# Choice of place of delivery in Nigeria: examining spatial pattern

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## Extended Abstract

### Introduction

Access to quality healthcare during pregnancy and in particular, during delivery is a crucial factor in explaining the huge disparity in maternal and perinatal mortality and morbidity between developing and the industrialized world. Nigeria is making much slower progress in maternal and child health indicators among other developing countries. The country has one of the leading maternal mortality ratio estimated at 545 maternal deaths per 100,000 live births in 2008 and 840 maternal deaths in 2010 (NPC and ICF Macro, 2009, UNDP, 2012). An emerging consensus has it that, these deaths can be prevented if deliveries are overseen by skill attendants. Most birth that take place at home are often attended to by relatives or at best, having own experience of childbirth (Wagle et al., 2004). Increasing the percentage of births delivered in health facilities is an important factor in reducing deaths arising from the complications of pregnancy. The expectation is that if complication arises during delivery, a skilled health worker can manage it or refer the mother to the next level of care.

There are a number of evidence that suggest that distance to health care facilities is a strong determinant of the choice of maternal health services. Several studies have assessed individual and household determinants in relation to utilization of maternal health services. Others have shown that maternal educational level and occupation, religion and occupation of spouse were found to be most consistently associated with the use of health institutions for delivery whereas, maternal age, parity,

marital status and place of residence are not significantly associated (Nwakoby, 1994). Utilization of healthcare services varies substantially across geographical locations in Nigeria resulting in lopsided health indicators in the country (FMOH [Nigeria], 2009, NPC and ICF Macro, 2009). It is therefore necessary to quantify spatial effect of state of residence on the choice of place of delivery among women in Nigeria in order to identify areas with increased or decreased risk. By highlighting health-seeking behaviour of women during deliveries according to their district of residence, resource allocation, health promotion campaigns and improved delivery of services can be tailored-designed to the needs of the areas as any potential policy intervention is more effective when planned at local level (Kazembe et al., 2006).

## Material and Method

### *Data*

The data analyzed in this study were collected as part of the 2008 NDHS. This data set is considered more appropriate for the study because it is a nationally representative sample, with a relatively large number of observations on the outcome variable. Moreover, it contains detailed geographical information that would permit spatial modelling. The 2008 NDHS employed a two-stage sampling design. At the first stage, 888 clusters (enumeration areas), 286 in urban areas and 602 in rural areas were selected. The enumeration areas were based on the census frame of the Population and Housing Census (PHC) of the Federal Republic of Nigeria conducted in 2006. At the second stage, a total of 36,298 households were selected for interview. In the interviewed households, a total of 34,596 women were identified to be eligible for the individual interview, and 97 percent of them were successfully interviewed.

### *Data Analysis*

The choice of place of delivery was modelled using the multinomial logit model within the framework of generalized linear mixed model (Fahrmeir and Kneib, 2011, Fahrmeir and Lang, 2001). The following four categorical response variables, $Y_{ij}$ , were defined for place of delivery

$$Y_{ij} = \begin{cases} 1 & \text{home delivery} \\ 2 & \text{public sector} \\ 3 & \text{private sector} \\ 4 & \text{others} \end{cases} \tag{1}$$

for woman *j* in area *i*. The response variable, $Y_{ij}$, is considered as a realization of some latent variable $U_{ij} = \eta_{ij} + \varepsilon_{ij}$, which the $j^{th}$ woman maximizes, where $\eta_{ij}$ is the predictor and $\varepsilon_{ij}$ is the error term. A woman chooses the $r^{th}$ place to deliver her baby if such place offers maximum benefit. Those benefits could be in terms of perceived quality of care, service or transport cost, time constraints or other similar opportunity cost.

The choice of the $r^{th}$ place of delivery is modelled as the probability of selecting that place category against some reference category. The influence of covariates are modelled using a multinomial logit model

$$P\left(Y_{ij} = r\right) = \frac{exp\left(\eta_{ij}^{(r)}\right)}{1 + \sum_{t=2}^{4} exp\left(\eta_{ij}^{(t)}\right)} \qquad r = 2,3,4 \tag{2}$$

the predictor $\eta_{ij}^{(r)}$ is given by

$$\eta_{ij}^{(r)} = v'\gamma^{(r)} + f_{ij}^{(r)}\left(x_{ij}\right) + f_{spat}^{(r)}\left(s_i\right). \tag{3}$$

Bayesian inference was based on multicategorical linear mixed model representation where the variance components $\tau_{\varepsilon}^{2}$, corresponding to the inverse smoothing parameters in a frequentist approach, are estimated via restricted maximum likelihood/marginal likelihood estimation.

**Results of spatial effects**

Figures 1 and 2 present the residual spatial effect of choice of place of delivery at state level in Nigeria, after controlling for all other factors, in addition to the unstructured spatial effect. Figures 1 (a), and 2 (c, e, & g) present the posterior effect while Figures 1 (b) and 2 (d, f & h) show the corresponding map of credible interval, used in accessing the significance of the spatial effects for models M1 and M2 respectively. From this, states with white (black) colour are associated with significant increased (decrease) odds for a particular choice versus home delivery while the effects are not significant for states in gray colour. Results showed that the likelihood of deliveries taking place at health sector against home delivery is significantly high in only four of the thirty-seven states, namely: Edo, Ekiti, Kogi and Imo while this is not significant for all the other states.

Figure 2 shows that the net effect of deliveries at public health sector against home, after adjusting for other covariates, is not significant for any of the thirty seven states. However, huge variation exists

among the states for deliveries made at private sector against home with similar pattern observed for neighbouring states. Specifically, deliveries taking place at privates health facilities against home was significantly low in the Northern states of Adamawa, Borno, Jigawa, Kebbi, Niger, Sokoto and Yobe while it is significantly high in Anambra, Benue, Edo, Imo, Kogi, Lagos,Ogun, Osun and Oyo. The effect is not significant in all the other states including the Federal Capital Territory, Abuja. Comparing with deliveries that take place in other places against home, findings from Figure 2 (g & h) reveal that the likelihood of deliveries taking place at other places against home is significantly high in Ekiti, Kwara and Lagos states.

(a) (b)

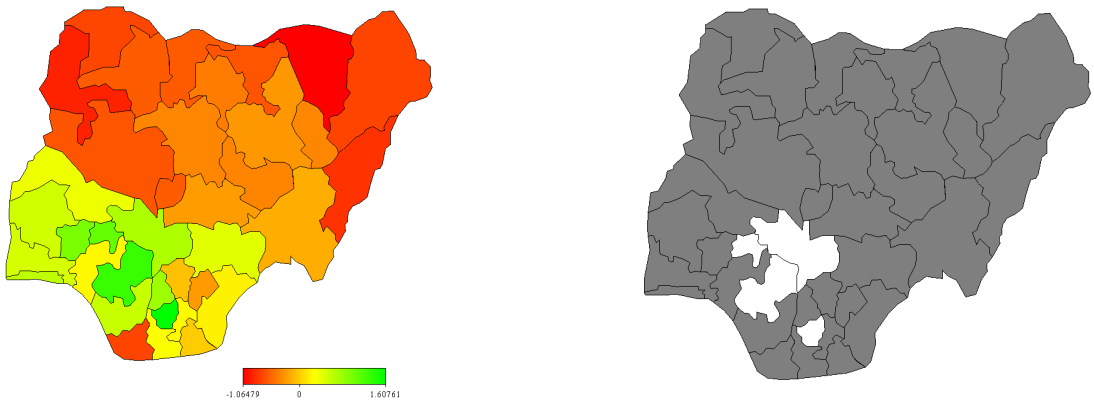


Fig. 1: Maps of Nigeria showing nonlinear spatial effect of health sector versus home delivery (a) and its corresponding 95% posterior probability (b)

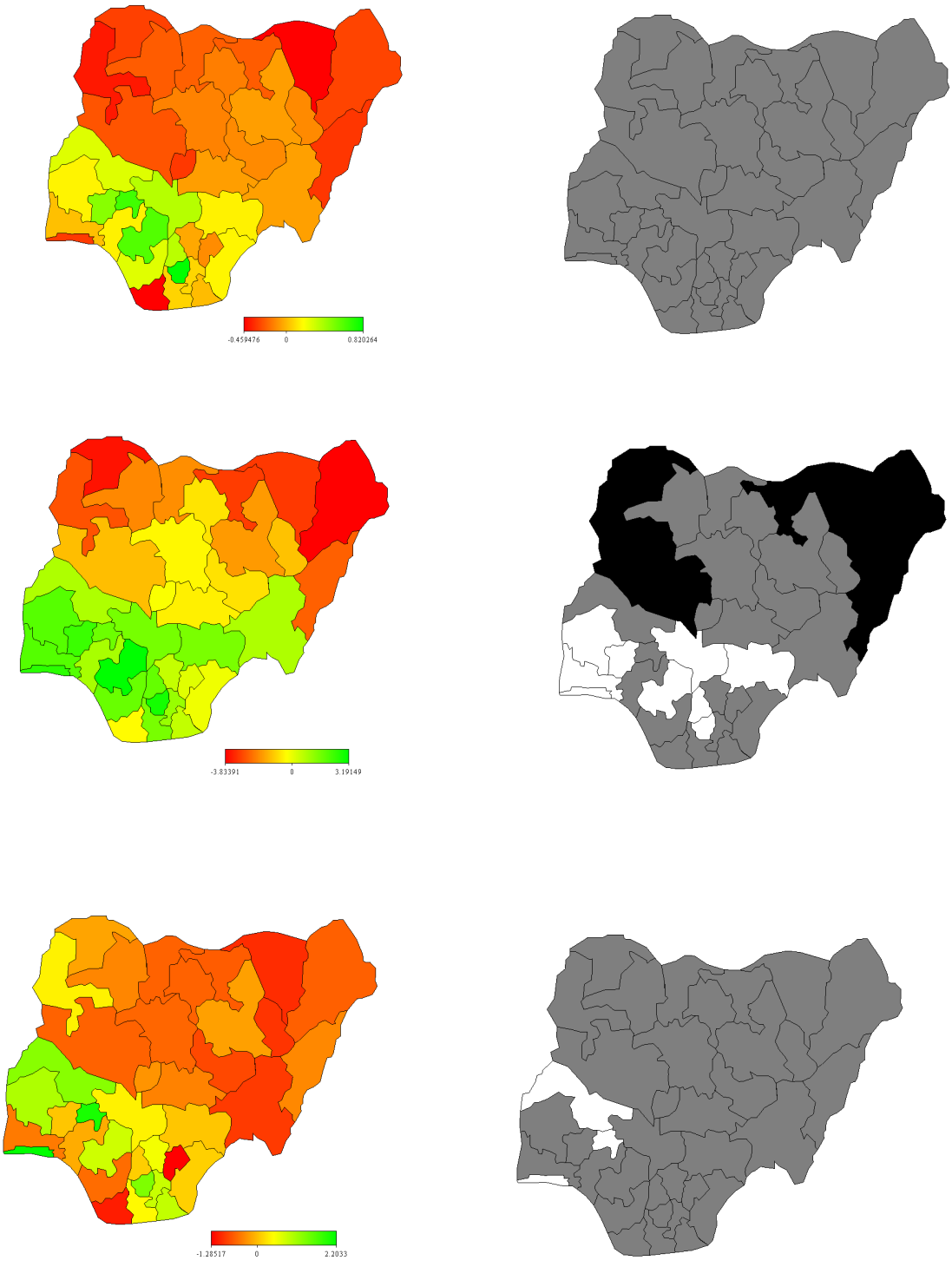


Fig 2: Maps of Nigeria show nonlinear spatial effect of (a) public sector versus home delivery and (b)its corresponding 95% posterior probability; (c) private sector versus home delivery and (d)its corresponding 95% posterior probability; (e) other places versus home delivery and (f)its corresponding 95% posterior probability

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