

# **Decision autonomy, quality of antenatal care and birthweight: indirect effects conditioned on the context of polygyny.**

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## **1. INTRODUCTION**

Adverse pregnancy outcomes manifest in different forms, including low birthweight (LBW) [1]. This refers to babies delivered with a weight lower than 2500 grams, regardless of gestational age [1,2]. Data spanning between 2000 to 2015 shows that the global annual prevalence of LBW is between 14.6% to 20.0%, equivalent to about 20 million births. In Sub-Saharan Africa (SSA), the prevalence of LBW is 13.7% [3]. Data from the Nigeria demographic and health survey (DHS) indicate that the proportion of newborns weighing less than 2500 grams in Nigeria was 7.3% in 2018, compared to 8.0% in 2008 [4]. Although about 54.0% of newborns are reportedly not weighed at birth [3].

Risks associated with LBW include mortality within the neonate period [5], risk of subnormal growth for survivors [6], and impaired cognitive abilities [7]. Social consequences may include inattention, hyperactivity disorder [8], and low educational attainment [9].

Birthweight may be affected by gestational age, intrauterine growth restriction [10], poor maternal nutrition [11], and inadequate antenatal care (ANC) [12,13]. Several of these have underlying social correlates including young maternal age, low educational status, poverty, or psychological distress [14]. As the process of fetal development (in most cases) happens

within the context of the family, familial factors such as the mother's decision autonomy may also constitute another aspect of underlying social correlates [15,16].

Familial factors may reinforce or impede a woman's decision autonomy within the household. In contrast to monogamy, empirical studies often portrayed polygyny to portend a negative effect on child health [17,18], and pregnancy outcomes [19,20]. Most findings, however, were based on the direct effects of what may be a complex web of interacting social factors. Therefore, using data from the Nigeria DHS, we aim to investigate the mediating role of the quality of ANC in the relationship between mother's household decision autonomy and birthweight, with attention to the moderating role of family structure.

## **2 MATERIALS AND METHODS**

### **2.1 Data**

Data was taken from the fifth wave of the Nigeria demographic and health survey collected from August to December 2018. The sample for the survey was selected using a stratified two-stage cluster design. This consisted of a selection of 1400 primary sampling units (PSUs) across both rural and urban strata. All women aged 15 to 49 years in the households were eligible for interview. Out of the 42,121 eligible women, 99% were successfully interviewed. Questions bordered on household socio-demography, reproductive health, and fertility history among others.

### **2.2 Sample Selection**

Our sample selection focused on respondents who are married and residing with their husbands and had a live birth within 5 years preceding the date of the survey. During the survey, the birthweight of the child was obtained from documented evidence (health card,

birth card), or from the mother's recall where such documentation was not available. Due to the possibility of recall bias, we only included the sample where the birthweight was obtained from documentations. The final sample included 7,012 mother-child-dyad. Analysis was performed based on case wise of missingness among other variables of interest which ranged from 0.3% to 3.2%.

## **2.3 Variable Measurement**

### **2.3.1 Dependent Variable**

The main outcome variable of this study is birthweight. operationalized this as a continuous variable. An alternative form is binary coding, where a weight less than 2500 grams (2.5 kg) is regarded as low birthweight, and weights equal to or greater than 2500 grams (2.5 kg) are regarded as normal [2].

### **2.3.2 Independent Variable**

The independent variable in this study is the mother's decision autonomy. During the survey, the women responded to questions on who makes decisions on five subject matter which include 1) personal healthcare, 2) purchases in the household, 3) visits to relatives or friends, 4) spending personal earning, and 5) spending husband's earning. For each of the items, we coded the responses into three ordinal categories "3=respondent alone; 2= respondent and partner jointly; 1= partner alone; 0= someone else". We aggregated the scores to generate a decision autonomy composite index. The scoring index ranged from 0 to 15, with a higher score representing better decision autonomy. The Cronbach alpha reliability coefficient of internal consistency for the five items in this current study is 0.78.

### 2.3.3 Mediating Variable

The mediating variable in this study is the quality of ANC. This was generated from seven binary-coded variables. 1) whether or not the ANC visit was initiated within the first trimester of the pregnancy, 2) whether or not there was up to a total of eight ANC visits, meeting the new minimum standards [21]. 3) whether or not a blood sample was collected, 4) whether or not urine sample was collected, 5) whether or not blood pressure was taken, 6) whether or not a minimum of two doses of ATT vaccine was administered and 7) whether or not IPTp was given.

### 2.3.4 Moderating Variables

Two moderating variables relating to the context of polygyny were utilized. The first moderating variable is rank as a wife. This includes “1=Second or later-order; 2=First wife; 3=Only wife”. The second moderating variable is the number of other co-wives, operationalized as a continuous variable.

### 2.3.5 Exogenous variables

Child-related factors include gender, birth order, birth interval, and type of birth. Maternal-related factors include age, education, employment status, parity, weekly exposure to the media, tobacco smoking, body mass index, and plan for the pregnancy. Household-related factors include the husband’s education, wealth index, distance to a medical facility, and religion. Community-related factors include rural/urban residency and geopolitical zone of residency.

## 2.4 Statistical analysis

We used structural equation modeling with the bootstrap method set at 5,000 replication and 95% confidence interval, to decompose the effect sizes, and also make a predicted estimation [22,23]. Bias-corrected bootstrap confidence interval is recommended for assessing the statistical significance of indirect effects, and they are considered significant when the confidence interval does not contain a zero [24,25]. All statistical analyses were performed in STATA software version 15.0 (StataCorp, College Station, TX, USA).

## 3 RESULTS

### 3.1 Moderated-mediation effects.

The result of the 5,000 bootstrap replications, estimating each path while holding all factors constant, is presented in Figure 1. The 95% bias-corrected bootstrap confidence intervals show that the path *decision autonomy*  $\rightarrow$  *birthweight* was not significant ( $\beta = -0.006$ ;  $p > 0.1$ ). Furthermore, while each of the indirect paths *decision autonomy*  $\rightarrow$  *quality of ANC* ( $\beta = 0.025$ ;  $p < 0.05$ ) and *quality of ANC*  $\rightarrow$  *birthweight* ( $\beta = 0.036$ ;  $p < 0.05$ ) were individually significant, the significant results of the moderating effects of the respective moderating variables indicate a case of moderated-mediation (*Conditional indirect effect*).

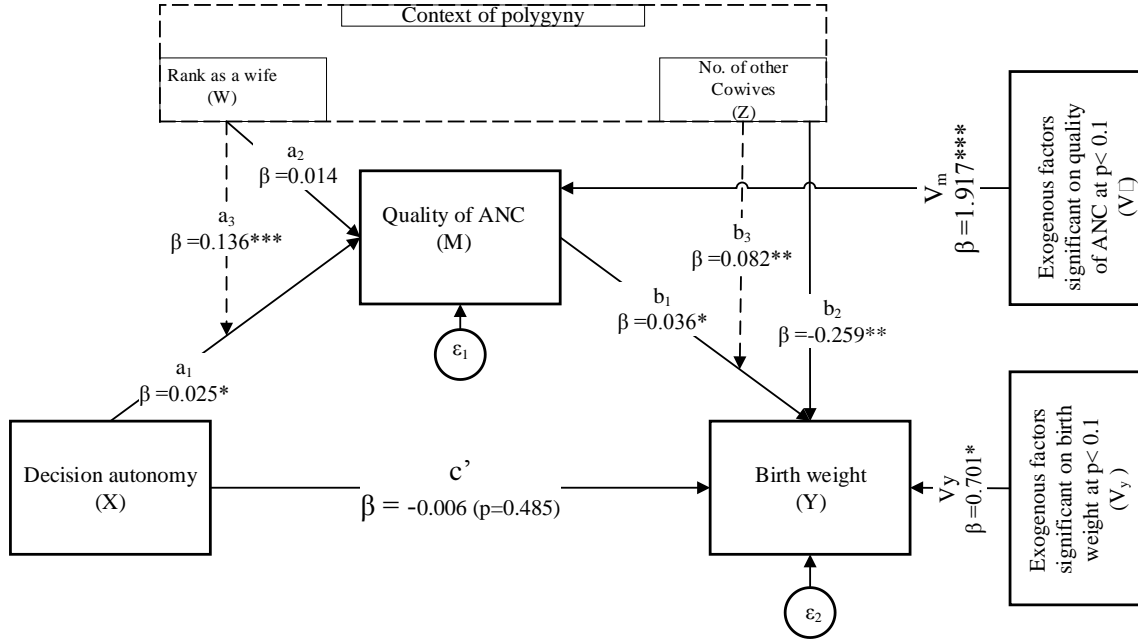


Figure 1. Estimation of Path Coefficient From 5,000 Bootstrap Sampling

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05

The decomposition of the effects is shown in Table 1. As seen, the total indirect effect was significant ( $\beta = 0.001$ ) and the conditional indirect effect was also significant ( $\beta = 0.019$ ). The predicted effects showed that the conditional indirect effect on birthweight decreases if a mother hypothetically moves from a monogamous to a polygynous union. Furthermore, wives who are of higher order ranking have a reduced conditional indirect effect compared to those who are first wives. But conversely, conditioned on the number of co-wives, the conditional indirect effect increases as the number of co-wives increases.

Table 1. Decomposition of effects of mother's decision autonomy on birthweight from 5,000 bootstrap sampling

Path	Effect description	Effect size ( $\beta$ )	BC bootstrap 95% CI
$c'$	Direct	-0.006	[-0.0239, 0.0106]
$(a_1) \times (b_1)$	Total Indirect (Non-Conditional)	0.001	[0.0001, 0.0027]
$(a_1 + a_3W) \times (b_1 + b_3Z)$	Total Indirect (Conditional)	0.019	[0.0063, 0.0374]
Predicted conditioned only on rank as a wife		$(\hat{a}_1 + \hat{a}_3W)$	
At (mean-1SD)	Second wife+	0.031	[0.0099, 0.0619]

At (mean)	First wife	0.044	[0.0138, 0.0883]
At (mean+1SD)	Only wife	0.056	[0.0175, 0.1143]
Predicted conditioned only on the number of cowives		$(\widehat{b}_1 + \widehat{b}_3 Z)$	
At (mean -1SD)		0.002	[-0.0030, 0.0081]
At (mean)		0.011	[0.0035, 0.0211]
At (mean +1SD)		0.019	[0.0063, 0.0377]

BC= bias-corrected; SD= standard deviation

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