TITLE: Modelling Regional Differences in Timing of Marriage among Women in Nigeria, sub-Saharan Africa

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EXTENDED ABSTRACT

Background
Researchers in Nigeria have addressed differential in female's age at first marriage, however, few studies paid attention to using modelling approach as evidenced in the current study.

MATERIAL AND METHODS
The study was retrospective cross-sectional in design, data were extracted from the record of survey conducted by ICF Macro Calverton, Maryland, USA in conjunction with National Population Commission (NPC), Nigeria (Nigeria Demographic and Health Survey, 2008). During the survey, a multi-stage probability sampling was adopted to select the respondents who were women of child-bearing age (15-49).

Administratively, Nigeria is divided into 36 states plus FCT-Abuja. Each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. In addition to these administrative units, during the last 2006 Population Census, each locality was subdivided into convenient areas called census enumeration areas (EAs). The available cartographic material demarcated for each EA was useful in the EA location and its identification; hence the sample frame for this survey is the list of EAs used in the last census population. The primary sampling unit, a cluster, for the survey was defined on the basis of EAs census frame. A minimum requirement of 80 households for the cluster size was imposed in the design. If the selected EA is small during the listing process, then a supplemental household listing was conducted in the neighbouring EA.

The target of the 2008 NDHS sample was to obtain 36,800 completed interviews. Based on the level of non-response found in the 2003 Nigeria DHS, to achieve this target, approximately 36,800 households were selected, and all women age 15-49 were interviewed using a well designed questionnaire. A requirement was to reach a minimum of 950 completed interviews per state. In each state, the number of households was distributed proportionately among its urban and rural areas. The selected households were distributed in 888 clusters in Nigeria, 286 clusters in the urban areas, and 602 clusters in the rural areas. Under the final allocation, each of the 36 designated states and FCT-Abuja had at least 950 completed women interviews.

The current study focused on women aged 45-49 years who ever married. In the questionnaire designed for the survey, a question was asked from the respondents on age at first marriage (Quantitative). This was used as dependent variable while region, education, religion and place of residence were independent variable. The region was re-categorized into North and South; this is to see if there is a gap in age at marriage between the two regions. This is because the regions in the North share similar characteristics and likewise in the South.

The analysis began with Chi-square model which was used to determine if there exist an association between the background variables and age at first marriage. Thereafter, variables found to be significant in the analysis were entered into Cox-proportional Hazard model to predict the strength of the associations between these variables and timing of marriage.

The interaction between the variables was used to generate three Cox-proportional Hazard models. The variable region was analysed with no interaction (**Model 1: Region**). Religion was added to this model as a covariate to generate (**Model 2: Region and Religion**). In Nigeria, the Northerners are predominantly Muslims, while the Southerners are mostly Christians. Due to strong influence of Education on every demographic variable, it was introduced into the model two to produce the third model (**Model 3: Region, Religion and Education**).

Marriage pattern was modelled using a discrete-time duration model. The survival time is assumed to begin at birth and ends when the individual gets married. It is censored for an individual still single as at the time of the survey. The duration from birth to marriage, T, is assumed to be a discrete random variable that takes on only positive integer. The population at risk are all women involved in the study. The observation continues until time t, at which an event marriage occurs or the observation is censored in 2008 (The year of the survey). The study ends for an individual at time T = t if married. The Cox model is usually written in terms of hazard model which gives an expression for the hazard at time t for an individual with a given specification of a set of explanatory variables (Region, Religion, Education and Residence) denoted by X which are predictor variables that is being modelled to predict an individual's hazard (Age at Marriage).

$$h_1(t, X) = h_0(t)\exp\left(\sum_{i=1}^{i=n} \beta_i X\right) \qquad \text{Where; } X = X_1, X_2, X_3, \dots X_n$$

$$\log_e\left(\frac{h_1(t,X)}{h_0(t)}\right) = \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4$$

RESULTS
The data show that the mean age at first marriage was 17.8±4.8 years and the four variables considered in the analysis were found to be highly significantly related with timing of first marriage (p<0.0001). Majority of the women married between ages 15-19 years (43.1%) while, very few marriage late (2.3%) and about 27.0% married too early (10-14 years). Early marriage was more common in all the

regions in the North than the South. Majority of the Northern women married at ages between 10 and 19 years, whereas, in the South majority married at age interval 15 to 24 years. Late marriage was mostly common among women in the South East (6.8%) than in any other region in Nigeria. Also, the highest mean age at marriage (20.9±5.4) was recorded in this region, but the least is found in North West (15.3±3.1).

The percentage of women who married at ages 10-14 and 15-19 in urban area were 15.9 and 38.2 respectively, whereas, in rural it was 31.7 and 45.5. The mean age at marriage was significantly higher in urban (19.6±5.1) than rural area (17.0±4.3). Majority of women who had no formal education married at age 10-14 (42.4%) and 15-19 (45.9%) years. Among women with higher level education there was dominancy of marriage at ages 20-24 (35.1%) and 25-29 (34.3%) years. Very few of women with no education married very late (at ages 30 years and above) (0.2%). The mean age at first marriage increases considerably with increasing level of education. It increases from 15.7±3.5 years among women with no education through 23.6±4.9 years for those with higher level of education.

Women who belong to Islamic religious sect married earlier than their counterparts who are Christians. At age 10-14 and 15-19 years, 39.5% and 46.0% of Muslim women were already married, but as for Christians, 11.9% and 39.5% married at those ages respectively. Only 0.7% of Muslims married at ages 30 years and above. Early marriage was also common among traditional worshippers than late marriage. The mean age at marriage for Christians and Muslims were 20.0±5.0 and 16.0±3.7 respectively and the difference was statistically significant ($p<0.001$). When the regions in the North and South were collapsed into two categories; it became quite obvious that Northern women married early than their counterpart in the South. Evidence of postponement was seen in the South and there was a significant difference between the mean age at first marriage of women in the North (16.0±3.6) and South (20.4±5.0) ($p<0.001$).

The hazard of early marriage was highest in the North West and North East. In North West and North East, the hazards of early marriage were 1.5($p<0.001$) and 1.4($p<0.001$) respectively and significantly higher than that of their counterparts in the North central. In all the regions in the Southern part of Nigeria, the hazard of early marriage was lower than that of the North central. For instance, the hazard of marriage for women in the South East and South South were 0.792($p<0.001$) and 0.788($p<0.001$) respectively. However, no significant relationship existed between timing of marriage and women in South west Nigeria.

Hazard of early marriage also varied considerably among subgroup of women in terms of their place of residence, education and religion. Women who reside in rural area (H.R=1.15; C.I=1.11−1.18) married early than their counterparts in the urban area. The data further showed that the higher the level of education of the women, the lower the hazard of early marriage. Women who had primary, secondary and higher education were 0.88($p<0.001$), 0.68($p<0.001$) and 0.44($p<0.001$) respectively less likely to marry early than those with no education. Also, the hazard of early marriage was more pronounced among Muslim women (H.R=1.34; C.I=1.29−1.39) than Christians.

The Cox proportional hazard model of relationship between timing of first marriage and region collapsed into North and South was also assessed. Women in the North (H.R=2.11; C.I=2.05−2.17) were significantly marrying very early than their counterparts in the South. Multiple Cox-proportional hazard models of relationship between timing of first marriage and background characteristics was analysed. Three models were generated from the data. At first, the analysis was restricted to region (model 1). All regions in the southern Nigeria show a lower hazard of early marriage than the regions in the North. Introducing, religion into the analysis (model 2) reduces the risk of early marriage in the North, but increases hazard rate of early marriage in the south. However, the strength of hazard rate was reduced for women in the South West. When education was included to interact with region and religion, the hazard of early marriage diminishes across all the regions in the North, but increases, the hazard rate in the South. The relationship between timing of marriage and women in south western region which was earlier significant in the previous models became insignificant. Model 3 emerged as the best model, this is because it has the highest Chi-square and the least -2 Log Likelihood values. Therefore, the hazard of marrying early if compared with the North Central (Refrence category) were 1.45(p<0.001), 1.60(p<0.001), 0.79(p<0.001) and 0.77(p<0.001) in the North East, North West, South East and South South respectively. Significantly, Muslims women also have higher hazard (HR=1.32; p=0.000)of early marriage than Christian.

Conclusion
Women married too early in Nigeria with Teenage marriage more common in the North than the South. Education shows strong influence on age at marriage, therefore, women should have at least secondary education before marriage. This will have positive impact on their health.