Modelling level, trend and geographical variations in stigma and discrimination against people living with HIV/AIDS in Nigeria
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Abstract
People living with HIV and AIDS (PLHA) often face stigma and discrimination. Stigma is a powerful tool for social control and PLHA are to varying degrees stigmatised against. Consequences of stigma and discrimination against PLHA may result in low turn-out for HIV counselling and testing, identity crises, isolation, loneliness, low self-esteem and lack of interest in containing the disease. To achieve the millennium development goal on HIV reduction, efforts should be targeted at measuring impact of HIV preventive interventions. In this paper, effort was made to explore geographical variations in addition to level and trend of accepting attitude towards PLHA using 2003 - 2007 population-based household survey data. Inferences are based on Markov Chain Monte Carlo techniques, while model selection was based on Deviance Information Criteria. Findings revealed significant positive trend and spatial variations on level of accepting attitude towards PLHA. Level of exposure to HIV prevention interventions and perceptions about social support received on HIV are significantly associated with accepting attitude towards PLHA. Findings provide policy makers with tools to discern states where prevention efforts on HIV-related stigma and discrimination should be intensified. This in turn, can enhance an effective utilization of scarce resources that is paramount in developing countries.

Keywords: Markov Chain Monte Carlo technique, probability sampling procedure, Nigeria, perception about social support, spatio-temporal, stigma and discrimination.

Résumé
Les personnes vivant avec le VIH et le Sida (PVVS) se trouvent souvent confrontées à la stigmatisation et la discrimination. La stigmatisation constitue un outil de contrôle social puissant et les PVVS sont stigmatisés à des degrés variables. Les conséquences de la stigmatisation et de la discrimination à l’encontre des PVVS peuvent résulter sur une faible participation aux services de conseil et de dépistage du VIH, des crises d’identité, une isolation, une mauvaise estime de soi et un manque d’intérêt dans le confinement de la maladie. Pour pouvoir atteindre l’objectif du Millénaire pour le développement réduction du VIH, des efforts devraient être axés sur la mesure de l’impact des interventions de prévention du VIH. Dans cet article, un effort d’étude des variations géographiques a été réalisé en plus de la mesure et de la tendance d’une attitude d’acceptation à l’égard des PVVS en utilisant les données d’une étude réalisée auprès des ménages de 2003 - 2007. Les inferences sont basées sur les techniques Monte Carlo par chaîne de Markov (MCMC), la sélection du modèle étant basée sur le Critère information de la Déviance. Les conclusions ont révélé une tendance positive et des variations spatiales significatives quant au niveau de l’attitude d’acceptation à l’égard des PVVS. Le niveau d’exposition aux interventions de prévention du VIH et les perceptions du support social reçu sur le VIH sont étroitement associés à une attitude d’acceptation à l’égard des PVVS. Les conclusions fournissent aux décideurs des outils permettant de discerner des situations dans lesquelles les efforts de prévention en matière de stigmatisation et de discrimination associées au VIH devraient être intensifiés. Ceci peut à son tour favoriser la bonne utilisation de ressources rares, essentiel dans les pays en développement.

Mots clés: Technique Monte Carlo par chaîne de Markov, procédure d’échantillonnage aléatoire, Nigeria, perception sur le soutien social, spatio-temporel, stigmatisation et discrimination.
Introduction

Of the health problems throughout the world, HIV/AIDS poses the greatest threat to the populace and its environs with deaths from AIDS estimated at about 2.1 million in 2007, while 33.2 million adults and 2.5 million children continue to live with the virus. Developing countries, especially sub-Saharan African countries, are the worst affected with an estimated 1.6 million deaths in 2007 and 22.5 million individuals currently living with HIV/AIDS (FM0H, 2008a; UNAIDS, 2007a). According to WHO (2003), HIV/AIDS remains the major cause of death in the sub-Saharan African region for over a decade. In Nigeria with a population of over 140 million people (Federal Republic of Nigeria Official Gazette, 2009), estimates of the adult HIV prevalence from pregnant women attending antenatal clinics (ANC) has progressively increased from 1.8% in 1991 to 5.8% in 2001 when it reached the highest peak, before dropping to 5.0% in 2003 and a further decline to 4.4% in 2005. These prevalence translated to an estimated 2.86 million individuals living with HIV in Nigeria in 2005 (FM0H, 2002, 2006a; UNAIDS, 2007b, UNAIDS, 2007c, and USAID/PEPFAR, 2008). Evidence from descriptive analysis of the studies mentioned above revealed substantial geographical variations of HIV prevalence at the geopolitical zonal level which is highly aggregated and may conceal information.

Usually, HIV stigma is expressed through social ostracism, personal rejection, direct and indirect discrimination as well as laws that deprive people living with or affected by HIV and AIDS of their basic rights (IAIDS, 2007). Since the beginning of the epidemic, HIV/AIDS-related discriminations are often widely reported in employment, healthcare, insurance and education. HIV/AIDS-related stigma arises mostly from fear and ignorance about the disease and/or hostility and existing prejudices about the groups most affected by it. Discrimination is the unfair treatment meted out on the people on the basis of their actual or suspected HIV status. Examples of discriminatory practices include pre-employment HIV testing, denial of employment to people who test positive, harassment in the workplace and pressure to resign. UNAIDS (2000) describes discrimination as an aspect of stigma defined as a form of exclusion, or restriction of expression, marginalisation, or restriction of access to something or services. See also Gilmore and Somerville (1994).

Major factors that contribute to HIV/AIDS-related stigma include the fact that HIV is a life-threatening disease, lack of understanding about the disease, biased media reporting of HIV-related news, religious or moral beliefs that having HIV/AIDS is as a result of moral fault such as promiscuity that deserves to be punished. With a widespread belief that HIV/AIDS is shameful, this provides a powerful basis for both stigma and discrimination against PLHA. People often have relatively extreme negative and promiscuous images of those who are infected with HIV. These stereotypes enable some people to deny their likelihood of being infected or affected. This often results in an inaccurate self-assessment of contracting the virus which can militate against designing effective prevention strategies. Stigma and discrimination against PLHA could be associated with low turn-out for HIV counselling and testing which is an entry point to treatment. Identity crises, isolation, loneliness, low self-esteem and lack of interest in containing the disease are also consequences of stigma and discrimination against PLHA. All these also hinder motivation to preventive practices (Nyblade and MacQuarrie, 2006).

Survey methodology and data

Survey methodology

The Federal Ministry of Health [Nigeria] in collaboration with the Society for Family Health received funding from the United States Agency for International Development (USAID) and the British Department for International Development (DFID) to conduct the first national survey on HIV and AIDS in Nigeria. The survey was planned as a three-wave study to be conducted biennially. This was aimed at assessing and monitoring levels and trends of various indicators on HIV/AIDS and other reproductive health issues. The first wave of the National HIV/AIDS and Reproductive Health Survey (NARHS) was conducted in 2003 with the subsequent follow-ups in 2005 and 2007. In addition to other HIV/AIDS and reproductive health issues addressed in the surveys, stigma and
discrimination against PLHA was given appropriate consideration. Specifically, NARHS was aimed at providing information on the situation of reproductive and sexual health in Nigeria, the variety of factors that influence reproductive and sexual health, and to provide data regarding the impact of ongoing HIV and reproductive health behaviour change interventions in Nigeria. As part of the survey, various types of mass media interventions that were implemented by the Society for Family Health (SFH) and other implementing partners were evaluated through exposure questions. Ethical approvals were sought and obtained from the Nigerian Institute of Medical Research, which is one of the Institutional Review Boards in Nigeria. Confidentiality of information was stressed and assured to the respondents. Each eligible respondent had the right to partake or otherwise in the surveys.

Eligible respondents for these surveys were women (15 - 49 years) and men (15 - 64 years). Selection was based on a stratified probability sampling technique based on locality of residence (i.e. rural and urban). Individual respondents were selected within households in various enumeration areas across the country. Within a state (administrative division), all eligible persons irrespective of the nature of residence (rural or urban) were given equal chance of being included in the final sample. Using appropriate formula that allows for comparison between baseline and subsequent follow-up studies, sample sizes were calculated based on 5% level of significance and 80% power of the test. The final sample sizes of 10 258, 10 250 and 11 822 were calculated for 2003, 2005 and 2007 respectively, based on the need for precision of estimates within various strata. The non-response rates were 1.64%, 1.65% and 2.55% for 2003, 2005 and 2007 respectively (FMOH, 2003, 2006b, 2008b). In total, 31 692 respondents were included in the analyses (10 090 in 2003; 10 081 in 2005 and 11 521 in 2007). Questionnaires were pre-tested and administered by trained interviewers under the supervision of seasoned researchers.

Data
For this paper, a database from the main data of the survey for all respondents (men and women) was created. Questions measuring varying degrees of stigma and discrimination were included in these surveys. These include ‘willingness to eat from the same dish with a person infected with HIV,’ ‘willingness to care for a male relative who becomes ill with AIDS,’ ‘readiness to allow an HIV-positive student (though not sick) to continue attending school,’ ‘willingness to care for a female relative who becomes ill with AIDS,’ ‘willingness to allow a female teacher who is infected with HIV (though not sick) to continue teaching,’ ‘willingness to buy food from a HIV-positive shopkeeper or food seller,’ ‘keeping the status of a HIV-infected member of one’s family secret,’ ‘willingness to allow a colleague who is known to be infected with HIV to continue working,’ and ‘willingness to allow a child infected with HIV to continue attending school.’ Standard UNAIDS questions were used to obtain information on stigma and discrimination against PLHAs. This was aimed at providing insights to identifying the determinants that may be associated with reduced stigma and discrimination against PLHA.

In this paper, indicator of stigma and discrimination was restricted to UNAIDS definition. Therefore a composite index was developed by assigning scores for items based on the UNAIDS questions. The dependent variable y takes the value ‘1’ if a respondent exhibits a tolerant (accepting) attitude (reduced stigma and discrimination based on affirmative responses to all the UNAIDS questions except willingness to keep secret when a family member is infected with HIV) towards PLHA, else ‘0’. In other words, a respondent who expressed willingness to eat from the same dish with a person who had HIV, willingness to care for a female relative who is ill with AIDS, willingness to allow a female teacher who has HIV but is not sick to continue teaching in school, willingness to buy food from a shopkeeper or food seller who has HIV, and the readiness not to keep a member of family who becomes ill with the virus that causes AIDS secret are considered to exhibit an accepting attitude towards PLHA. For the purpose of this analysis, response indicating an accepting attitude was scored ‘1’ and ‘0’ otherwise.

Similar to previous studies, relevant determinants that were known to be associated with stigma and discrimination were investigated in this paper (UNAIDS, 2000; Utulu and Lawoyin, 2007; Wigley, 2004). These include demographic characteristics and cultural background of the respondents, sexual behaviour, and knowledge/awareness about modes of transmission and modes of prevention of HIV/AIDS. Length of stay in a community of residence as at the time of survey was measured as: below two years, or two years and above (reference category). Others include being sexually active in the last 12 months, risky sexual behaviour, respondents’ perception about social support on HIV/AIDS such as institutional and organisational. Perception was measured as the support from religious leaders, traditional rulers, government (local government, state and federal governments), non-governmental organisations (NGOs), community-based organisations (CBOs) and community leaders. Questions on perception about social support were based on an eleven (11) scale items. A Cronbach's alpha of 0.94 was obtained from these scale items. A propensity score was created from all these various supports and later categorised into ‘no support’ if the total propensity score was 0, ‘low support’ if the score was between 1 and 7; and ‘high support’ if the score was higher than 7. Exposure to mass media campaigns on HIV/AIDS was also explored in this study in the same manner as for social support. Exposure was measured as viewership, listenership and intensity (frequency) of being exposed to all or some of the HIV and AIDS messages aired in Nigeria prior to the conduct of the surveys. Scale items measuring whether a respondent has ever listened to different messages were included in the questionnaire. A Cronbach's alpha of 0.81 was obtained for these scale items. Propensity scores were created based on these items. Appropriate weights were attached to the propensity score based on the level of intensity of exposure. Intensity was measured as frequency and duration of listener-ship. For ease of analysis, the total propensity score was categorised into ‘No’, ‘Low’ and ‘High’ level of exposure. Respondents with ‘0’ total propensity score from these items were considered to have no exposure. Low exposure was created based on respondents whose total propensity scores were below the average total propensity score while those with total propensity scores of at least the average were considered as having high exposure. To establish possible trend in level of accepting attitude towards PLHA, year of study was also controlled for in this paper. This was aimed at assessing possible changes in...
the level of accepting attitude towards PLHA between 2003 and 2007. Adequate training and supervisions of data collectors were carried out to minimise bias and errors.

Data analysis
Geo-additive logistic regression models based on Bayesian technique were used to explore possible association between level of accepting attitude towards PLHA and relevant covariates. This method of analysis permits joint estimation of time, spatial, non-linear and fixed effects simultaneously. Consider observations \( (y_i, x_i, s_i, v_i) \), \( i = 1, \ldots, n \), where \( y_i \) is a binary response variable, a vector \( x = (x_i, \ldots, x_j)' \) of metrical covariate (say respondents’ age), \( s = (1, \ldots, 37) \) the state (district) where respondent \( i \) lived during the survey and a further vector \( v = (v_i, \ldots, v_j)' \) of categorical covariates. Usually one intends to model the dependence of \( y_i \) on metrical, spatial and categorical covariates within the context of generalized additive model (Hastie and Tibshirani, 1990). The predictor \( \eta_i \) for the geo-additive model is defined as

\[
\eta_i = \sum_{j=1}^{p} f_j(x_{ij}) + f_{spat}(s_i) + v_i \beta
\]

(1)

where \( f_1, \ldots, f_p \) are nonlinear (unknown) smooth functions of the metrical covariates, \( f_{spat} \) is the nonlinear effect of spatial covariates and \( \beta = (\beta_1, \ldots, \beta_j)' \) is a vector of fixed effect parameters for the categorical covariates including time (i.e. year of study with 2003 as the reference category). One may further split up spatial effects \( f_{spat} \) into spatially correlated (structured) and uncorrelated (unstructured) effects as

\[
f_{spat}(s_i) = f_{str}(s_i) + f_{unstr}(s_i).
\]

A rationale behind this is that a spatial effect is a surrogate of many unobserved influential factors, some of which may be a strong spatial structure and others may only be present locally.

In an attempt to explore possible determinants, trend and spatial variations on level of accepting attitude towards PLHA, analysis were based on predictor (1). Influence of determinants on level of accepting attitude towards PLHA was modelled through a binary logistic model within a Bayesian perspective that jointly accounts for nonlinear, time-varying, interaction and spatial effects. Bayesian geo-additive logit model is preferred because of ease of interpretation and the possibility of computing posterior odds ratios (which is a measure of strength of association in logistic regression) directly from the MCMC output. An independent variable whose confidence intervals for odds ratio include 1 are not statistically significant. The predictors in these models include non-parametric effect of a metrical covariate (in this case age in years), spatial components and linear part in an additive form.

Within a Bayesian context, all parameters and functions are usually considered as random variables upon which appropriate priors are assumed. For the non-linear effect, a Bayesian P-splines prior with 20 knots, 3 degrees of spline was assumed. For the structured spatial effects \( f_{str}(s) \) we chose a Gaussian Markov random field prior which is common in spatial statistics, see Besag, York and Mollie (1991). Unstructured spatial effects are i.i.d. random effects.

In order to be able to estimate the smoothing parameters for non-linear and spatial effects simultaneously, highly dispersed but proper hyper-priors are assigned to them. Hence for all variance components, an inverse gamma distribution with hyperparameters \( a \) and \( b \) is chosen, e.g. \( \tau^2 \sim IG(a,b) \). Standard choices of hyperparameters are \( a=1 \) and \( b=0.005 \) or \( a=b=0.001 \). Sensitivity to the choice of priors was investigated in this case-study through different means. First, we compared results from MCMC with similar models using Restricted Maximum Likelihood (REML) approach. Second, hyperpriors for smoothing parameters were varied systematically. Lastly, we considered different priors such as ‘Markov Random Field’, ‘Two dimensional P-spline with first order random walk penalty’ which is known as geospline, for spatial effects. For model choice and comparison, the deviance information criterion (DIC) which was developed by Spiegelhalter, Best, Carlin, and van der Linde (2002) was used. BayesX, software for Bayesian inference using structured additive regression models was used for all analyses (Brezger, Kneib and Lang, 2009).

Fully Bayesian inference is based on the posterior distribution of the model parameters, which is not of a known form. Therefore, MCMC sampling from full conditionals for nonlinear effects, spatial effects, fixed effects and smoothing parameters was used for posterior analysis. For nonlinear and spatial effects, Metropolis-Hastings algorithms based on conditional prior proposals (Knorr-Held, 1999) and iteratively weighted least squares (IWLS) proposals suggested by Brezger and Lang (2006) as an extension of Gamerman (1997) were applied. Similar results were obtained from both sampling schemes but we rely on IWLS proposal which has good mixing properties without requiring tuning.

All categorical covariates were dummy-coded. The response variable \( y \) is given as

\[
y_{it} = \begin{cases} 
1 & \text{if respondent } i \text{ exhibits tolerant attitude towards PLHA in year } t \\
0 & \text{otherwise}
\end{cases}
\]

Series of logit models

\[
p(y_{it} = 1 | \eta_{it}) = \frac{e^{\eta_{it}}}{1 + e^{\eta_{it}}}
\]

(2)

were analysed with predictors incorporating year of study, a spatial component and further covariates. At a more advanced stage of this exploratory process, further time varying effects (geographically weighted model) were explored. Equation (2) can be equivalently expressed as

\[
\frac{p(y_{it} = 1 | \eta_{it})}{p(y_{it} = 0 | \eta_{it})} = \exp(\eta_{it}),
\]

(3)
i.e. as a multiplicative model for the odds. Starting from very simple models, we increase complexity to show what can be gained by more sophisticated approaches, and we end up with models which turned out to be best in terms of DIC. Below are the models explored in this paper.

\(M_1\): year of study (time, \& time, i.e. dummies for 2005 and 2007 with 2003 as the reference category

\(M_2\): year of study, plus spatial effects

\(M_3\): year of study, spatial effects, plus demographic characteristics (age categorised as in Table 2)

\(M_4\): \(M_3\) but with non-linear effect of age

\(M_5\): \(M_4\) plus with knowledge indicators about HIV

\(M_6\): \(M_5\) but with age nonlinear and time-varying effect

\(M_7\): \(M_6\) + perception about social support

\(M_8\): \(M_7\) plus nonlinear effect of age

\(M_9\): \(M_8\) plus exposure to messages/interventions

\(M_{10}\): \(M_9\) + non-linear effect of age.

**Results**

Table 1 presents the percentage distribution of respondents that exhibited an accepting attitude towards PLHA according to states of origin, disaggregated by year and gender. Substantial geographical variations and trend were evident. While accepting attitudes in some states were as low as 0%, some were as high as 10%. However, statistical significance of such variations needs to be properly explored in the presence of adjusting for other factors of HIV/AIDS-related stigma and discrimination. This was aimed at providing HIV programmers with effective tools to enhance proper design of HIV prevention interventions as regards stigma reduction. In the preliminary analysis, the effects of all determinants described in the data Section of this paper were carefully explored. For instance, Table 2 presents the descriptive analysis of all the factors considered in this paper at bivariate level. However, after a careful selection process, using exploratory tools and model choice based on the DIC presented in Table 3 for all models, we present results for the best model i.e. model \(M_{10}\). Furthermore, the directions of the significance of all the effects in models \(M_1\) through \(M_9\) were similar. Inferences were based on 95% credible intervals from the MCMC samples. Parameters with significant positive credible intervals are significantly associated with high level of accepting attitude while parameters with significant negative credible intervals are significantly associated with low level of accepting attitude towards PLHA. Therefore, in addition to the combined analysis, we further disaggregated analysis according to gender.

**Trend effect**

Table 4 presents the results of the fixed effect parameters. A notable trend on level of accepting attitudes towards PLHA was positively significant for the combined and separate analyses. For the combined analysis, respondents were about 72% more likely to show an accepting attitude towards PLHA in 2005 compared with 2003, i.e. OR=1.72 (95% CI [1.47; 2.00]). The change in accepting attitude further increased to about 163% in 2007 compared with 2003 i.e. OR=2.63 (95% CI [2.29; 3.02]). The direction of significance was similar for both male and female analyses.

**Non-linear and spatial effects**

Fig. 1 presents the geographical locations of states in Nigeria while Fig. 2 displays the spatial effects at states level for models where only year of study was adjusted for. Obviously substantial spatial variations were evident. For instance, in the combined analysis, the spatial variation was not significant based on 95% credible intervals but significant in each of the separate analyses of males and females analyses. This model provides justification for the importance of separate analysis and adjusting for covariates. Non-linear effects of respondents’ age are presented in Fig. 3 while Fig. 4 shows the spatial effects in the models where covariates were adjusted for. From top to bottom are the results for combined, male and female analyses respectively. An approximately inverse ‘J’ shaped of respondents’ age was evident for the combined analysis (Fig. 3 top panel). This implies that the older a respondent is, the more likely to exhibit an accepting attitude towards PLHA.

![Fig. 1. Map of Nigeria showing geographic locations of states.](image)
significantly associated with low level of accepting attitude towards PLHA (black colour on the map of significance), some were significantly associated with high level of accepting attitude towards PLHA (white colour on the map of significance). The notable spatial pattern that was seen in some states was not significant (grey colour). Although the spatial pattern in all the models was similar, however, the significance of the spatial effects varies as the complexity of the models increases. This suggests that significance of spatial effects changes considerably after controlling for some covariates. Therefore, we shall base discussion of spatial effects on models where additional covariates were adjusted for. In the combined analysis, Bauchi, Gombe, Kaduna, Jigawa, Katsina, Plateau, Nassarawa and Zamfara states, and the Federal Capital Territory were significantly associated with high level of accepting attitudes towards PLHA, while AnAMBra, Cross-River, Kwara, Ogun, Ondo, Osun and Oyo states were associated with significantly low accepting attitude towards PLHA. The notable spatial variations in the remaining states were not significant (grey colour on the map of significance).

**Fixed effects**

Table 4 presents findings from the fixed effects. Males were about 46% more likely to demonstrate accepting attitude towards PLHA compared with their female counterparts. This reveals a substantial gender differential in HIV-related stigma and discrimination. This further justifies the need for separate models for males and females, results of which are also presented alongside in Table 4.

| State          | Combined  | Male       | Female     |
|----------------|-----------|------------|------------|
|                | 2003 (%)  | 2005 (%)  | 2007 (%)  | 2003 (%)  | 2005 (%)  | 2007 (%)  | 2003 (%)  | 2005 (%)  | 2007 (%)  |
| Abia           | 2.4       | 2.8       | 4.8       | 3.2       | 0.8       | 9.2       | 1.6       | 4.9       | 0.0       |
|Adamawa         | 4.0       | 4.7       | 8.9       | 7.2       | 6.0       | 13.9      | 0.8       | 3.3       | 3.5       |
|Akwa-Ibom       | 2.0       | 9.8       | 3.9       | 1.7       | 6.3       | 3.8       | 2.3       | 13.5      | 4.0       |
|AnAMBra         | 2.0       | 3.4       | 1.9       | 2.4       | 5.6       | 1.4       | 1.6       | 0.8       | 2.4       |
|Bauchi          | 5.6       | 8.6       | 24.2      | 7.4       | 5.9       | 23.2      | 4.2       | 12.7      | 25.7      |
|Benue           | 2.3       | 6.9       | 7.6       | 2.4       | 7.3       | 11.7      | 2.2       | 6.5       | 2.9       |
|Borno           | 3.6       | 3.3       | 5.3       | 4.3       | 3.8       | 5.8       | 3.1       | 2.8       | 4.9       |
|Bayelsa         | 2.5       | 6.9       | 18.3      | 3.2       | 7.6       | 26.6      | 1.9       | 6.1       | 8.0       |
|Cross-River     | 1.6       | 8.1       | 5.5       | 1.6       | 8.1       | 3.8       | 1.6       | 8.0       | 7.3       |
|DeltA           | 8.8       | 2.0       | 11.5      | 10.6      | 2.8       | 13.0      | 7.1       | 0.9       | 9.5       |
|Ebenyi          | 2.6       | 4.8       | 15.1      | 3.0       | 6.4       | 23.5      | 2.4       | 3.1       | 7.5       |
|Edo             | 2.0       | 8.8       | 12.6      | 1.5       | 13.8      | 16.1      | 2.6       | 2.0       | 8.5       |
|Ekiti           | 2.8       | 10.4      | 10.2      | 3.3       | 11.3      | 12.5      | 2.3       | 9.3       | 7.6       |
|Enugu           | 4.0       | 5.5       | 11.8      | 7.3       | 8.8       | 12.0      | 0.8       | 2.3       | 11.6      |
|FCT             | 5.3       | 8.3       | 11.9      | 6.6       | 6.5       | 13.0      | 4.2       | 11.1      | 10.2      |
|Gombe           | 3.2       | 12.2      | 14.5      | 6.6       | 18.7      | 10.2      | 0.0       | 5.0       | 19.5      |
|Imo             | 0.9       | 16.5      | 7.3       | 0.9       | 28.1      | 8.3       | 0.8       | 5.0       | 6.3       |
|Jigawa          | 1.5       | 7.1       | 6.5       | 2.4       | 12.1      | 8.4       | 0.7       | 0.9       | 4.4       |
|Kaduna          | 7.6       | 15.2      | 19.4      | 7.3       | 21.8      | 23.0      | 7.9       | 7.3       | 15.1      |
|Kebbi           | 0.8       | 9.1       | 0.8       | 0.8       | 7.3       | 0.7       | 0.8       | 10.9      | 0.9       |
|Kogi            | 2.4       | 1.7       | 2.7       | 4.7       | 3.7       | 3.9       | 0.0       | 0.0       | 1.4       |
|Kano            | 5.7       | 2.9       | 7.7       | 4.8       | 3.7       | 12.8      | 6.7       | 2.1       | 1.7       |
|Katsina         | 6.3       | 7.5       | 3.4       | 10.4      | 13.2      | 6.1       | 2.4       | 1.4       | 0.4       |
|Kwara           | 2.8       | 0.8       | 2.4       | 2.4       | 0.8       | 4.3       | 3.2       | 0.9       | 0.0       |
|Lagos           | 3.8       | 9.5       | 10.0      | 3.4       | 12.9      | 14.1      | 4.2       | 5.2       | 5.2       |
|Nasarawa        | 2.8       | 13.2      | 14.7      | 4.1       | 20.0      | 17.2      | 1.5       | 5.5       | 11.9      |
|Niger           | 2.0       | 4.3       | 7.6       | 2.4       | 5.9       | 11.0      | 1.6       | 2.5       | 3.5       |
|Ogun            | 1.2       | 0.8       | 3.3       | 2.4       | 0.7       | 2.9       | 0.0       | 0.9       | 3.6       |
|OnDo            | 1.6       | 2.0       | 2.0       | 2.4       | 3.8       | 2.2       | 0.8       | 0.0       | 1.7       |
|Osun            | 4.4       | 2.9       | 4.8       | 8.6       | 4.9       | 6.1       | 0.0       | 0.8       | 3.4       |
|Oyo             | 0.9       | 1.7       | 7.6       | 0.6       | 2.7       | 9.4       | 1.2       | 0.0       | 4.5       |
|Plateau         | 10.0      | 27.9      | 21.4      | 14.5      | 37.9      | 24.2      | 5.6       | 17.5      | 18.6      |
|Rivers          | 7.6       | 3.6       | 6.2       | 11.9      | 4.7       | 8.2       | 3.2       | 2.2       | 3.6       |
|Sokoto          | 0.8       | 0.4       | 1.8       | 1.7       | 0.0       | 2.8       | 0.0       | 0.9       | 0.6       |
|Taraba          | 4.4       | 3.3       | 17.1      | 3.3       | 3.1       | 21.9      | 5.4       | 3.4       | 12.2      |
|Yobe            | 0.8       | 7.1       | 14.4      | 1.7       | 7.4       | 6.8       | 0.0       | 6.7       | 22.9      |
|Zamfara         | 0.1       | 0.1       | 11.6      | 0.1       | 0.1       | 2.3       | 0.0       | 0.2       | 21.5      |
|National        | 3.5       | 6.6       | 9.0       | 4.5       | 8.5       | 10.8      | 2.5       | 4.4       | 6.8       |
Table 2. Bivariate analysis and descriptive statistics of factors relating to stigma and discrimination that were used in this paper

| Variables                        | Accepting attitude | Total (N) | Missingness (N) | p-value |
|----------------------------------|--------------------|-----------|-----------------|---------|
|                                  | Yes (%)            | No (%)    |                 |         |
| Year study                       |                    |           |                 |         |
| 2003 (ref. category)             | 0.035              | 0.965     | 10 090          | <0.0001 |
| 2005                             | 0.066              | 0.934     | 10 081          |         |
| 2007                             | 0.090              | 0.910     | 11 521          |         |
| Sex                              |                    |           |                 |         |
| Male                             | 0.082              | 0.918     | 16 519          | <0.0001 |
| Female (ref. category)           | 0.046              | 0.954     | 15 173          |         |
| Place of residence               |                    |           |                 |         |
| Rural (ref. category)            | 0.057              | 0.943     | 21 011          | <0.0001 |
| Urban                            | 0.079              | 0.921     | 10 681          |         |
| Ethnicity                        |                    |           |                 |         |
| Hausa                            | 0.067              | 0.933     | 8 380           | <0.0001 |
| Igbo                             | 0.063              | 0.937     | 4 740           |         |
| Yoruba                           | 0.044              | 0.956     | 5 694           |         |
| Others (ref. category)           | 0.073              | 0.927     | 12 878          |         |
| Age                              |                    |           |                 |         |
| 15 - 19 (ref. category)          | 0.043              | 0.957     | 7 043           | <0.0001 |
| 20 - 24                          | 0.060              | 0.940     | 5 972           |         |
| 25 - 29                          | 0.076              | 0.924     | 4 917           |         |
| 30 - 34                          | 0.072              | 0.928     | 3 830           |         |
| 35 - 39                          | 0.070              | 0.930     | 2 908           |         |
| 40 - 44                          | 0.072              | 0.928     | 2 683           |         |
| 45 - 49                          | 0.063              | 0.937     | 2 130           |         |
| 50 - 64                          | 0.092              | 0.908     | 2 209           |         |
| Religion                         |                    |           |                 |         |
| Muslim                           | 0.059              | 0.941     | 15 232          | <0.0001 |
| Christian                        | 0.072              | 0.928     | 15 875          |         |
| Traditional and others (ref. category) | 0.036              | 0.964     | 583             |         |
| Age at first sex                 |                    |           |                 |         |
| Never had sex/below 15 years (ref. cat) | 0.050              | 0.950     | 10 238          | <0.0001 |
| 15 years and above               | 0.074              | 0.926     | 19 041          |         |
| Marital status                   |                    |           |                 |         |
| Married                          | 0.067              | 0.933     | 18 193          | 0.1130  |
| Never                            | 0.063              | 0.937     | 12 009          |         |
| Others (ref. category)           | 0.056              | 0.944     | 1 275           |         |
| Educational attainment           |                    |           |                 |         |
| None (ref. category)             | 0.041              | 0.959     | 7 373           | <0.0001 |
| Qur’anic                         | 0.055              | 0.945     | 2 898           |         |
| Primary                          | 0.060              | 0.940     | 6 624           |         |
| Secondary                        | 0.069              | 0.931     | 11 568          |         |
| Higher                           | 0.126              | 0.874     | 3 137           |         |
| Geopolitical zones               |                    |           |                 |         |
| North West                       | 0.060              | 0.940     | 7 310           | <0.0001 |
| North East                       | 0.081              | 0.919     | 4 504           |         |
| North Central (ref. category)    | 0.075              | 0.925     | 5 520           |         |
| South West                       | 0.050              | 0.950     | 5 808           |         |
| South East                       | 0.058              | 0.942     | 3 761           |         |
| South South                      | 0.069              | 0.931     | 4 789           |         |
| Perceived social support         |                    |           |                 |         |
| None (ref. category)             | 0.025              | 0.975     | 4 603           | <0.0001 |
| Low                              | 0.056              | 0.944     | 9 698           |         |
| High                             | 0.080              | 0.920     | 17 391          |         |
Table 2. Continued

| Variables                              | Accepting attitude | Total (N) | Missingness (N) | p-value |
|----------------------------------------|--------------------|-----------|-----------------|---------|
|                                        | Yes (%)            | No (%)    |                 |         |
| Exposure to media campaigns            |                    |           |                 |         |
| None (ref. category)                   | 0.024              | 0.976     | 211             | <0.0001 |
| Low                                    | 0.043              | 0.957     | 11 892          |         |
| High                                   | 0.078              | 0.922     | 19 589          |         |
| Knowledge                              |                    |           |                 |         |
| Health looking can be HIV positive     | 0.085              | 0.915     | 20 645          | <0.0001 |
| Know that AIDS has no cure             | 0.070              | 0.930     | 24 741          | <0.0001 |
| Know someone who has died of HIV       | 0.094              | 0.906     | 7 225           | <0.0001 |
| Know correct mode of transmission      | 0.115              | 0.885     | 6 940           | <0.0001 |
| Know correct modes of prevention       | 0.084              | 0.916     | 14 528          | <0.0001 |
| Sexual behaviour                       |                    |           |                 |         |
| Ever had sex                           | 0.068              | 0.932     | 24 781          | <0.0001 |
| Had sex in the last 12 months          | 0.071              | 0.929     | 20 332          | <0.0001 |

1 Majority of these people were those that have had sex but cannot remember their age at first sex.
2 This includes: separated, widowed and divorced.

Table 3. Summary of the Deviance Information Criterion as measure of model selection

| M     | D (bar_mu) | pD  | DIC  | Sample size |
|-------|------------|-----|------|-------------|
| M_0   | 14934.43   | 3.09| 14940.62 | 31 692     |
| M_1   | 14269.24   | 35.55| 14340.35 | 31 692     |
| M_2   | 12802.11   | 52.62| 12907.35 | 28 781     |
| M_3   | 12795.33   | 53.85| 12903.03 | 28 781     |
| M_4   | 12492.82   | 56.90| 12606.62 | 28 781     |
| M_5   | 12494.28   | 57.49| 12609.26 | 28 781     |
| M_6   | 12490.81   | 58.79| 12608.39 | 28 781     |
| M_7   | 12491.07   | 59.22| 12609.51 | 28 781     |
| M_8   | 12482.21   | 61.05| 12604.30 | 28 781     |
| M_9   | 12481.77   | 59.83| 12601.43 | 28 781     |

Here, we shall discuss the results of the combined analysis only. Level of accepting attitude towards PLHA varies according to ethnicity. Among Hausa, Igbo and Yoruba, findings showed that Yoruba were most likely to discriminate against PLHA compared with other ethnic groups, i.e. OR=0.70 (95% CI=[0.530; 0.901]). Living in urban areas was positively and significantly associated with accepting attitude towards PLHA compared with living in rural areas, i.e. OR=1.16 (95% CI=[1.041; 1.304]). Religion was found to be significantly associated with attitudes towards PLHA. Christians (i.e. Catholics and Protestants) were about 86% more likely to demonstrate an accepting attitude towards PLHA than their counterparts in the other age range 24 - 25 years demonstrated a high accepting attitude towards PLHA. The majority of these people were those that have had sex but cannot remember their age at first sex. Separately, those in the age range 29 - 39 years were associated with an approximately sinusoidal pattern was noticed for females. This included: separated, widowed and divorced.

On knowledge indicators, findings showed that correct knowledge was positively and significantly associated with level of accepting attitude. Respondents who knew that a healthy looking person can be HIV-positive (OR=1.15, CI=[1.032; 1.287]), knew all correct modes of HIV transmission (OR=1.69, CI=[1.526; 1.874]) and correct modes of HIV prevention (OR=1.17, CI=[1.059; 1.303]) were more likely to exhibit high accepting attitude towards PLHA.

Exposure to mass media, peer education, inter-personal communications and other forms of information on HIV and AIDS was found to be positively and significantly associated with accepting attitude towards PLHA. As described earlier, exposure was based on scale items from where we developed, ‘Low’, ‘Low’ and ‘High’ exposure categories. Positive and significant trend according to exposure was evident. While respondents with low exposure to HIV/AIDS activities were about 85% more likely to exhibit an accepting attitude towards PLHA, those with high exposure were more than 100% more likely to demonstrate similar attitude compared with those who were not exposed to any HIV/AIDS activities at all (low exposure: OR=1.85, CI=[0.702; 4.307] vs. high exposure: OR=2.06, CI=[1.996; 2.131]). Similarly, perception about social support on HIV and AIDS was positively associated with HIV-related stigma and discrimination against PLHA. While the respondents with low perception of social support were only about 28% more likely to demonstrate an accepting attitude towards PLHA, those who perceived that they received high social support were about 54% (almost doubled that of low social support) more likely to demonstrate an accepting attitude towards PLHA. As described earlier, exposure was based on scale items from where we developed, ‘Low’, ‘Low’ and ‘High’ exposure categories. Positive and significant trend according to exposure was evident. While respondents with low exposure to HIV/AIDS activities were about 85% more likely to exhibit an accepting attitude towards PLHA, those with high exposure were more than 100% more likely to demonstrate similar attitude compared with those who were not exposed to any HIV/AIDS activities at all (low exposure: OR=1.85, CI=[0.702; 4.307] vs. high exposure: OR=2.06, CI=[1.996; 2.131]). Similarly, perception about social support on HIV and AIDS was positively associated with HIV-related stigma and discrimination against PLHA. While the respondents with low perception of social support were only about 28% more likely to demonstrate an accepting attitude towards PLHA, those who perceived that they received high social support were about 54% (almost doubled that of low social support) more likely to demonstrate an accepting attitude towards PLHA.

Separate analyses

From the separate analyses of male and female data, considering nonlinear effect of age (Fig. 3, middle and bottom panels), a similar pattern as in the combined analysis was observed for males, i.e. an approximately inverse ‘J’ shaped feature. However, an approximately sinusoidal pattern was noticed for females. This revealed that females in the age range 29 - 39 years were associated with declined accepting attitude towards PLHA. Women in the age range 24 - 25 years demonstrated a high accepting attitude towards PLHA compared with their counterparts in the other age range...
Generally, tolerant attitude increased significantly among both males and females and findings were similar to the combined analysis. For males, accepting attitude increased by about 83% in 2005 (OR=1.83, CI=[1.515; 2.177]) and 158% in 2007 (OR=2.58, CI=[2.143; 3.075]) compared with 2003. However, for females, accepting attitude increased by about 54% in 2005 compared with 2003 (OR=1.54, CI=[1.196; 1.921]) and by about 183% in 2007 compared with 2003 (OR=2.83, CI=[2.242; 3.514]). Interestingly, religion and level of exposure to HIV/AIDS-related activities or information contributed significantly to gender differentials on level of accepting attitude towards PLHA. Firstly, both Christian and Muslim females have higher likelihood of exhibiting accepting attitude compared with their male counterparts. On the other hand, males were more exposed to HIV/AIDS-related activities compared with their female counterparts.

Turning attention to spatial effects (Fig. 4, middle and bottom panels), while males from Bauchi, Gombe, Kaduna, Nassarawa and Plateau states were significantly associated with high accepting attitude towards PLHA, males from Abia, Akwa-Ibom, Anambra, Cross-River, Ogun and Ondo states were significantly associated with low level of accepting attitude towards PLHA. Similarly, while females from Bauchi, Kaduna, Kebbi, Nassarawa, Plateau and Zamfara states were significantly associated with high level of accepting attitude towards PLHA, those from Ondo, Osun and Rivers were significantly associated with low level of accepting attitude towards PLHA.

**Discussion and conclusion**

Findings from this study revealed a positive trend in accepting attitude towards PLHA from 3.5% in 2003 to 9.0% in 2007. The positive trend in accepting attitude towards PLHA in Nigeria could be attributed to intensive interventions by various key players and exposure to many messages on reduction of HIV-related stigma. Series of training programmes, media roundtables and other information sharing platforms as well as provision of regular publications on HIV/AIDS by media and other NGOs campaigning against the spread of HIV/AIDS have been of great importance in the fight against stigma and discrimination in the country. Many support groups also provided information on HIV/AIDS especially on correct modes of transmission and prevention which could in turn reduce the level of stigmatisation against PLHA. Many HIV/AIDS advocates have preached that PLHAs need love and care rather than rejection and discrimination. Neglect and rejection of PLHAs is tantamount to making them social outcasts. With the emergence of many NGOs on HIV/AIDS in all nooks and crannies of Nigeria, people are becoming more equipped and informed on developing tolerant attitude towards PLHA. With the development of National HIV/AIDS Policy, NACA and other advocates strongly frowned at stigmatisation and discrimination against PLHA in any private or public institutions. Many paid television/radio advertisements on
HIV/AIDS prevention, care and support were supported by NACA in Nigeria, Society for Family Health, and many other organisations and agencies. In addition to such advertisements, various billboards and handbills were produced. Some inscriptions on anti-stigma banners displayed at some rallies read thus: ‘PLHA are people like you and I,’ ‘Let us join hands to fight stigma and discrimination against them,’ ‘Live and let live,’ ‘No! To discrimination against PLHA in Nigeria,’ ‘A hug gives comfort and not HIV,’ ‘Show love and care to PLHA,’ ‘Stop stigmatisation now! PLHA have the right to live. So give them hope and show them love.’ In the recent times, workplace interventions on HIV/AIDS have become popular and adopted by some companies. Of particular interest is a billboard that adopted by some companies. Of particular interest is a billboard that adopted workplace interventions on HIV/AIDS have become popular and adopted by some companies. Of particular interest is a billboard.

| Variables                                           | Combined                   | Male                  | Female                 |
|-----------------------------------------------------|----------------------------|-----------------------|------------------------|
|                                                     | OR 95% Cred. Int.          | OR 95% Cred. Int.     | OR 95% Cred. Int.      |
| Intercept                                           | 0.003 Lower 0.001 Higher 0.009 | 0.004 Lower 0.001 Higher 0.012 | 0.002 Lower 0.0001 Higher 0.010 |
| Year of study                                        |                            |                       |                        |
| Time 2 (2005)                                       | 2.628* 2.299 3.022         | 1.582* 0.519 2.177    | 1.538* 1.196 1.921     |
| Time 3 (2007)                                       |                            |                       |                        |
| Sex: Male                                           | 0.911* 0.770 1.071         | 0.869 0.704 1.068     | 0.951 0.731 1.238      |
| Ethnicity                                           |                            |                       |                        |
| Hausa                                               | 0.808 0.614 1.049          | 0.772 0.540 1.052     | 0.828 0.523 1.276      |
| Igbo                                                | 0.699* 0.530 0.901         | 0.669* 0.482 0.923    | 0.685 0.428 1.059      |
| Yoruba                                              | 0.973 0.788 1.224          | 0.923 0.656 1.259     | 1.094 0.783 1.500      |
| Locality: Urban                                     |                            |                       |                        |
| Below 2 years                                       | 1.163* 1.041 1.304         | 1.242* 1.084 1.419    | 1.014 0.838 1.225      |
| Religion                                            |                            |                       |                        |
| Education                                           |                            |                       |                        |
| Muslims                                             | 1.590 0.934 2.521          | 1.417 0.811 2.382     | 5.597 0.805 39.846     |
| Christians                                          | 0.525* 0.346 0.737         | 0.453 0.277 0.737     | 0.683 0.227 2.056      |
| Islamic                                                                                          |
| Age at first sex                                     |                            |                       |                        |
| First sex at 15 years and above                      | 1.859* 1.097 2.676         | 1.638 0.949 2.767     | 6.581 0.943 47.828     |
| Marital status                                       |                            |                       |                        |
| Married                                              | 0.831 0.612 1.069          | 0.927 0.579 1.425     | 0.667* 0.440 0.994     |
| Never married                                        | 0.752 0.546 1.012          | 0.853 0.521 1.378     | 0.639* 0.396 0.971     |
| Education                                           |                            |                       |                        |
| Qur’anic education                                   | 1.051 0.839 1.286          | 1.325* 1.030 1.737    | 0.884 0.605 1.251      |
| Primary education                                    | 1.061 0.878 1.277          | 1.198 0.922 1.547     | 0.999 0.766 1.286      |
| Secondary/Higher education                           | 1.271* 1.075 1.513         | 1.402* 1.095 1.765    | 1.250 0.943 1.640      |
| Zones                                               |                            |                       |                        |
| North East                                           | 0.962 0.518 1.609          | 0.949 0.404 2.361     | 1.358 0.382 4.662      |
| South West                                          | 0.922 0.674 1.500          | 1.731 0.555 4.053     | 2.290 0.598 6.762      |
| South East                                          | 0.914 0.578 1.539          | 1.958 0.747 4.203     | 1.987 0.404 5.677      |
| South South                                         | 0.912 0.578 1.539          | 1.958 0.747 4.203     | 1.987 0.404 5.677      |
| North East                                          | 2.152 0.789 4.600          | 1.777 0.644 4.291     | 3.697 0.877 12.278     |
| Knowledge                                           |                            |                       |                        |
| Healthy looking can be HIV-positive                  | 1.882* 1.625 2.182         | 1.838* 1.520 2.219    | 1.950* 1.539 2.433     |
| AIDS has no cure                                     | 1.169* 1.009 1.353         | 1.114 0.924 1.335     | 1.336* 1.058 1.677     |
| Knew someone who died of AIDS                        | 1.151* 1.032 1.287         | 1.170 0.913 1.331     | 1.188 0.977 1.439      |
| Knew correct modes of transmission                   | 1.693* 1.526 1.874         | 1.872* 1.645 2.143    | 1.482* 1.222 1.764     |
| Knew correct modes of prevention                     | 1.172* 1.059 1.303         | 1.141* 1.004 1.295    | 1.317* 1.089 1.554     |
| Sexual behaviour                                     |                            |                       |                        |
| Ever had sex                                         | 0.904 0.608 1.341          | 0.781 0.529 1.087     | 0.582* 0.362 0.895     |
| Had sex in the last 12 months                        | 1.120 0.950 1.328          | 0.952 0.756 1.180     | 1.313 0.960 1.738      |
| Exposure                                             |                            |                       |                        |
| Low exposure                                         | 1.854 0.702 4.307          | 2.469 0.783 6.517     | 1.661 0.353 4.745      |
| High exposure                                        | 0.904 0.396 2.131          | 2.825* 1.922 4.279    | 1.798 0.387 4.959      |
| Social support                                       |                            |                       |                        |
| Low support                                          | 1.278* 1.009 1.585         | 1.342 0.932 1.900     | 1.267 0.885 1.766      |
| High support                                         | 3.138* 1.217 1.900         | 1.560* 1.093 2.184    | 1.645* 1.172 2.244     |

NA—Not applicable
*Significant effects based on 95% credible intervals.
Kogi State of Nigeria.

The gender differentials noticed in this paper are similar to findings from other studies. For instance, see Babalola (2007), Babalola, Fatusi and Anyanti (2009). Generally knowledge about HIV/AIDS is higher among males than females. This may explain the gender differential in accepting attitude towards PLHA. As also shown in Table 4, religion and exposure to HIV/AIDS intervention could account for this gender differential. HIV/AIDS-related stigma and discrimination was found to be associated with socio-cultural background; as level of accepting attitude towards PLHA varies across different ethnic groups. Findings from this paper further revealed that people living in urban areas are more exposed to a number of preventive interventions on HIV/AIDS as they exhibited higher accepting attitude towards PLHA. Efforts, therefore, need to be targeted at ensuring that rural areas also benefit from necessary HIV/AIDS interventions. Involvement of faith-based organisations seems to be yielding positive results as both Christians and Muslims demonstrated high accepting attitude towards PLHA.

Respondents that were well informed in terms of knowledge about HIV/AIDS: modes of transmission, modes of prevention, AIDS does not have a cure, healthy looking person can be HIV positive; were more likely to demonstrate accepting attitude towards PLHA. Findings based on level of educational attainment further corroborate this. A positive association between level of educational attainment and level of accepting attitude towards PLHA was evident. Consequently, those that were highly exposed to HIV/AIDS interventions were more likely to exhibit highly tolerant attitude towards PLHA. Similar findings were obtained for perception about social support. Respondents who perceived to have received high social support were more likely to be more tolerant to PLHA. Encouraging social support will go in a long way to fight the spread of HIV/AIDS.

Evidently, substantial geographical variations on level of accepting attitude towards PLHA were noticed (Fig. 4). For instance, Ogun, Oyo, Ondo and Kwara states (mainly Yoruba speakers apart from Kwara that has a mixture of other ethnic groups) were associated with low level of accepting attitude towards PLHA. This further corroborates findings about ethnicity that Yoruba are most likely to discriminate against PLHA. Similarly, Bauchi, Gombe, Kaduna, Jigawa, Katsina, Plateau, Nassarawa and Zamfara states are mainly Hausas and were significantly associated with high accepting attitude towards PLHA. The gender differentials became clearer from separate analyses with ease of identifying states where males exhibited accepting attitude towards PLHA and states where females exhibited accepting attitude.

Following several years of denial, Nigerians are beginning to come to terms, albeit slowly, with the reality of HIV and AIDS. The sustained sensitisation campaigns by AIDS organisations as well as bold steps taken by some PLHAs to put a face to the epidemic could among other factors be advanced for this positive response. AIDS-related stigma and discrimination has been identified as the bane of several efforts aimed at addressing the impact of the epidemic. Before 2001, when the first widely reported case of AIDS-related stigma and discrimination was brought to public attention, most Nigerians living with HIV only experienced stigma and discrimination underground. They faced it, endured it and suffered in silence. However, when AIDS-related stigma and discrimination came to the fore in 2000, it became a national issue that brought to light the various challenges that need to be addressed in checking the spread of the pandemic (JAAIDS, 2007). Clear cases of individuals who had their rights to meaningful employment and education as well as rights to aspire to any height in their chosen career trampled upon as a result of their positive HIV status were documented in JAAIDS (2007).

In an attempt to address the adverse influence of stigma and discrimination on the effectiveness of HIV prevention strategies,
many countries have enacted legislation to protect the rights and freedoms of PLHA in order to safeguard them from discrimination. Much of this legislation has sought to ensure their right to employment, education, privacy and confidentiality as well as the right to access information, treatment and support. Strong and persistent government support can provide enabling environment and positive results (UNAIDS, 2007d). Nigerian government and various institutions and NGOs were also not left out in responding to the fight against the scourge of the disease. For instance, in 2000 the government established a Presidential Committee on AIDS and the National Action Committee on AIDS now known as National Agency for the Control of AIDS (NACA). Furthermore, the former President of Nigeria, Chief Olusegun Obasanjo gave assent to the 2003 HIV/AIDS Policy by stating that ‘the Federal Government of Nigeria affirms the following: person living with or affected by HIV shall not be discriminated against on the basis of their health status with respect to education, training, employment, housing, travel, access to health care and other social amenities and citizenship rights’ (NACA, 2004). During the 2005 International Conference on HIV/AIDS and STIs in Africa (ICASA) held in Abuja, Nigeria, groups of PLHA presented their request of free Anti-Retroviral treatment for PLHA to the Nigerian government under the leadership of Chief Olusegun Obasanjo. This was favourably considered and free treatment began to be available for PLHAs since then.

While Babalola et al. (2009) and Fakolade et al. (2010) extensively considered a number of factors that are associated with stigma and discrimination against PLHA, they failed to consider geographical variation at a highly disaggregated level of state as in our case in this paper. Although Fakolade et al. (2010) explored trend of stigma and discrimination, they also failed to consider geographical variation that were present in the data at a highly disaggregated level of states. Furthermore, effect of continuous covariates was modelled assuming a flexible pattern through a semi-parametric function. In our case here, we ensured that spatial variation is modelled in a more flexible way.

In conclusion, findings from this paper provide insight to policy formulation. Scarce resources have been identified as a major challenge towards implementation of necessary intervention strategies in sub-Saharan African countries including Nigeria. This paper provides policy-makers with tools to enhance appropriate policy formulation on the prevention of HIV/AIDS; which can also assist in allocating resources to states or districts where the resources can be effectively utilized. While

![Fig. 4. Non-linear effects showing spatial variations in accepting attitude towards PLHA in models adjusting for covariates. Shown are the posterior means (left panels) and 95% point-wise credible intervals (right panels) for the combined (top panels), male (middle panels) and female (bottom panels).](image)
identifying states that require intensive prevention efforts towards the reduction of stigma and discrimination, the need for sustenance of the accepting attitude towards PLHA in states that are associated with positive trend must be ensured by the policy-makers in the affected states. Furthermore, the need to ensure that laws to protect rights of PLHA are upheld. Involvement of community and religious leaders in awareness programme especially in rural areas should be encouraged.

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References

Adebayo, S.B. (2004). Bayesian Geosadditive Modelling of Breastfeeding Initiation in Nigeria. Journal of Applied Econometrics, 19(2), 267-281.

Adebayo, S.B., & Fahrmeir, L. (2005). Analyzing Child Mortality in Nigeria with Geosadditive Discrete time Survival Models. Statistics in Medicine, 24, 709-728.

Babalola, S. (2007). Readiness for HIV testing among young people in northern Nigeria: The roles of social norms and perceived stigma. AIDS and Behaviour, 11, 759-769.

Babalola, S., Fatusi, A., & Anyanti, J. (2009). Media saturation, communication exposure and HIV stigma in Nigeria. Social Science & Medicine, 68, 1513-1520.

Besag, J., York, Y., & Mollie, A. (1991). Bayesian Image Restoration with Two Applications in Spatial Statistics (with Discussion). Annal of the Institute of Statistical Mathematics, 43, 1-59.

Breger, A., & Lang, S. (2006). Generalized Structured Additive Regression based on Bayesian P-splines. Computational Statistics and Data Analysis 50, 967-991.

Breger, A., Kneib, T., & Lang, S. (2008). BayesX: Software for Bayesian Inference in Structured and Additive Regression Models, version 1.51. Available under: http://www.stat.uni-muenchen.de/~bayesx

Fahrmeir, L., & Lang, S. (2001). Bayesian Semparametric Regression Analysis of multcatagorical time-space data. Annals of the Institute of Statistical Mathematics, 52(1), 1-18.

Fakolade, R., Adebayo, S.B., Anyanti, J. & Ankomah, A. (2010). The impact of Exposure to Mass Media Campaigns and Social Support on Level and Trends of HIV-related Stigma and Discrimination in Nigeria: Tools for Enhancing Effective HIV Prevention Programmes. Journal of Biosocial Science, 42, 395-407.

Federal Ministry of Health (2002). HIV/AIDS: What it means for Nigeria (Background, Projections, Impact, Interventions and Policy). Nigeria.

Federal Ministry of Health [Nigeria] (2003). National HIV/AIDS & Reproductive Health Survey (NARHS), 2003. Federal Ministry of Health, Abuja: Nigeria.

Federal Ministry of Health [Nigeria] (2006a). The 2005 National HIV Prevalence Sentinel Survey among Pregnant Women Attending Antenatal Clinics in Nigeria. Abuja: Nigeria.

Federal Ministry of Health [Nigeria] (2006b). National HIV/AIDS & Reproductive Health Survey (NARHS), 2006. Federal Ministry of Health, Abuja: Nigeria.

Federal Ministry of Health [Nigeria] (2006c). National HIV/AIDS & Reproductive Health Survey 2007 (NARHS Plus). Federal Ministry of Health, Abuja: Nigeria.

Federal Republic of Nigeria Official Gazette (2009). Legal Notice on Publication of 2006 Census Final Results. Official Gazette of the Federal Republic of Nigeria, Vol. 96, No. 2 of 2nd February, 2009.

Gamerman, D. (1997). Efficient Sampling from the Posterior Distribution in Generalized Linear Models. Statistics and Computing, 7, 57-68.

Gilmore, N., & Somerville, M.A. (1994). Stigmatization, Scape-goating and Discrimination in Sexually Transmitted Diseases: Overcoming 'them' and 'us'. Social Science and Medicine, 39(9), 1339-1358.

Hastie, T., & Tibshirani, R. (1990). Generalized Additive Models. London: Chapman & Hall.

Journalists Against AIDS Nigeria (2007). Taking on the Hydra: An Account of Nigeriа’s most celebrated Fight Against AIDS-related Stigma and Discrimination. JAAIDS Abuja: Nigeria.

Knorr-Held, L. (1999). Conditional Prior Proposals in Dynamic Models. Scandinavian Journal of Statistics, 26, 129-144.

Lang, S., & Breger, A. (2004). Bayesian P-splines. Journal of Computational and Graphical Statistics, 13, 183-212.

National Action Committee on AIDS (2003). National Policy on HIV/AIDS. Federal Government of Nigeria, Abuja.

Nyblade, L., & MacQuarrie, K. (2006). Can we Measure HIV/AIDS related Stigma and Discrimination? Current Knowledge about Quantifying Stigma in Developing Countries. ICRM: The Policy Project.

Spiegelhalter, D.J., Best, N.G., Carlin, B.P., & von der Linde A. (2002). Bayesian Measures of Model Complexity and Fit (with Discussion). Journal of the Royal Statistical Society B, 64, 583-640.

UNAIDS (2000). Nigeria Epidemiological Fact Sheets on HIV/AIDS and Sexually Transmitted Infections. Country Update, http://www.who.int/emc/disease/hiv/ or http://www.unaids.org

UNAIDS (2007a). 2007 AIDS Epidemic Update (Global Summary of the AIDS Epidemic). Available on www.unaids.org

UNAIDS (2007b). 2007 Country Progress Report (Nigeria UNGASS Report). Available on www.unaids.org

UNAIDS (2007c). Nigeria: Country Situation Analysis. Available on www.unaids.org/en/CountryResponses/Countries/nigeria.asp

UNAIDS (2007d). Towards Universal Access to Prevention, Treatment and Care: Experiences and Challenges from the Mbeya Region in Tanzania, a Case Study. Best Practices Collection, http://www.unaids.org.

USAID/PEPFAR (2008). 2008 Country Profile (Nigeria and Americans in Partnership to fight HIV/AIDS). Available on www.pepfar.gov/press/81548.htm

Utulu, S.N., & Lawoyin, T.O. (2007). Epidemiological Features of HIV Infection among Pregnant Women in Makurdi, Benue State, Nigeria. Journal of Biosocial Science, 39, 397-408.

Wigley, S. (2004). “Who’s setting the media agenda? A look at non-traditional interactive media and the gatekeeping process.” Paper presented at the annual meeting of the Association for Education in Journalism and Mass Communication, Toronto, August 2004.

World Health Organisation (2003). World Health Report: Shaping the Future. Geneva: Switzerland.

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