CI

Variables	Government (home)	Private (home)
Fixed effect:		
Age (years)		
35+	1	1
25–34	0.80 (0.69–0.91)[b]	0.77 (0.62–0.91)[b]
15–24	0.81 (0.66–0.98)[a]	0.75 (0.55–0.95)[a]
Parity		
1–3	1	1
4+	0.81 (0.70–0.92)[b]	0.77 (0.63–0.91)[b]
Education level		
No education	1	1
Primary	1.39 (1.25–1.53)[b]	1.81 (1.61–2.01)[b]
Secondary/higher	2.43 (2.28–2.58)[b]	3.38 (3.16–3.59)[b]
Partner's education level		
No education	1	1
Primary	1.26 (1.11–1.42)[a]	1.39 (1.18–1.60)[b]
Secondary/higher	1.41 (1.28–1.57)[b]	1.50 (1.28–1.72)[b]
Health insurance		
No	1	1
Yes	1.72 (1.39–2.05)[b]	2.00 (1.65–2.35)[b]
Woman's occupation		
Not working	1	1
Manual	1.00 (0.89–1.13)	0.97 (0.97–1.14)[b]
Professional	1.23 (1.11–1.35)[b]	1.16 (1.00–1.32)[b]
Wealth index		
Poorest	1	1
Poorer	1.29 (1.11–1.47)[a]	1.11 (0.96–1.27)
Middle	1.65 (1.45–1.88)[a]	1.37 (1.16–1.62)[b]
Richer	2.88 (2.66–3.10)[b]	1.45 (1.21–1.82)[b]
Richest	4.45 (4.22–4.70)[b]	1.86 (1.45–2.38)[b]
Neighborhood-level:		
Region of residence		
North Central	1	1
North East	0.55 (0.31–0.79)[b]	0.10 (–0.32 to 0.53)
North West	0.31 (0.10–0.56)[b]	0.10 (–0.37 to 0.58)
South East	0.79 (0.50–1.08)	2.08 (1.70–2.45)[b]
South West	0.50 (0.25–0.75)[b]	0.47 (0.14–0.80)[a]
South South	1.41 (1.16–1.65)[a]	1.79 (1.48–2.10)[b]
Place of residence		
Urban	1	1
Rural	0.94 (0.74–1.14)	0.68 (0.41–0.95)
Community-level variables		
Community antenatal		
Low	1	1
High	2.90 (2.68–3.11)[b]	3.01 (2.64–3.37)[b]
Neighborhood economic disadvantage		
Low	1	1
High	0.63 (0.42–0.82)[b]	1.21 (0.87–1.67)
Random effect		
Intercept	0.30 (0.22–0.41)[b]	0.34 (0.21–0.53)[b]
Community-level variance (SE)	1.80 (0.05)[b]	1.13 (0.04)[b]
ICC (%)	35.2	25.5

Notes: $P < 0.05$; [a]$P < 0.01$; [b]$P < 0.001$.
Abbreviations: SE, standard error; ICC, intracluster correlation; CI, confidence interval.

1.57; OR 1.26; 95% CI 1.11, 1.42). Also, women with health insurance were 72% more likely to use government facilities than choose home delivery for child birth than women without health insurance. Professional women were more likely to use government facilities than choose home delivery than women not working or in a manual occupation (OR 1.23; 95% CI 1.11, 1.35). Women ≤34 years and with birth order of ≥4 were less likely to use government and private health facilities for child birth than women ≥35 years, and those with birth order of ≤3 (OR 0.80; 95% CI 0.69, 0.91; OR 0.81; 95% CI 0.66, 0.98; OR 0.81; 95% CI 0.70, 0.92).

Women from the richest household were >4 times more likely than women from poorest households to use government facilities for child birth (OR 4.45; 95% CI 4.22, 4.70). In general, the likelihood of using government facilities relative to home delivery increased with increasing household wealth. Women living in communities with a higher rate of antenatal care were almost 300% more likely to use government facilities for child birth than women living in communities with a lower rate of antenatal care. The likelihood of using government facilities for child birth was lower (OR 0.63; 95% CI 0.42, 0.82) for women residing highly socioeconomic disadvantaged neighborhoods than that of those residing in low socioeconomically disadvantaged neighborhoods. The results of the random effect model showed that 35.2% variability in the log likelihoods of women's decision to use government facilities for child birth relative to home delivery could be attributed to other unobserved characteristics at the community level ($r = 1.80$; $P < 0.0001$).

Women from the North Eastern and North Western geographic regions were less likely to use government facilities for child birth than women from the North Central geographic region (OR 0.55; 95% CI 0.31, 0.79; OR 0.31; 95% CI 0.10, 0.59). Likewise, women from the South Western geographic region were less likely to use government facilities for child birth relative to those from the North Central geopolitical region (OR 0.50; 95% CI 0.25, 0.75). However, women from the South South region were 41% more likely to use government facilities for child birth than their counterparts from the North Central region (OR 1.41; 95% CI 1.16, 1.65). There were no associations between place of residence and likelihood of using government facilities compared with home delivery.

Home and private hospital

Women from the richest households were more likely than women from the poorest households to choose a private hospital over a home delivery (OR 1.86, 95% CI 1.45, 2.38).

Professional women were more likely than those not working to choose private hospitals over home delivery (OR 1.16, 95% CI 1.00, 1.32). However, the likelihood of using private hospitals for child birth relative to home delivery was lower for women who were in a manual occupation (OR 0.97, 95% CI 0.97, 1.14). Also, the odds of using private hospitals compared with home delivery decreased with decreasing age, women of age group 25 to 34 and those within the age range 15 to 24 having lower likelihoods (OR 0.77, 95% CI 0.62, 0.91; OR 0.75, 95% CI 0.55, 0.91), respectively, than those of age group ≥35 years. Likewise, women with birth order of ≥4 had a lower likelihood (OR 0.77, 95% CI 0.63, 0.91) of using private hospitals than home delivery. Women whose partner had a secondary and higher, and at least primary education, were more likely than women whose partner had no education to use private hospitals than home delivery (OR 1.50, 95% CI 1.28, 1.72; OR 1.39, 95% CI 1.18, 1.60). Similarly, women with secondary and higher education, and at least primary education, were more likely than women without any form of education to choose private hospitals over home delivery (OR 3.38, 95% CI 3.16, 3.59; OR 1.81, 95% CI 1.61, 2.01). Women with health insurance and those residing in a community with a high level of physician-attended antenatal care were 100% and 300%, respectively, were more likely to use private hospitals for delivery.

The likelihood of using private hospitals relative to home delivery increased with increasing household wealth index. Women from the richest households, and those at the fourth and middle level of wealth index, were 86%, 45%, and 37% more likely to use a private hospital for child birth than women from the poorest households, respectively. Use of private hospitals relative to home delivery varied widely across the regions. Women from the South South and South East regions were more likely than women from the North Central region to choose private hospitals over home delivery (OR 1.79, 95% CI 1.48, 2.10; OR 2.08, 95% CI 1.70, 2.45). Women from the South West region were 53% less likely to using private hospitals for child birth than women from the North Central region. The results of the unconditional model, however, show that 25% of the variability in the log odds of using a private hospital compared with home delivery could be attributed to the community ($r = 1.13$; $P < 0.0001$). This variation remained significant across women and across the community.

Discussion

The results of this study have demonstrated the role played in the choice of delivery location by neighborhood economic status and individual SEP among women of reproductive age in Nigeria. Our study, to the best of our knowledge, is the first in Nigeria and in SSA to document that living in a highly socioeconomic disadvantaged neighborhood is associated with greater use of home for child birth than government health facilities even after controlling for women's SEP and that of her household. However, this study shows no contextual socioeconomic association for the choice of private hospital compared with home among the women. Our assertion that increasing household wealth status is associated with use of private and government health facilities for child birth was established, and thus corroborates what has been previously reported.[34,35] Consistent with other studies in Nigeria,[18,21,36] and from other parts of the world,[35,37] this study found a strong influence of education and occupation on use of government and private health facilities for child birth. Multilevel modeling analysis shows that women in professional occupations and those with a higher level of education were more likely to use both these facilities than home for child birth. This finding is expected, given the fact that educational attainment and occupation are sources of economic resources which empower women to take charge of their own health and facilitate easy access to quality maternal care. Our study goes further, and supports another study,[38] in documenting the role of the partner's education in the choice of both private and government health facilities over child birth. In particular the result shows that women having partners with a higher level of education tend to use either of these facilities rather than giving birth at home.

Lack of adequate health insurance mechanisms coupled with huge out-of-pocket expenses has long been recognized as a major challenge to healthcare financing in Nigeria.[39] Hence, it is not surprising in this study that only those women who had any form of health insurance were able to use either private or government health facilities for child birth, while those without engaged in home delivery. This finding is not new, and is consistent with those of others.[14,40] Possession of health insurance is an indication of wealth, and according to various health benefits packages across SSA would be instrumental in improving access to maternal health care utilization.[41]

Our analysis also revealed that living in a neighborhood where antenatal attendance is higher favors the patronage of both government and private health facilities for child birth. The probable reason for this finding might be related to the intensified health awareness campaign which tends to reaffirm the importance of using preventive maternal health care services around the communities. Background characteristics

such as parity and maternal age at birth are well known to influence choice of delivery place and improve access to maternal healthcare in addition to economic ability.[42] This study's results show that women of younger age at child birth were less likely to use both the government and private health facilities for child birth than older women at child birth. This finding agrees with those of many others in SSA and in other developing regions of the world.[37,43,44] Specifically, studies have shown that older women are more knowledge-able in terms of health service use than younger women and adolescents, and sometimes more influential in household decision making on the use of health care facilities for child birth.[45–49] In addition, advancing maternal age is known to be a risk factor for poor maternal birth outcomes, and this may sometimes warrant the use of health facilities by older pregnant women.[50]

On the other hand, limited empirical analysis has found mixed results on the effect of women's age on the utilization of healthcare services. McTavish and colleagues,[51] in their study that looked at the effect of national female literacy and individual socioeconomic position on maternal health care use in some countries in SSA, reported that both younger and older mothers had a similar risk of low likelihood of access to maternal healthcare. The main reasons for these mixed findings could be various, including culture, belief, ethnicity, and associatin with a traditional group.[46,49,52,53]

Study limitations and strength

This study, like every other study in developing countries with a focus on health services use, could be criticized for using indirect methods for measuring household wealth. The main reason is attributed to the paucity of reliable data on income and expenditure in most low- and middle-income countries. The asset-based index method of quantifying household wealth has thus become the most widely used methodology and has been accepted by the World Bank as a good proxy for wealth at household level. In spite of this limitation, the strength of our study is clear. It is nationally representative study with a large sample size.

Conclusion

This study has documented the importance of both individual and contextual socioeconomic status on the access to and utilization of appropriate care for child birth among women of reproductive age in Nigeria. This initiative, which aimed to ensure that women before and during the period of birth had unhindered access to maternal care, should be given a priority at all levels. In implementing the initiative, efforts should

be made to consider the level of economic development of the communities where these women reside in addition to the economic ability of their respective households. More importantly, the fact that many more women, despite living in an urban area, still had home delivery is of concern and points to the existence of concentrated neighborhood poverty.

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Disclosure

The authors declare that they have no competing interests in relation to this work.

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