Association between antenatal care and low birth weight: findings from the 2018 Nigeria Demographic and Health Survey

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(Please note: This preliminary finding is based on single-level modelling. Additional analysis is underway including using Poisson regression with the original count variable (birthweight), testing for measure of variation (random effects) to determine if multi-level model is a better fit than the single level models presented here, and determining the goodness of fit of the models)

Overview

Low birth weight is a persistent public health issue in Africa and many developing countries, including Nigeria. Low birth weight is defined as a birth weight of less than 2500g (up to and including 2499g) (WHO, 2004). Of all births reported annually, an estimated 15-20% are low birth weight (LBW) infants. Low- and middle-income countries account for a disproportionate burden of LBW accounting for over 95% of total LBW infants worldwide. The Sub-Saharan Africa contributes 13% of annual LBW infants (Cutland, et al, 2017).LBWhas many consequences for the health and survival of infants, and also on their long-term health status during childhood and adolescence, such as long-term neurologic disability, impaired language development, impaired academic achievement and increased risk of chronic diseases including diabetes and cardiovascular diseases (Cutland, 2017 & Zerbeto, 2015).

This paper proposes to assess the effect of mothers' use of antenatal care on the birth weight of children born in the last 5 years before the 2018 Nigeria Demographic and Health Survey was conducted. The study will be guided by two research questions: first, is there a significant difference between the mean birthweight of children whose mothers attended four or more antenatal visits and children whose mothers made less than four antenatal visits? Second, is the use of antenatal care services related to an infant's birth weight, taking other covariates into consideration?

Methodology

Data: The data comes from the 2018 Nigerian Demographic and Health Survey. The cross-sectional survey included women of reproductive age (15-45 years), from whom information on various reproductive health topics were elicited using a structured questionnaire. The NDHS has multiple recode datasets for each year with each focusing on different subpopulations e.g. couples, household, men, women, etc. For this analysis, the appropriate dataset was used - the Kids Recode Dataset (containing information on under-5 children). There were 34,194 (weighted total) under-five children in the sample, but only 8093 had birthweight records – either recorded on a card and seen by interviewer, or reported by the mother during interview.

Variables and measurements

Outcome: The binary outcome is low birthweight (yes = 1 if birthweight was less than 2.5 kg, and no=0 if birthweight is equal to or greater than 2.5 kg).

Main Exposure: The main exposure of interest is the number of antenatal visits during pregnancy ranging from 0-20 visits (we dichotomized this as "4+ visits"=1 if mother made 4 or more antenatal visits, and "less than four visits"=0 if mother made less than 4 antenatal visits). Women who "did not know” if they had antenatal or not during their last pregnancy in the last five years were excluded from the analysis.

Covariates: The variables controlled for in the model are Mother’s age at birth of child (generated from mother’s current age and date of her last birth) and coded as Less than 20 years, 20-29 years, 30-39 years, and 40+ years; region (Nigeria has 6 geo-political regions), residence (rural/urban), mother’s education, household wealth status, pregnancy gestation (premature birth=1, normal gestation (9 months)=0), and whether Child is a twin/multiple birth. Timing of first antenatal visit was dropped by both forward and backward stepwise regression and thus excluded from analysis.

Statistical Method

The analysis included examination of the variable identity numbers for possible duplicates, assessing the degree of missing data per variable, and model building using both the stepwise regression approach and empirical evidence from relevant literature. The Collin test for multicollinearity in Stata was used to examine multicollinearity among the predictors and the variance inflation factor was below 1.52 for any variable in the model, suggesting no multicollinearity. Using the continuous birthweight variable, we verified that the assumptions of independence of observations, and normality holds and then performed the F-test to address the first research question. A bivariate association of the birthweight (dichotomized) and each of the covariates was examined using the generalized linear regression (glm) and the result is presented as an unadjusted model. The full model using GLM and the adjusted odds ratio, standard errors, p-value and 95% confidence interval is presented as model 2. The appropriate survey weights were applied to all percentages and models to reduce selection and non-response bias, thus making the results of the regressions generalizable to the Nigerian population. All analysis were performed using Stata version 16.1 (StataCorp, 2018).

Preliminary Results

The data shows that 7.28% of children born the last five years were low birthweight babies. Disaggregating by the main predictor variable, antenatal visits, the cross-tabulations suggest that lower proportions of children born to women who made 4 or more antenatal visits experience low birthweight (6.71%) compared to 10.17% among children whose mother made less than 4 antenatal visits. The data also show that 45% of children delivered prematurely had low birthweights compared to 6.8% of children delivered after normal gestation. Children who are multiple births (27%) have a higher proportion of low birthweights compared to 6% of non-twin births. The F-test shows that there is a significant difference in the mean birthweight by number of antenatal visits ($p<0.003$, F-stat=8.674). The negative coefficient of -104.896 suggests an inverse association - as number of antenatal visits increase, the risk of low birthweight reduces. The null hypothesis that there is no difference in mean birthweight is thus rejected.

In the unadjusted model, relative to children born to mothers who made 4 or more antenatal visits, the odds of low birthweight among children of women who made 3 or less antenatal visits are 1.04 times higher ($p<0.05$, CI=[1.004,1.068]). Other covariates that are significantly associated with low birthweight at the bivariate level include age of mother at child’s birth (children born to women of higher ages 20-29, and 30-39 tend to be at lower odds of low birthweight compared to children of women who had their birth before 20 years). Expectedly, children whose birth were premature are at higher odds of having low birthweight than children delivered after nine months gestation period. Similarly, a child born as one of multiple births (twin, triplet, etc) is significantly at higher odds of low birthweight compared to children who were single births. The unadjusted model indicates that having higher education is protective against low birthweight and being born in a household in the highest wealth quintile also appears to be protective against low birthweight.

In the full model, when the association between low birthweight and number of antenatal visits was adjusted for the effect of other covariates, the model shows that the number of antenatal visits is not a significant predictor of low birthweight. However, the effects of mother's age at birth of child, gestation (whether preterm birth or normal duration), child being a multiple birth (twinning), and mother's education all became stronger as they significantly moved away from the null. For instance, the adjusted odds (AOR) of low birthweight for children born to women ages 30-39, (relative to women who delivered at age less than 20), nearly halved to 0.490 ($p<0.01$, CI=[0.301,0.797]) from the UOR of 0.953. Also, the AOR of low birthweight for children delivered prematurely increased to 13.217 ($p<0.001$, CI=[6.218,28.095]) from UOR of 1.468. Furthermore, after holding other covariates constant, the odds of low birthweight among children who were multiple births (twinning) increased nearly fivefold from 1.241 to 5.260 ($p<0.001$, CI=[3.246,8.522]) times higher than the odds among children who were single births (reference). The adjusted model also indicates a stronger predictive association of increased low birthweight among women with lower education (primary) or no education relative to women with higher than secondary education ($p<0.001$, AOR=1.952, CI=[1.195,3.188]).

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