FOOD INSECURITY AND FAMILY STRUCTURE IN NIGERIA

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Abstract

The article explores a series of questions and hypotheses related to polygynous family structures and both household and individual-level food security outcomes. The World Bank Living Standards Measurement Survey data from Nigeria, collected in 2011 and 2013, is used for the study of these relationships. A Correlated Random Effects (CRE) model is used to examine the relationship between polygyny and household-level food security, and the degree to which it is mediated by household wealth, household composition, and agricultural livelihood. Given the limitations of the household-level food security data, child-level health indicators are also examined, using both a pooled OLS regression model and a household fixed effects model to control for unobserved household characteristics.

Results of the household-level regressions indicate that polygynous households have better food security outcomes than monogamous households, with differences in household composition and agricultural livelihood as potential explanatory mechanisms. Although results from pooled OLS regressions appear to indicate that children of monogamous mothers have better health statuses than children of polygynous mothers, significant differences between these family structures are no longer present once household fixed effects are controlled for. The presence of better food security outcomes at the household level for polygynous families, combined with the absence of evidence of better child-health outcomes in monogamous households may hint at some caution in the criticism of polygynous family structures, particularly with relation to food security outcomes.

I. INTRODUCTION AND MOTIVATION

Progress toward achieving food security is often cited, with focus typically on global progress toward the Millennium Development and World Food Summit goals, that estimate the proportion and numbers (respectively) of the population that is undernourished (SOFI, 2015). Nonetheless, not only have the *numbers* of the estimates of those globally affected actually increased in some areas, but progress is uneven. Existing indicators mask the underlying distribution, including both regional variation within countries and variation within households (Barrett, 2010). Among the most difficult issues to understand and measure is that food insecurity is an individual concept, and different members of specific households can experience different outcomes—men versus women, adults versus children, and potentially even different children within the same household.

Nigeria is of particular interest given that the numbers of individuals experiencing food insecurity is rising. According to an FAO (2015) report, despite Nigeria having achieved the reduction of undernourishment of the population by more than half, from 19.3% in 1990 to 8.5% in 2010 to 2012, the number of people who are undernourished in Nigeria increased from roughly 10 million to almost 13 million from 2010 to 2012. Additionally, there is regional, rural-urban, and cultural variation in food security across the country. Food insecurity in Nigeria is also likely to vary based on existing family structures, given the existing decision-making processes. Family structure in Nigeria is complex and varied, with potential implications for resource distribution and bargaining power that are likely to be important determinants of food security at the household and individual levels (Nazli, nd).

The current research focuses on family structure and food security in Nigeria, and in particular on the possible influence of polygyny, the still common practice of a man marrying more than one wife, on both household and child-level outcomes. While more wives may mean more potential caregivers and farm hands, engendering better food security outcomes, the presence of multiple wives may lead to competitive rather than cooperative strategies, making the relationship between polygyny and food security ambiguous.

Despite the extraordinary importance of issues of food security in Nigeria, the subject area remains poorly-understood and sparsely researched in large part due to the complexity of the problem. Additionally, the data needed to assess the determinants of food security in a nuanced manner across the entire country, and at the individual level are rarely available. Where nationally representative data is available, these often do not include food and nutrition indicators, particularly at the individual level. Data sets that do contain food security indicators are not often nationally representative and instead focus on small geographical areas, or districts (e.g. Abimbola & Adejare, 2013; Atoloye, Olubukola & Folake, 2015).

This paper explores the relationship between polygyny and food security, as measured by both household-level dietary diversity and coping strategies indicators, and individual-level child anthropometric outcomes. It is hypothesized that polygyny has a significant relationship with food security outcomes at the household level, after controlling for household structure, wealth and other relevant factors. In turn, children of mothers in polygynous unions have different individual health outcomes than children of mothers in monogamous unions.

These relationships are examined using the nationally-representative Nigeria General Household Survey, collected as part of the Living Standards Measurement Survey – Integrated Surveys on Agriculture (LSMS-ISA) project of the World Bank. Two waves of the data are exploited to use correlated random effects (CRE) and fixed effects (FE) estimators, in order to convincingly examine relationships and mechanisms. The study contributes to the existing literature in the following ways. First, appropriate and nationally representative data is employed in carrying out micro-level analyses of food security in Nigeria. Second, the study contributes to literature on both intra-household bargaining and the nature and implications of the practice of polygyny, with the specific application of its implications for food security in Nigeria.

II. BACKGROUND

a. Correlates of Polygyny

A number of factors are correlated both with the societal prevalence of polygyny and the likelihood that men and women join in polygynous unions. Religion and culture are often important factors. While most Christians customarily discourage the practice, most Muslims allow it (Boserup, 1970), although some Muslim countries like Turkey and Tunisia do not encourage the practice. Ethnicity can also play an important role, as different groups have different values and traditions, both related to and independent of religious traditions, and may also have differential exposures to the effects of modernization. In Nigeria, Hausa women, commonly found in the Northwest region of the country, are more likely to be in polygynous union, compared to other ethnic groups, including Yorubas.[1] These ethnic divides are highly, but not perfectly, correlated with the Muslim-Christian religious divide, and cross-ethnic marriage is also common (Kritz & Makinwa-Adebusoye, 1995).

Economic conditions, including wealth and livelihood activities, are also potentially highly related to polygyny. Polygyny is less prevalent, for example, in urban areas, given the higher cost of living and raising children, as well as the lack of farming opportunities, which can decrease the potential value-added of additional household labor (Maillu, 1988). The level of household wealth can be both cause and consequence of polygyny (Timaeus & Reynar, 1998). On the one hand, wealthier men are able to afford more wives as they are more likely to be able to provide for them; on the other hand, polygyny may increase men's access to land and labour from women and children, leading to higher production and higher wealth. This latter phenomenon is more likely to hold in agricultural communities (Mair, 1971).

Finally, engaging in polygyny can be related to individual characteristics and experiences, particularly for women. Education plays a particularly important role; using demographic and health survey data for women in sub-Saharan Africa, Hayase and Liaw (1997) found that the transition of women from secondary to higher education results in a significant reduction in their likelihood of engaging in polygynous unions. This trend may relate to exposure through the formal education system to Western cultures, in which monogamous unions are the norm and polygyny is frowned upon or even illegal. Age is also a factor; older women are more likely to be in polygynous unions for two reasons; first, given the increasing effects of modernization, younger cohorts may be less likely to be in polygynous unions. According to the 2013 Nigerian Demographic and Health Survey, the proportion of women in polygynous

[1] In the present study sample, the highest concentration of polygynous households is, indeed, found in the north west (*see Table 2*)

unions increases with age, and this is mostly attributable to the Islamic religion and the prevailing culture which allows a man to have more than one wife. The age at which a woman gets married may also affect the nature of her union. On the one hand, a woman who marries at a very young age may become likely to be in a polygynous union later in her life. On the other hand, women who marry at later ages may agree to be second wives, as they are willing to marry into polygynous unions, in order to avoid the social stigma of not being married (Hayase & Liaw, 1997).

b. Motivations and Consequences of Polygyny

In Nigeria, roughly a third of all married women are in polygynous unions (NDHS, 2008). While under the increasing influence of Westernization and modern attitudes, the traditional patriarchal system dominates, which is related to the higher rate of polygyny (Asinyanbola, 2005). The effects of gender asymmetry with respect to social and cultural rights and responsibilities within the patriarchal system are also readily observed in practices such as defined gender roles. In keeping with these traditional roles, men are typically the heads of families while females are involved in domestic chores and child rearing. With respect to agricultural activities, men are traditionally responsible for land preparation activities while women plant and harvest the crops. Polygynous households are therefore able to cultivate larger plots of land, given the labour supply and greater cultivation activities by co-wives (Asiyanbola, 2005). Therefore, despite the potentially thinner distribution of resources among many family members, the net gain could be positive, due to economies of scale.

Nigerian society places significant emphasis on having children, which constitutes a major motivation for marriage, often leading to early marriage and pregnancy, particularly in the rural and northern parts of the country (Isiugo-Abanihe, 1994). On average, polygyny leads to a larger number of children in the household, which conforms with social expectations and also increases a man's social status within his community. According to Isiugo-Abanihe (1994), even a man who is not well-endowed financially is regarded with more respect if he has many children.

The motivation for polygyny differs between men and women, and may have differential implications for welfare on women and men. The literature on the effects of polygyny on women's welfare is mixed. Some researchers argue that polygyny is beneficial to women (Becker, 1981; Grossbard, 1980) while others find negative outcomes among women engaged in these unions (Ickowitz & Mohanty, 2015; Bergmann, 1995). Proponents of polygyny argue that women in polygynous unions tend to benefit from increased consumption after marriage due to access to husband's resources and her bride price that is received. Additionally, women may also benefit from labour sharing among co-wives with respect to domestic work, agricultural responsibilities, or child care duties, resulting in increased leisure time.

According to Becker (1981), women in polygynous unions are likely to fare better than women in monogamous unions. This conclusion is based on the assumption that there are fewer men on the marriage market than women. While data on Nigerian population and demography indicates a slightly higher proportion of males than females in general, the proportion of females in the youth category (15-39 years) is larger than the proportion of males in this category (National Bureau of Statistics, 2016). A polygamist regime might therefore increase the supply of men through increased demand for brides. This higher demand for women would therefore raise the price of women and result in their higher access to marital income and consumption. However, many disagree with these conclusions. For instance, women

in polygynous unions may not be better off than their monogamous counterparts if ceilings are placed on access to marital income. The presence of price ceilings on the consumption of women in polygynous unions is likely to result from the situation where marriage gives men some legal control over the distribution of marital products. Men may then use this power to place restrictions on women's access to marital income, even when a woman's price in a marriage may be higher, as is proposed to be the case under polygyny (Grossbard, 2014).

In the African context, polygyny may indeed be beneficial to women in some societies given that polygynous husbands tend to be wealthier and the pool of laborers available for domestic work from the larger number of wives reduces the need for wage laborers (Adams & Mburugu, 1994; Dorjahn, 1988). According to Ware (1979), approximately 60% of Yoruba women in Nigeria preferred to be in a polygynous union because it would provide both a social opportunity to interact, as well as provide help with the domestic work.

However, opponents of polygyny cite co-wife conflict and oppression as negative effects on women. In the African context, there may be challenges with the arrival of a new wife. This is because of the fear that additional wives would reduce the availability of household material resources, take away the husband's time and also his affections and availability (Adams & Mburugu, 1994; Ware, 1979). The presence of these fears or perceptions of threats may give rise to envy and jealousy between co-wives, leading to conflict (Eichenbaum & Orbach, 1988; Potash, 1995). In addition to the possibility of a lower level of consumption and higher conflict situations among women in polygynous unions, the view of polygyny as a tool for the oppression of women is of graver concern (Ickowitz & Mohanty, 2015). Indeed, Ickowitz and Mohanty (2015) found that women in polygynous unions in Ghana are often more likely to experience domestic violence, and have lower decision-making power, compared to women in monogamous unions.

With respect to their welfare, men are likely to benefit from polygyny as a result of the traditional system of agriculture, which prevails in rural areas and in the northern regions of Nigeria. Where farming and pastoralism are common, having more labour available at the household level from wives and children can increase agricultural production. Similarly, for women, the presence of additional wives may lead to shared responsibilities and hence increased leisure time (Ware, 1979). Where these relationships are of primary importance, it is expected that polygynous households would have better agricultural and food security outcomes. Although polygyny is more popular in rural areas where there is more potential for economic benefits, it is often practiced in urban areas in Nigeria as well. The motivation for this practice in urban areas appears to be more related to social prestige, given that a large family is symbolic of wealth in the Nigerian context (Naksomboon, 2013).

c. Polygyny and Food Security

The question of how polygyny affects the distribution of power and subsequent household welfare has been explored. Anderson et al. (2016), for example, found that while women in monogamous households have more decision-making authority than women in polygynous households, this perception differs between husbands and co-wives in polygynous households; while women in polygynous households report having less authority, their husbands do not appear to feel the differences in the share of household

decision-making as strongly. The authors also find that women tend to have differential levels of bargaining power over particular kinds of decisions within the household.

A number of factors are highlighted as important determinants of women's bargaining authority within the household, such as her level of education, income-earning capacity, and socio-cultural norms. Within polygynous households, however, there are some additional complexities in the bargaining process. Different researchers have found evidence for both co-operation and competition among co-wives in polygynous households.

Akresh et al. (2012) highlight the role of co-wife cooperation within polygynous households in Burkina Faso, where cooperation among wives is measured by agricultural yield differentials. Where wives cooperate with each other, but with not their husbands, their yields are higher than that of their husband. Co-operative outcomes are not always by choice, however. According to Dauphin (2016), a wife may be forced to cooperate under a husband's threat to take an additional wife if she does not. Dauphin (2016) found a negative correlation between polygyny and efficiency, as measured by agricultural production in Benin, Burkina Faso and Senegal. Other studies also find a negative relationship between polygyny and efficiency. For example, Kazianga and Klonner (2006) point to co-wife rivalry as a driver of inefficient outcomes, namely health disparities between wives in rural Mali. Other studies find that efficiency in polygynous households tends to be context-specific. For instance, Han and Foltz (2015) found that the degree of co-wife competition or cooperation in Mali depends on the cultural characteristics of polygyny. Using ethnic groups as a proxy, the authors found that among the Dogon, Fulani, and Bambara, there were differences in child health outcomes as a result of unobserved characteristics linked to ethnicity. Munro et al. (2010), however, found no difference in household efficiency between monogamous and polygynous households in their experimental study conducted in northern Nigeria. Here, the total endowment invested in a common pool by monogamous and polygynous wives did not differ, indicating an absence of efficiency loss from polygyny. Where husbands controlled the allocations however, there was higher investments of household resources under monogamous unions; and polygynous husbands' investments tended to favour first wives. Husbands were the ultimate gainers from the household allocation of resources.

Where there is cooperation, polygynous households may benefit greatly from labour sharing; the large pool of labour from women and children in the household may potentially increase the over-all wealth and food supply (Boserup, 1970; Zietzen, 2008). This supposition would be most applicable in households engaged in labor-intensive agriculture. Increasing rates of school attendance, particularly by girls, may induce household labor shortages, which could provide still another incentive for co-wives to cooperate (Nasimiyu, 1985). All of these findings point to ambiguous effects of polygyny on household level measures of food security.

It is expected that household size and structure be positively related to food security outcomes where there are scale economies associated with number of household members. At the same time, if larger household size induces more competition for resources, this could result in uneven or thinner distribution of resources across household members. For instance, investments in children may fall with larger family sizes (Heer, 1985; Maitra & Pal, 2008). On the other hand, some earlier research indicates that children may on net contribute to household resources (Gomes, 1984; Chernichovsky, 1985). Beyond scale economy and resource dilution effects of household size, it might be expected that the relationship

between the adult household members (that is, whether they are married to the same person or not) be related to the efficiency of the household. In a household where there are multiple co-wives, cooperation or competition might be expected to either enhance or undermine the efficiency gains of larger household size relative to a household with multiple females who are not all married to the same person.

d. Child Health Outcomes and Polygyny: Intra-household bargaining effects

Polygyny may have implications for both women and children's well-being, as a number of studies have found that women in polygynous marriages had poorer welfare outcomes, as measured by mental and psychological statuses. Sellen (1999) also found that anthropometric outcomes of both women and children worsened under polygynous regimes in Tanzania. Interestingly, he found that children of both first and second wives were worse off under polygyny, than other lower-order wives, attributing this to these women entering the marriage under more favorable or prosperous circumstances. Arney (2002) found that there were higher risks of child mortality in polygynous, compared to monogamous households, using Demographic and Health survey data from 6 countries in West Africa. Kazinaga and Klonner (2009) also found evidence of higher child mortality risks in polygynous households in rural Mali. Hadley (2005) found that children of polygynous households had poorer outcomes, as measured by their nutritional status and growth outcomes in Tanzania. Wagner and Rieger (2015) used demographic and health data for 26 African countries and household fixed effect models and found that children of monogamous households had better long term nutritional outcomes than children of polygynous households. Additionally, children of junior wives had worse outcomes than children of senior wives. These studies appear to consistently suggest that polygyny is adversely related to both women and children's welfare, although seniority within a polygynous household may be advantageous.

Food security is best considered individually, since different members of the same households can experience different outcomes based on gender, age, or other factors. Different children within the same household may have different food security outcomes. The relationship between polygyny and individual children's health outcomes most likely operates through the efficiency channels described above, while at the same time depending on characteristics of the child's mother. Polygyny is generally negatively correlated with female bargaining power; co-wives in polygynous households wield less bargaining power than their monogamous counterparts because the value of individual wives' assets in the latter, on which bargaining power may be based, is smaller, given that multiple wives contribute to household welfare (Anderson et al., 2016).

It is important to note that selection into polygynous unions is non-random, and therefore, women in monogamous unions may have systematically different characteristics than women in polygynous unions, which independently affect their bargaining power and children's wellbeing. Women's higher bargaining power within monogamous households may thus be linked to observable characteristics, such as education, income-earning capacity, and productivity, as well as unobservable characteristics (Amankwaa, 1996; Doss, 2013). Given their higher bargaining power, higher share of household production and women's general proclivity to readily apply resources towards household welfare goals such as food, clothing and health, children of monogamous women may fare better than their polygynous counterparts with regards to food security (Haddad, Hoddinott, & Alderman, 1997; Thomas 1997; Quisumbing & Maluccio 2003). To the extent that monogamous women have greater autonomy to allocate resources, they can better weight the costs and benefits of alternative uses of household resources to assure the most efficient outcomes (Smith, 1995). To the degree that polygyny increases efficiency and

allows access to more resources, and if those resources are pooled among wives (Akresh, Chen & Moore, 2016), it might be expected that children of women in polygynous households exhibit better health outcomes. If resources are not fully pooled (that is, there is not full cooperation between wives), then it would be expected that children of women in polygynous unions exhibit the same or worse health outcomes as children in monogamous households.

III. DATA AND DESCRIPTIVE STATISTICS OF KEY STUDY VARIABLES

The study employs nationally-representative data from the Nigerian General Household Survey (GHS), containing information collected from 5,000 households. The survey comprises three main components: household, agriculture and community modules. The present study draws data from each of these components, but focuses primarily on the household module, which includes information on demographics, education, health, food security, and economic shocks, among others.

The data consists of two waves, 2010/2011 and 2012/2013[2], and each wave consists of two seasons, post-planting and post-harvest. The post- planting data was collected directly after the planting season to collect information on the preparation of plots, inputs used, labour used for planting and other issues related to the planting season. The post-harvest data was collected after the harvest season and included information on crops harvested, labour used for cultivating, harvest activities, and other issues related to the harvest cycle. The study relies primarily on the post-harvest data, only updating missing information using the post-planting rounds, as the data in this season included information on both household-level food security and child anthropometric outcomes that were necessary for the analysis.

The survey defines a household as a social unit consisting of one or more people who are or are not related, and who live in the same household unit; that is, live under the same roof, and who eat together; that is "eat from the same pot". This definition and its application in practice have implications for the nature of the responses to food security questions, in particular for polygynous households. First, while in principle a respondent is to be a knowledgeable person answering on behalf of all household members, a potential limitation lies in that it cannot be ascertained that a respondent in a polygynous setting is in fact answering for all co-wives and children, as opposed to for his or her specific family unit within the household. The child-level analysis, however, overcomes this limitation, as it addresses specific children of a certain age regardless of their mothers' status. Second, this definition of a household also has implications for how polygyny is handled in this paper; some polygynous households may have wives who would not be considered as family members.

This section contains summaries of the variables used, including key control variables and the outcomes of interest. Descriptives are provided along the lines of key features of family structure—either polygynous or not, at the household level, and the status of the mother- monogamous or polygynous- at the child level. Appendix 1 describes the key control variables used, and how they are constructed.

Polygyny, as the main explanatory variable of interest, is constructed from the number of wives present in the household roster. Self-reported information on marital status is not used, given that the data contains

[2] A third wave of the data is available but does not include consumption aggregates and therefore has not been used in the present study

some individuals who reported being in a polygynous union while there was only one spouse present in the household, and men and women reporting differential marital status (polygynous versus monogamous). As mentioned above, there may also be the case of co-wives who lived away from a specified household. As the study focuses specifically on bargaining over food and other resources on site, "observed" polygyny is preferred, the case in which multiple wives of the same husband are in fact present in the household.

For household-level outcome variables, two indices of food security are constructed, in order to reflect different aspects of the availability of and access to food. First, dietary diversity is examined through the Food Consumption Score (FCS), following the World Food Programme approach put forward by Weismann, Basset, Benson and Hoddinott (2009). The FCS uses information on the frequency of consumption in the week prior of cereals, tubers, pulses, vegetables, fruits, meats and fish, milk, sugar and oil. Higher scores are indicative of better food security, and in practice, a score less than 21 is considered poor, 21 to 35 is borderline, and above 35 is considered acceptable. To reflect other dimensions of food security, such as economic and social access to food, the Reduced Coping Strategies Index (RCSI) is also constructed, following Maxwell, Vaitla, Tesfay and Abadi (2013). The RCSI provides information on household behaviour or coping strategies in the presence of food deficits. It is constructed from self-reported practices, including relying on less preferred foods, limiting portion sizes and the number of meals eaten, and reducing meals so as to give priority to children. The index is a combination of these practices and their frequencies in the prior week, such that a higher score is an indication of greater food insecurity. In practice, scores of 0 to 4 are considered food secure while scores of greater than 20 are considered very food insecure.

For individual-level food security, child anthropometric measures are used as a proxy. The height-for-age z-score (HAZ) compares children's height against global averages for that age (in months). Children's skeletal (linear) growth may be compromised due to constraints to nutrition or health, making HAZ a good indicator of stunting, resulting from long-term or chronic nutritional deprivation**.** The weight-for-height z-score (WHZ) is also considered. As children suffer thinness resulting from energy deficit and disease-induced poor appetite, or loss of nutrients, the WHZ is a fitting indicator for wasting, or more short-term or transitory nutritional deprivation.

a. Summary Statistics

Summary statistics of variables from wave 1 (2010/2011) are provided in the tables below. It is noted in the descriptions where averages differ greatly between wave 1 and wave 2. The descriptive statistics are presented as follows: Table 1 presents summary statistics of household level controls, including education, wealth, socioeconomic and geographical characteristics in the post-harvest season, with information on education and religion updated from the post-planting season. Table 2 summarizes food security indicators at the household level for the post-harvest season. Table 3 presents descriptive statistics of two measures of child nutritional outcomes, by monogamous versus polygynous wives, for both waves 1 and 2. Finally, Table 4 summarizes characteristics of mothers in polygynous versus monogamous marriages, and fathers in polygynous versus monogamous marriages, in the first wave of the survey.

i. Table 1- Household Level Variables, by Family Structure: Nigerian General Household Survey, Baseline data, 2011

About 23% of households in the data were in polygynous unions. While the rate of polygyny has been on the decline in recent years, it remains a defining feature of household structure in the Nigerian context (Fenske, 2011). Polygynous and monogamous households differ significantly with respect to participation in formal education and the highest education level attained by any household member. While only 12% of household members in monogamous households report having no formal education, 21% of members in polygynous households had no education. Additionally, in 33% of monogamous households, the highest educational qualification among members was a secondary school education, compared to only 20% in polygynous households. This might lead to better outcomes among monogamous households, given that higher formal education may be correlated with better knowledge about nutrition and food preparation. Regarding employment level, there were no statistically significant differences between household heads' employment in monogamous and polygynous households. Across all households, roughly 89% of heads in the sample are employed.

The study sample is predominantly rural, with only about 29% of respondents based in urban areas. Consistent with existing literature, polygyny is predominantly a rural phenomenon; only 16% of polygynous households were based in urban areas, compared with 33% of monogamous households.

Religious dummies were constructed for household heads and it is observed that a majority of polygynous households reported being Muslim; 77% of household heads in polygynous unions are Muslim. The higher proportion of Muslims among polygynous households is not surprising, as Muslim men's right to marry multiple wives is rooted in the Koran. There is, however, a reasonably high incidence of polygyny among Christians also (21% of polygynous households are Christian).

With respect to household composition, the dependency ratio, that is the ratio of children and the elderly to total household members, is higher in polygynous households, as is the number of children below 5 and 15 years of age. In polygynous households, dependency ratios, the number of children under 5 years and the number of children under 15 years are 0.52, 1.74 and 4.72 on average, respectively. Monogamous households have smaller numbers of 0.46, 0.94 and 2.54, respectively. The average household size for polygynous households is 9.43 members, compared to 5.66 members for monogamous households. Finally, polygynous households in the sample were characterized by a higher share of females in the household of 0.53, compared to 0.48 for monogamous households, and the former also had a higher number of adult women in the household, compared to the latter. Thus, while more labor is available in polygynous households, each worker still has on average more members to support.

With respect to household wealth, results indicate that a greater proportion of monogamous households were found in the higher wealth quintiles, compared to polygynous households. Twelve percent of polygynous household belonged to the richest wealth quintile, compared to 24% of monogamous households. Although food and total household expenditures were higher in polygynous, compared to monogamous households, the reverse is true once per capita measurements are employed. The consumption aggregates are computed from the expenditure sections of the questionnaire for general food and non-food expenditures and annualized from the post-harvest and post-planting seasons. Non-food expenditures comprise expenditures on items such as education, housing, clothing, among others. Total

household expenditure is calculated by adding total food and non-food expenditures. In per capita terms, monogamous households had annual food and total household expenditures of $304 and $404, while polygynous households had lower food and total household expenditures of $227 and $277.

There does not appear to be significant differences in livestock ownership, as measured by Tropical Livestock Units (TLUs), and in total land size between polygynous and monogamous households. Using a dummy variable for household experiences of idiosyncratic shocks, it is also seen that there were no differences between polygynous and monogamous households in the incidence of shock experience. Finally, polygynous and monogamous households' geographical distribution indicate a prominence of polygynous unions in the northern parts of the country, versus the south, particularly in the north western zone.

Table 1: Summary Statistics of Household-Level Variables, by Polygyny: Nigerian General Household Survey, Baseline data, 2011

	Aggregate Sample		Monogamous		Polygynous		T-tests	
	Mean	SD	Mean	SD	Mean	SD	Mono- Poly	
Polygyny	0.225	0.42	-	-	-	-	-	-
Gender of household head (male)	0.999	0.03	0.999	0.04	1	0	-0.00135	(-1.08)
Age of household head	48.813	14.58	48.146	14.8	51.108	13.57	-2.962***	(-5.27)
Highest educational qualification among household members								
No education	0.135	0.34	0.116	0.32	0.207	0.41	-0.0910***	(-6.36)
Basic education	0.337	0.47	0.33	0.47	0.365	0.48	-0.0353	(-1.77)
Secondary education	0.301	0.46	0.325	0.47	0.215	0.41	0.110***	(5.72)
Post-secondary education	0.226	0.42	0.23	0.42	0.214	0.41	0.0163	(0.92)
Household head is employed	0.888	0.32	0.887	0.32	0.891	0.31	-0.00392	(-0.32)
Urban locality	0.294	0.46	0.334	0.47	0.156	0.36	0.177***	(10.22)
Religion								
Household head is Christian	0.481	0.5	0.559	0.5	0.21	0.41	0.349***	(18.89)
Household head is Muslim	0.501	0.5	0.421	0.49	0.777	0.42	-0.356***	(-19.27)
Household Composition								
Dependency ratio	0.479	0.21	0.468	0.21	0.516	0.17	-0.0481***	(-6.08)
Household size	6.511	2.94	5.659	2.21	9.438	3.22	-3.779***	(-39.54)
# household members < 5yrs	1.122	1.17	0.942	0.97	1.739	1.53	-0.797***	(-18.35)
# household members < 15 yrs	3.028	2.23	2.536	1.81	4.719	2.67	-2.183***	(-27.76)
Ratio of female to hh members	0.494	0.16	0.484	0.16	0.53	0.14	-0.0467***	(-7.68)
Adult women (15-65)	1.707	1.03	1.438	0.84	2.63	1.07	-1.192***	(-34.43)
Adult women (>=15)	1.779	1.03	1.506	0.85	2.717	1.07	-1.211***	(-34.75)
Wealth Quintiles								
Poorest wealth quintile	0.208	0.41	0.199	0.4	0.24	0.43	-0.0409**	(-2.61)
Poorer wealth quintile	0.199	0.4	0.182	0.39	0.26	0.44	-0.0789***	(-5.12)
Middle wealth quintile	0.188	0.39	0.177	0.38	0.227	0.42	-0.0497**	(-3.29)
Richer wealth quintile	0.194	0.4	0.206	0.4	0.149	0.36	0.0572***	(3.75)
Richest wealth quintile	0.211	0.41	0.236	0.42	0.124	0.33	0.112***	(7.17)
Per capita food consumption expenditures ($)	286.68	217.03	304.19	230.18	227.07	150	77.12***	(9.14)
Per capita household expenditure ($)	375.35	278.84	404.15	294.72	277.28	185.37	126.9***	(11.79)
Tropical livestock units	24.837	946.44	33.576	1142	5.676	22.31	27.9	(0.60)
Land size (meters square)	441.44	5430	559.30	6337.2	132.59	1180.3	426.7	(1.79)
Idiosyncratic shocks	0.201	0.4	0.198	0.4	0.212	0.41	-0.0135	(-0.87)
Geographical Zones								
North central zone	0.172	0.38	0.161	0.37	0.208	0.41	-0.0467**	(-3.21)
North east zone	0.187	0.39	0.155	0.36	0.297	0.46	-0.142***	(-9.54)
North west zone	0.219	0.41	0.186	0.39	0.333	0.47	-0.147***	(-9.28)
South east zone	0.132	0.34	0.159	0.37	0.038	0.19	0.121***	(9.34)
South west zone	0.154	0.36	0.178	0.38	0.074	0.26	0.104***	(7.47)
South south zone	0.136	0.34	0.161	0.37	0.05	0.22	0.111***	(8.49)
Observations	3839		2974		865		3839	

t-statistics in parenthesis: *p < 0.10, **p<0.05, ***p<0.01

ii. Table 2- Household Level Food Security Indicators, by Family Structure: Nigerian General Household Survey, Baseline data, 2011

Table 2 provides descriptive statistics of food security variables and indicators for both polygynous and monogamous households, using the baseline survey data. As mentioned earlier, these indicators may be limited when it comes to polygynous households, as it cannot be ascertained that any given respondent reports the food security situation for his or her own sub-family unit, or for all members of the household.

That being said, on examination of the RCSI and its component coping strategies, it is observed that in both waves of the survey, polygynous households reported resorting to fewer coping strategies than monogamous households did. While both sets of households had overall scores less than four, indicating that they were generally food secure, the total is significantly lower for polygynous households (1.01 versus 2.43) on average. With respect to dietary diversity, there were no significant differences in FCS between polygynous and monogamous households in the baseline survey year. In the second wave of the data, however, a greater proportion of polygynous households were found to have high dietary diversity (FCS > 35), compared to monogamous households. It appears that not only did polygynous households appear to resort to fewer coping strategies in the second wave of the survey (*not shown*), but they also had a better dietary diversity, compared to monogamous households.

Table 2: Household Level Food Security Indicators, by Polygyny: Nigerian General Household Survey, Baseline data, 2011

	Aggregate		***Monogamy***		***Polygyny***		***T-tests***	
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***	***(Mono-Poly)***	
# Days in past week rely on less preferred foods	0.68	1.45	0.74	1.47	0.47	1.34	0.258***	-4.56
# Days in past week limit portion sizes at mealtimes	0.39	1.04	0.44	1.1	0.18	0.72	0.222***	-5.89
# Days in past week reduce the number of meals eaten in a day	0.36	1.05	0.42	1.14	0.11	0.52	0.251***	-6.83
# Days in past week Restrict consumption by adults in order for small children to eat	0.22	0.85	0.25	0.93	0.08	0.44	0.137***	-4.59
Reduced Coping Strategies Index (0 - 56)	2.14	5.1	2.43	5.5	1.01	2.9	1.198***	-6.63
FCS poor, less than 21	0.04	0.19	0.04	0.18	0.05	0.22	-0.0135	(-1.80)
FCS borderline, 21-35	0.16	0.37	0.17	0.38	0.14	0.35	0.019	(1.40)
FCS good, greater than 35	0.8	0.4	0.8	0.4	0.81	0.39	-0.00559	(-0.37)
Food Consumption Score	53.24	20.19	53.1	19.96	53.77	21.03	0.0244	(0.03)
Observations	3789		2931		858		3789	

t-statistics in parenthesis: *p < 0.10, **p<0.05, ***p<0.01

iii. Table 3- Child Nutrition Measures, by Family Structure

These tables provide child-level nutrition statistics disaggregated by monogamous and polygynous mothers for the 2010/2011 and 2012/2013 data. T-tests are provided to determine significance of the correlations.

In Table 3, for both waves of the data, children of monogamous mothers fare better than children of polygynous mothers in the long, as shown by height-for-age estimates. This is consistent with the idea that wives in monogamous households could wield higher levels of bargaining power than their polygynous counterparts, allowing them to divert a greater amount of resources to their children. Using education as a proxy for bargaining power, it may be observed that women in monogamous marriages are more educated than their counterparts in polygynous marriages (see Table 4 below). Additionally, given the larger household sizes and number of child dependents in polygynous households (see Table 2), children in these households may be more susceptible to resource dilution, where scarce household resources are spread more thinly among larger numbers of children, subsequently resulting in poorer health and nutrition outcomes.

Table 3: Summary Statistics of Child-Level Anthropometric measures, by Family Structure; Nigerian General Household Survey, 2010/2011 & 2012/2013

	Wave 1		**Wave 2**	
	Monogamous Wife	***Polygynous Wife***	***Monogamous Wife***	***Polygynous Wife***
Height for Age (HAZ)	-1.300*** (N= 913)	-1.932*** (N= 394)	-0.819** (N=600)	-1.111** (N=283)
	t= 5.26		T=2.43	
Weight for Height (WHZ)	0.009 (N= 1029)	-0.090 (N=465)	-0.165 (N=600)	-0.111 (N=287)
	t= 0.098		T= -0.559	

t-statistics in parentheses: *p<0.10, **p<0.05, ***p<0.01

iv. Table 4- Mother and Father Characteristics, by Family Structure, 2010/11

In order to better understand the mechanisms behind these differences in child health outcomes, characteristics of mothers and fathers are examined in polygynous versus monogamous unions.

It is observed in Table 4 below that mothers in monogamous unions were better educated on average. While only 13% of mothers in monogamous marriages reported having no formal training, as many as 37% of mothers in polygynous households had no formal schooling. Additionally, while a third of mothers in monogamous marriages had secondary school qualifications, only 16% of mothers in polygynous households reported having this qualification. Finally, 14% of mothers in monogamous unions have had some post-secondary education, compared to 9% of mothers in polygynous unions. Everything else being equal, it might be expected that this higher level of education would contribute to better food security outcomes in monogamous households, given that more educated mothers may be more knowledgeable about nutrition and dietary needs. The level of education could also be a proxy for bargaining power, which could improve child outcomes. This is consistent with what is observed in Table 3; children of monogamous had better nutritional status in the long term, compared to children of polygynous mothers. Table 4 also shows that a slightly higher percentage of mothers are employed in monogamous unions, compared to the employment figures in polygynous households.

Fathers in polygynous households tended to be older than fathers in monogamous households by almost 5 years. Similar to mothers, the key difference between fathers in monogamous and polygynous unions was in education; fathers in polygynous marriages tended to be less educated, with 25% of these men having no education, compared to 13% of fathers in monogamous marriages. Additionally, 30% of fathers in monogamous marriages had a secondary school education, compared to only 16% of fathers in polygynous marriages. With respect to employment, 93% of fathers in the sample reported being employed, with no significant difference between fathers in monogamous and polygynous unions.

Table 4: Summary Statistics of Parent Characteristics, by Family Structure; Nigerian General Household Survey, Wave 1, 2010/2011

Part A: Mother Characteristics by Polygyny

	Total		Monogamous		Polygynous		Difference	
	Mean	SD	Mean	SD	Mean	SD	Mono-Poly	T-tests
Age	30.05	7.14	30.2	7.21	29.72	7	0.483	(1.34)
No education	0.18	0.39	0.13	0.34	0.37	0.48	-0.238***	(-9.19)
Basic education	0.42	0.49	0.44	0.5	0.38	0.49	0.0552	(1.61)
Secondary education	0.26	0.44	0.30	0.46	0.16	0.36	0.138***	(4.54)
Post Sec education	0.13	0.33	0.14	0.35	0.09	0.29	0.0449*	(1.93)
Employed	0.68	0.46	0.70	0.46	0.66	0.47	0.0386*	(1.65)
Observations	1836		1264		572		1836	

Part B: Father Characteristics by Polygyny

	Total		Monogamous		Polygynous		Difference	
	Mean	SD	Mean	SD	Mean	SD	Mono-Poly	T-tests
Age	41.56	10.06	40.1	9.91	44.81	9.65	-4.715***	(-9.50)
No education	0.16	0.37	0.13	0.34	0.25	0.43	-0.112***	(-5.04)
Basic education	0.37	0.48	0.37	0.48	0.37	0.48	0.00216	(0.07)
Secondary education	0.26	0.44	0.30	0.46	0.16	0.37	0.138***	(5.24)
Post Sec education	0.2	0.4	0.20	0.4	0.22	0.42	-0.0285	(-1.17)
Employed	0.93	0.25	0.94	0.24	0.92	0.27	0.0174	(1.37)
Observations	1831		1262		569		1831	

t statistics in parentheses:
* p<0.10, ** p<0.05, *** p<0.01

IV. METHODOLOGY

Building directly on the diverse—and often conflicting—findings in the literature, a series of questions and hypotheses related to polygynous family structures and household-level food security outcomes are explored, as well as child-level health outcomes in Nigeria.

a. Estimation Strategy

As mentioned above, causal claims cannot be made about the nature of the relationship between polygyny and child health or nutrition outcomes. Descriptive analyses of these relationships are therefore provided, and a series of robust correlations are examined, so as to test the hypotheses about the relationship between food security and polygyny, and elucidate the underlying mechanisms that may be at play.

It may be expected that unobservable household characteristics simultaneously influence a household's propensity to have multiple wives and a household's food security status. That is, there is selection into polygyny on unobservables. A common approach in this case would be to include a household-level fixed effect, since a household fixed-effect model may be expected to account for these omitted variables, to the extent that these unobservables are time-invariant. However, a fixed-effects model cannot address inter-temporal selection into polygyny based on time-varying unobservables at the household level, nor is it useful for identifying the coefficient of interest on polygyny, which is for the most part time invariant. A random effects model may allow for identification of the coefficient on polygyny, but the essential assumption of a random effects model, that the household-specific random effect is uncorrelated with selection into polygyny and other control variables, is unlikely to hold.

Due to polygyny's limited variation over time, a correlated random effect model (CRE) at the household level is estimated, as an approximation of a fixed effects model that allows the identification of coefficients on time-invariant characteristics (Mundlak, 1978; Chamberlain, 1980). For child-level outcomes, however, a fixed effects model is run. Given intra-household variation, coefficients of interest such as mothers' characteristics can be examined, while controlling for all time-invariant household-level traits with the fixed effect.

The various hypotheses and specific empirical models for the household-level and then for the child-level are outlined below.

b. Household-level Analysis

Four hypotheses are developed regarding the relationship between polygyny and household-level food security:

1. Polygyny has a relationship with food security independently of wealth, household structure, and agricultural livelihood strategy.
2. While household-level wealth should, on average, relate positively to food security as it improves access to food, for polygynous households, the effect of wealth on food security is different than for monogamous households due to different bargaining structures.
3. In polygynous households, the effect of household structure on food security is different than in monogamous households.

4. In polygynous households, the effect of an agricultural livelihood strategy on food security is different than in monogamous households.

To test these hypotheses, a basic CRE model is set out as follows:

$$FS_{ht} = \alpha P_{ht} + \gamma_1 X_{ht} + \gamma_2 \overline{X}_h + \delta T_t + \tau_h + \varepsilon_{ht} \quad (1)$$

In this model, FS_{ht} refers to food security (as measured by FCS and RCSI) for household h at time t and P_{ht} is a dummy variable for whether a household is polygynous (P_{ht}=1) or not (P_{ht}=0). The set of control variables is represented as as X_{ht}, all of which vary across households and some of which vary across time. Included in this vector are urban locality dummy, household wealth scores, religion dummy for religion of household head, TLU, education, sex and age of household head, all as presented in Appendix 1. This model also includes a vector of within-household averages of all time-varying covariates, $\overline{X}_h$. To the extent that $\overline{X}_h$ is correlated with unobservable household characteristics, a fixed-effect control is approximated. T_t, a term containing the year and region indicator variables and their interactions are added, to account for factors common to all households in a given location and year, such as ecological, economic, or political shocks, or other region-specific time trends. A household random effect τ_h, is included, as well as ε_{ht} , as the idiosyncratic error term for each household and time period.

To test our first hypothesis, (1) is estimated. The coefficient of interest is α, and the anticipated direction of effect is ambiguous.

To test our second hypothesis, the following is estimated:

$$FS_{ht} = \alpha P_{ht} + \beta_1 W_{ht} + \gamma_1 X_{ht} + \gamma_2 \overline{X}_h + \delta T_t + \tau_h + \varepsilon_{ht} \quad (2)$$

Relative to (1), per capita total consumption is added, W_{ht}, as an indicator of household wealth, and include its within-household mean in $\overline{X}_h$. It is expected that β_1 be positive. The magnitude or direction of any changes in α are also interpreted.

To test the third hypothesis, indicators of household structure are added to the model:

$$FS_{ht} = \alpha P_{ht} + \beta_1 W_{ht} + \beta_2 F_{ht} + \eta D_{ht} + \gamma_1 X_{ht} + \gamma_2 \overline{X}_h + \delta T_t + \tau_h + \varepsilon_{ht} \quad (3)$$

Because of the interest in multiple facets of household composition, a dependency ratio indicator, D_{ht} is added, along with an indicator of the number of adult women in the household, F_{ht}. Within-household means of both of these variables to $\overline{X}_h$ are also added. The direction of β_2 is interpreted as an indicator of competition (negative) or cooperation (positive). The magnitude or direction of any changes in α are also interpreted.

Finally, the fourth hypothesis is tested by estimating:

$$FS_{ht} = \alpha P_{ht} + \beta_1 W_{ht} + \beta_2 F_{ht} + \beta_3 A_{ht} + \eta D_{ht} + \gamma_1 X_{ht} + \gamma_2 \overline{X}_h + \delta T_t + \tau_h + \varepsilon_{ht} \quad (4)$$

Here, an indicator variable is included, A_{ht}, for whether the household has an agricultural livelihood and the within-household mean of A_{ht} in $\overline{X}_h$. The land size is employed as a proxy for agricultural livelihoods. The expected direction of β_3 is ambiguous, and the magnitude or direction of any changes in α will be interpreted.

c. Child-level Analysis

In this section, hypotheses are developed, each building on the previous, related to the relationship between child-level health outcomes and the existing family structure. While it is recognized that selection into polygyny is non-random, it is posited that the key features of selection that would be likely to affect child heath, including household, parent, and child-level characteristics, are captured in this formulation. What unobservable factors may remain manifest as differences in bargaining power and cooperation, and as such allow us to test our hypotheses. First, a pooled OLS regression model is applied, where these unobserved household fixed effects are not controlled for. In the next stage, a household fixed effects model is employed in order to explore within-variations at the household level. The hypotheses to be tested are outlined below:

1. The polygynous status of mother has a direct relationship with her child's health outcomes, controlling for all observables likely to otherwise determine child health or be highly associated with polygyny, including mother's characteristics, the child's birth order, and household-level characteristics. If children of polygynous mothers have worse health outcomes on average, when controlling for other factors, this indicates uncooperative equilibria in the distribution of household resources and the on average lower bargaining power of women in polygynous unions
2. While per capita expenditure should have a positive influence on child health, due to greater availability of resources for food and health, it is hypothesized that to the degree that mothers in polygynous unions have lower bargaining power, the positive influence of household expenditure will be less evident for the children of polygynous mothers
3. Other features of household structure, such as overall household size and number of caretakers, would also influence bargaining power and cooperation. Having more household members—in particular women—present increases the labor availability and hence resource base for child care. It is hypothesized, however, that a mother's status as polygynous specifically decreases her bargaining power, even in the presence of more caretakers or women. It is hypothesized that children of polygynous mothers may be better off from increased child care from the presence of more adult women in the household. A larger household size and dependency ratio may however lead to adverse outcomes as a result of resource dilution

The pooled OLS regression model takes the following form in the first stage of the analyses:

$$Y_{iht} = \alpha_1 P_{iht}^{m} + \gamma_1 M_{iht} + \gamma_2 F_{iht} + \gamma_3 C_{iht} + \gamma_4 X_{ht} + \delta T_t + \varepsilon_{iht} \quad \text{(a)}$$

In this formulation, Y_{iht} is the health status (HAZ or WHZ) of child *i*, in household *h*, at time *t*. P_{iht}^{m} is a binary variable indicating whether the child's mother is in a polygynous union. M_{iht} contains the i^{th} child's mother's age, education, and employment status. F_{iht} contains the i^{th} child's father's age, education, and employment status; C_{iht} contains child characteristics such as age and birth order. X_{ht} contains other time-varying household characteristics (dependency ratio, household size, asset index, TLU and idiosyncratic shocks). T_t, is a term containing the year and region indicator variables. A stepwise regression technique is used to examine the importance of mediators such as per capita wealth and household composition in subsequent specifications.

In the second stage of the child-level regressions, a household-level fixed effects model is applied at the individual level, as follows:

$$Y_{iht} = \alpha_1 P_{iht}^m + \gamma_1 M_{iht} + \gamma_2 F_{iht} + \gamma_3 C_{iht} + \gamma_4 X_{ht} + \delta T_t + \mu_h + \varepsilon_{iht} \quad (1)$$

The variables are as defined in (a) above. Additionally, μ_h represents the household-level fixed effect.

The first hypothesis is tested by observing the sign and significance of α_1, the nature of the robust correlation between polygynous mothers with child health, controlling for these other drivers.

The second hypothesis, 2, is tested by including per capita wealth (consumption expenditure) in the regression:

$$Y_{iht} = \alpha_1 P_{iht}^m + \beta_1 W_{ht} + \gamma_1 M_{iht} + \gamma_2 F_{iht} + \gamma_3 C_{iht} + \gamma_4 X_{ht} + \delta T_t + \mu_h + \varepsilon_{iht} \quad (2)$$

The significance of β_1 as well as changes to α_1 are observed and interpreted.

Finally, the third hypothesis is tested, delving further into the question of scale economies and household size, by including also the number of adult women, which may include, for example, other female relatives and children of daughters-in-law, rather than co-wives.:

$$Y_{iht} = \alpha_1 P_{iht}^m + \beta_1 W_{ht} + \delta_1 N_{ht} + \gamma_1 M_{iht} + \gamma_2 F_{iht} + \gamma_3 C_{iht} + \gamma_4 X_{ht} + \delta T_t + \mu_h + \varepsilon_{iht} \quad (3)$$

Here, N_{ht} is the number of adult women in the household. The sign and significance of δ_1 as well as changes to α_1 are observed and interpreted

V. ESTIMATION RESULTS AND DISCUSSION

This section summarizes regressions results at the household and individual level. Data for both waves of the Nigerian General Household Survey are pooled; a correlated random effects model is used in the household-level analysis, and a pooled OLS and household fixed-effects model is used for the child-level analyses.

a. Household-Level Regressions

Our results at the household level are presented in Table 6, with a column for the core regression and each step-wise change, and panels for each household-level food security outcome indicator. It is noted first that polygynous households performed better than monogamous households with respect to food security as measured by dietary diversity, with dietary diversity scores on average 2 to 3 points higher for polygynous households with statistical significance at the 1% level. This confirms our initial hypothesis, that there is a relationship between polygyny and household-level food security. While the relationship between with RCSI is negative, as shown in Table 3, which also indicates on average better food security for polygynous households, this coefficient varies depending on the model and is not statistically significant.[3]

In terms of identifying mechanisms, some supportive evidence for the posited pathways of wealth, household structure, and agricultural livelihoods are found. In model two, after inclusion of per capita food expenditures, the coefficient on polygynous household increases and remains significant, indicating that this is not a potential channel of explanation for better food security performance among polygynous households. Controlling for household structure, however, reduced the magnitude of the difference in food security outcomes between monogamous and polygynous households. The implication here is that the household make-up of polygynous households differs from the composition of monogamous households, and those differences at least in small part explain the better dietary diversity outcomes in the former. Polygynous households, for example, have a larger number of adult females, which may serve as useful labor on farms. The inclusion of land size as a proxy for agricultural participation further reduces the magnitude of the polygyny variable, indicating that agricultural participation may also be part of the relationship between food security outcomes and polygyny.

While not the focus of our attention for these hypotheses, other variables included in the regressions relate to food security more or less as expected. Polygynous households perform better than monogamous households with respect to food security, as measured by dietary diversity**.** Wealthier households resort to fewer coping strategies, as do households that own more livestock. The presence of shocks is negatively correlated with households' use of coping strategies.

The findings from the present research appear to suggest better outcomes for polygynous households. This differs from existing literature, which often finds negative outcomes for women and children of polygynous households (Al-Krenawi & Graham, 2006; Arney, 2002; Kazinaga & Klonner, 2009). Our findings are more consistent with Munro et al. (2010), who used experimental analyses in northern

[3] The coefficient on polygyny in these regressions is negative and significant under some specifications, but loses this significance with our preferred model and specification, as shown.

Nigeria to show that polygynous households were not necessarily less efficient than their monogamous counterparts, with respect to the allocation of household resources. Findings from the present research are also consistent with literature which considers polygyny to have a positive impact on the wives' consumption within polygynous households, in addition to increased labour sharing among co-wives with respect to domestic work, agricultural responsibilities or child care duties, which increases leisure time (Grossbard, 1980; Becker, 1981). As mentioned previously, a significant shortcoming in undertaking household-level analysis in this case lies in that it is not known for certain who answered questions about dietary diversity and coping strategies, nor the extent of that person's knowledge of the overall household's food consumption patterns and behaviors. As a result, these results may be interpreted with some caution.

Table 6: Testing the Various Hypotheses- Regression Estimates of Polygyny in Nigeria (2010/11 & 2012/13)

Dependent Variables:	Food Consumption Scores				Reduced-Coping Strategies Index			
Hypotheses:	H1	H2	H3	H4	H1	H2	H3	H4
Per Capita Expenditure		0.00	-0.00	0.00		-0.00	-0.00	-0.00
Polygyny	**2.39*** **	**3.39*** **	**3.16*** **	**3.01*** **	**0.24**	**0.16**	**-0.10**	**-0.09**
	(3.15)	**(4.42)**	**(3.51)**	**(3.29)**	**(1.45)**	**(0.89)**	**(-0.43)**	**(-0.40)**
Dependency ratio			3.33	3.57			0.04	-0.02
			(0.88)	(0.93)			(0.03)	(-0.02)
# Adult women			-0.64	-0.48			-0.31	-0.36
			(-0.79)	(-0.58)			(-1.38)	(-1.56)
Household size			-0.84	-0.78			0.49***	0.48**
			(-1.29)	(-1.14)			(2.66)	(2.43)
Land size (logged)				-0.42*				0.38***
				(-1.70)				(4.57)
Male head	-1.28	-1.55	-1.54	-2.12	-1.74	-1.70	-1.75	-1.59
	(-0.43)	(-0.54)	(-0.55)	(-0.75)	(-0.93)	(-0.91)	(-0.93)	(-0.83)
Age of Head	-0.06	-0.04	-0.05	-0.06	0.00	0.00	0.01	0.01
	(-0.77)	(-0.57)	(-0.72)	(-0.75)	(0.20)	(0.14)	(0.35)	(0.34)
Education (base: no educ)								
Basic	-0.18	-0.25	-0.19	-0.42	-0.31	-0.31	-0.25	-0.32
	(-0.12)	(-0.17)	(-0.12)	(-0.27)	(-0.74)	(-0.74)	(-0.60)	(-0.76)
Secondary	0.05	-0.16	0.03	-0.22	0.13	0.15	0.26	0.18
	(0.03)	(-0.09)	(0.02)	(-0.12)	(0.26)	(0.29)	(0.51)	(0.35)
Post-secondary	-0.33	-0.68	-0.44	-0.51	-0.31	-0.29	-0.24	-0.28
	(-0.18)	(-0.37)	(-0.24)	(-0.27)	(-0.66)	(-0.61)	(-0.51)	(-0.59)
Muslim head	-27.54***	-22.46***	-21.48***	-21.77***	0.40	0.32	-0.03	-0.09
	(-3.11)	(-3.84)	(-3.89)	(-3.81)	(0.36)	(0.26)	(-0.03)	(-0.09)
Urban	5.86	3.32	2.91	8.14	0.18	0.71	0.72	0.81
	(1.12)	(0.58)	(0.50)	(1.58)	(0.24)	(0.85)	(0.90)	(0.87)
Wealth scores	0.33	0.22	0.28	0.18	-0.26**	-0.25**	-0.26**	-0.25**
	(0.85)	(0.58)	(0.74)	(0.46)	(-2.49)	(-2.34)	(-2.36)	(-2.25)
Tropical livestock Units	0.00	0.00	0.00	0.00	-0.00***	-0.00***	-0.00***	-0.00***
	(0.30)	(0.30)	(0.27)	(0.25)	(-5.31)	(-5.05)	(-5.31)	(-5.37)
Shocks	0.49	0.77	0.84	0.55	1.30***	1.36***	1.36***	1.44***
	(0.38)	(0.59)	(0.65)	(0.42)	(3.46)	(3.57)	(3.56)	(3.72)
Zonal Controls	YES	YES	YES	YES	YES	YES	YES	YES
Wave control	YES	YES	YES	YES	YES	YES	YES	YES
Zone*Wave Interactions	YES	YES	YES	YES	YES	YES	YES	YES
R^2- Within	0.02	0.02	0.02	0.03	0.21	0.21	0.21	0.22
R2- Between	0.16	0.19	0.20	0.18	0.25	0.25	0.26	0.27
R2- Overall	0.13	0.16	0.16	0.15	0.25	0.25	0.25	0.26
# of Observations	3699.00	3650.00	3650.00	3495.00	3705.00	3653.00	3653.00	3507.00

t-statistics in parentheses: *p<0.10, **p<0.05, ***p<0.01

b. Child -Level Regressions

Our results at the child level are presented in Table 7. Results are presented from a pooled OLS regression and a preferred household fixed effects model specification; the latter which controls for potentially unobserved household characteristics that may be correlated with our outcome variable- child long- and short-term nutritional status. Significant results are found only for children's long-term health measures, using the pooled OLS model, but these results disappear when the fixed effects model is employed.

OLS regression results show that children from monogamous mothers are better off, in terms of their long-term health status, than children of polygynous mothers. In terms of identifying mechanisms, the effect of mother's polygyny status on child health is mediated, to some extent, by per capita expenditure and household composition, but these variables do not fully explain the differences in health outcomes between children of monogamous and polygynous households. The inclusion of per capita expenditure reduces the magnitude of the effect of polygyny on child long-term health. The presence of adult women in the household appears to worsen the nutritional status of children in the long run.

It is suspected that the OLS regression model may be plagued by the omission of some household characteristics that could be correlated with child health outcomes. A household fixed effects model is therefore run in the next stage of the regressions. Interestingly, once household fixed effects are controlled for, there is no longer a difference in long-term health outcomes between children of monogamous and polygynous mothers. This is contrary to findings by Munro et al. (2010) and Wagner and Rieger (2015). These studies are however based on cross-sectional data, and so cannot claim to explore the relationship between family structure and child growth for a specific mother or child over time. It is speculated that unobserved characteristics like co-operation among co-wives may explain the lack of significant differences in child outcomes between monogamous and polygynous mothers. In polygynous settings, for instance, although mothers tend to be less educated, with fewer of them being employed compared to mothers in monogamous unions (see Table 4), children may benefit from resources of other mothers, even when their own mothers may face challenges.

While not the focus of our attention for these hypotheses, other variables included in the regressions relate to child health more or less as expected. Mothers who are working appear to be associated with worse child health outcomes in the long-run. This is consistent with studies that find that mothers who are employed outside of the home may have less time to supervise children's food intake (Popkin, 1980; Agarwal et al., 1992; Abbi et al., 1991). It is interesting to note however that fathers who work have a positive effect on children's short-run nutritional status. Higher education of fathers is positively related with children's nutritional status in the long run, but negatively related in the short run. Older fathers are also associated with better nutritional outcomes for children in the long run.

Older children are associated with lower height-for-age scores in the preferred model specification. This is consistent with the existing literature (Field, Miller & Drake, 1981; Yimer, 2000; Van de Poel, Hosseinpoor, Jehu-Appiah, Vega, & Speybroeck, 2007). Consistent with existing literature, birth order is also negatively related with child health. Reasons for this may be biological or cultural. Biologically, children's nutritional status may decrease with increased childbearing by the mother, given the

detrimental impacts that child birth may have had on her health. Also low birth orders have more undivided parents' attention (and resources) devoted to them in their earlier years (Horton, 1988; Hatton and Martin, 2008). Culturally, older children may also be favored because in their parents' old age, the oldest child is the most likely to care for parents.

Table 7a: Household Fixed Effects Regressions of Child Health Outcomes on Polygyny- NGHS Survey (2011/2013)

	Pooled OLS Regression						**Household Fixed Effects**					
	Health-for-Age (Long-term nutrition)			**Weight-for-Height (Short-term nutrition)**			**Health-for-Age (Long-term nutrition)**			**Weight-for-Height (Short-term nutrition)**		
PolygynyM	**-0.35****	**-0.27***	**-0.31***	**-0.02**	**0.00**	**-0.15**	**-0.71**	**-0.65**	**-0.60**	**-0.48**	**-0.35**	**-0.23**
	(-2.40)	**(-1.80)**	**(-1.79)**	**(-0.20)**	**(0.02)**	**(-0.98)**	**(-0.75)**	**(-0.67)**	**(-0.60)**	**(-0.66)**	**(-0.48)**	**(-0.30)**
Age(M)	-0.02	-0.02	-0.02	0.01	0.00	0.00	0.04	0.04	0.03	-0.00	-0.01	-0.01
	(-1.50)	(-1.35)	(-1.37)	(0.55)	(0.37)	(0.27)	(1.16)	(1.08)	(1.06)	(-0.05)	(-0.19)	(-0.25)
Basic eduM	0.07	0.05	0.06	-0.01	-0.04	-0.01	-0.39	-0.40	-0.41	0.65	0.63	0.62
	(0.41)	(0.29)	(0.32)	(-0.05)	(-0.23)	(-0.09)	(-0.66)	(-0.67)	(-0.68)	(1.29)	(1.24)	(1.22)
Sec_educM	0.33	0.32	0.33	-0.05	-0.11	-0.10	-1.41	-1.43	-1.43	0.35	0.39	0.39
	(1.57)	(1.51)	(1.53)	(-0.25)	(-0.57)	(-0.52)	(-0.59)	(-0.59)	(-0.59)	(0.23)	(0.25)	(0.26)
Postsec_edu	0.32	0.27	0.27	-0.11	-0.12	-0.11	-1.02	-0.99	-1.00	0.05	0.20	0.21
	(1.25)	(1.03)	(1.04)	(-0.49)	(-0.52)	(-0.49)	(-0.37)	(-0.35)	(-0.36)	(0.02)	(0.10)	(0.10)
Working(M)	-0.45***	-0.49***	-0.50***	-0.09	-0.08	-0.08	0.02	-0.00	0.00	-0.00	-0.04	-0.03
	(-3.49)	(-3.76)	(-3.77)	(-0.79)	(-0.67)	(-0.72)	(0.05)	(-0.01)	(0.00)	(-0.01)	(-0.16)	(-0.14)
Age(D)	0.02***	0.02***	0.02**	-0.00	-0.00	-0.00	0.02	0.02	0.02	-0.04	-0.04*	-0.04
	(2.97)	(2.62)	(2.54)	(-0.09)	(-0.12)	(-0.38)	(0.77)	(0.75)	(0.76)	(-1.64)	(-1.65)	(-1.57)
Basic_eduD	-0.07	0.02	0.02	-0.08	-0.08	-0.08	11.22	10.23***	6.06	0.31	-2.96	-2.46
	(-0.35)	(0.09)	(0.08)	(-0.50)	(-0.46)	(-0.50)	(1.19)	(3.03)	(1.50)	(0.11)	(-0.92)	(-0.81)
Sec_eduD	0.12	0.20	0.19	0.14	0.14	0.13	3.70	9.55*	-0.01	-20.47**	-4.41	-4.81
	(0.62)	(0.96)	(0.95)	(0.79)	(0.80)	(0.75)	(0.94)	(1.93)	(-0.00)	(-2.41)	(-1.12)	(-1.61)
Postsec_edu	-0.14	-0.12	-0.12	0.17	0.19	0.18	9.53	11.63*	-1.82	-19.90**	-4.39	-3.74
	(-0.60)	(-0.50)	(-0.51)	(0.81)	(0.94)	(0.86)	(1.42)	(1.91)	(-0.27)	(-2.40)	(-0.81)	(-0.72)
Working(D)	0.13	0.03	0.03	0.81***	0.82***	0.83***	-0.97	-0.90	-0.88	1.41**	1.53**	1.56**
	(0.52)	(0.10)	(0.11)	(3.57)	(3.50)	(3.53)	(-1.29)	(-1.18)	(-1.15)	(2.32)	(2.49)	(2.52)
Child age	-0.04	-0.03	-0.03	0.08**	0.08**	0.08**	-0.12*	-0.13*	-0.13*	0.09	0.09	0.09
	(-0.90)	(-0.78)	(-0.77)	(2.19)	(2.17)	(2.17)	(-1.65)	(-1.79)	(-1.78)	(1.54)	(1.50)	(1.53)
Birth order	-0.05	-0.04	-0.04	-0.02	0.00	-0.00	-0.37***	-0.36***	-0.36***	0.08	0.10	0.11
	(-1.46)	(-1.14)	(-1.18)	(-0.51)	(0.09)	(-0.05)	(-3.30)	(-3.21)	(-3.19)	(0.91)	(1.14)	(1.18)
Econ shocks	0.18	0.19	0.19	0.13	0.13	0.11	-0.12	-0.12	-0.12	0.29	0.27	0.26
	(1.10)	(1.14)	(1.11)	(0.90)	(0.86)	(0.77)	(-0.35)	(-0.33)	(-0.34)	(0.97)	(0.90)	(0.87)
TLU	-0.00	0.00	0.00	0.01	0.01	0.01	0.08	0.08	0.08	-0.17***	-0.18***	-0.18***
	(-0.05)	(0.05)	(0.04)	(0.67)	(0.86)	(0.81)	(1.26)	(1.25)	(1.25)	(-2.76)	(-2.87)	(-2.88)
Wealth	0.03	0.04	0.04	-0.02	-0.04*	-0.04**	-0.24***	-0.28***	-0.28***	-0.02	-0.08	-0.08
	(1.58)	(1.58)	(1.50)	(-1.11)	(-1.84)	(-2.05)	(-2.86)	(-3.15)	(-3.13)	(-0.27)	(-1.03)	(-1.01)
Expenditure (logged)	-	0.08	0.09	-	0.19**	0.20**	-	0.56	0.56	-	0.81**	0.81**
		(0.82)	(0.87)		(2.10)	(2.28)		(1.32)	(1.33)		(2.22)	(2.23)
#Adult women	-	-	0.03	-	-	0.13*	-	-	-0.04	-	-	-0.10
			(0.45)			(1.94)			(-0.15)			(-0.41)
Zone controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Wave Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Household Fixed Effects	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
r2	0.09	0.10	0.10	0.03	0.03	0.04	0.70	0.70	0.70	0.68	0.68	0.68
N	1273.00	1231.00	1231.00	1375.00	1334.00	1334.00	1273.00	1231.00	1231.00	1375.00	1334.00	1334.00

T-statistics in parentheses: *p<0.10, **p<0.05, ***p<0.01

VI. CONCLUSION AND POLICY IMPLICATIONS

In this study, a series of questions and hypotheses related to polygynous family structures and both household and individual-level food security outcomes were explored. These questions were examined using two rounds of World Bank Living Standards Measurement Survey data from Nigeria, collected in 2010/2011 and 2012/2013. Analyses at the household level involved the use of a correlated random effects model, while a pooled OLS and household fixed effects models were employed for the individual-level analyses.

First, the relationship between polygyny and household-level food security was explored, and the degree to which it is mediated by household wealth, size, and livelihood. Some evidence was found in support of the posited pathways. Individual level mechanisms were then explored, and the study examined whether mother's status as monogamous versus polygynous related systematically to her child's health. Although preliminary evidence indicated superior child outcomes in monogamous households, this was not supported by the empirical analysis. Controlling for unobserved household characteristics, using a household fixed effect model, no significant differences in child health outcomes between mothers in polygynous and monogamous households were found.

Despite the decrease in its prevalence over the past century, polygyny remains a prominent feature in many African countries (Fenske, 2011), including Nigeria. While there is no universal consensus, there is a general negative perception of the practice of polygyny primarily among women's rights advocates, given the noted adverse effects of this practice on women, and often times, children as well. On a more global scale, apprehension regarding the practice of polygyny is further highlighted by the UN's Committee on the Elimination of Violence Against Women, which states that polygyny violates the rights of women and should be banned. The Committee lists this as a "harmful traditional practice" and equates it with other practices such as female circumcision and marital rape. As mentioned in the present article however, some individuals do appear to have motivations for entering into polygyny such as men who enjoy greater social prestige from a larger number of wives and children, and in some cases, women who benefit from the social network and labour sharing from the presence of co-wives in polygynous settings.

There are a number of calls to ban the practice of polygyny either to protect women's rights, or to foster a country's development (Tertilt, 2005; Gould, Omer & Simhon, 2008). Indeed, polygyny is banned in a number of developed and developed countries, although the practice still exists. In the absence of evidence to support this ban, women and children may actually be made worse off with the eradication of this practice. The present study sought to provide empirical evidence of the correlation between this practice and household and child welfare outcomes. While positive correlations between polygyny and food security at the household level were found, and the potential mechanisms of influence were discussed, significant differences in child health outcomes between monogamous and polygynous households were not observed.

Although there are noted concerns with the practice of polygyny in the African context, labelling it as wholly 'bad' may not be entirely accurate, given the historical and cultural benefits of polygyny, as discussed in this paper. Studies like this that use longitudinal data could be useful for getting at more

conclusive findings, although the small sample size in the present context is a limitation of the study. Studies that attempt to overcome small sample limitations by pooling data from a number of countries may miss come contextual differences in the different countries, given their ethnic and cultural differences. More evidence is needed to substantiate the calls to ban the practice of polygyny in many African countries, including Nigeria.

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Appendix 1: Description and Construction of Explanatory Variables for Household level regressions

Variable	• Survey Question(s)	Variable Construction
Polygyny	• None	Dummy variable for presence of multiple wives in the household, from roster
Age of Household Head	• How old is [Name] in completed years? • What is [Name]'s relationship to the head of the household?	Age (in years) for household heads is constructed
Sex of Household Head (Male)	• What is [Name]'s relationship to the head of the household? • What is the sex of [Name]	Dummy Variable constructed for males who are household heads. Comparative group is females who are heads
Age of Wife	• How old is [Name] in completed years? • What is [Name]'s relationship to the head of the household?	Age (in years) for wife is constructed
Highest Educational qualification of household members	• What is your highest educational qualification? (information from Post-Planting season)	Given educational qualifications, an individual is classified as having *no education*; *basic education* (first school leaving certificate, modern school leaving certificate, vocational or commercial); *secondary education* (senior secondary school, A Level); *post-secondary* (National certificate of education or ordinary national diploma, Nursing, Bachelor's degree, Masters or higher) At the household level, this is constructed as a dummy variable for the head of the household. At the individual level, this is constructed as dummy variables for education status of child's parents
Education of Wife	• What is your highest educational qualification? (information from Post-Planting season) • What is [Name]'s relationship to the head of the household?	Given educational qualifications, an individual is classified as having *no education*; *basic education* (first school leaving certificate, modern school leaving certificate, vocational or commercial); *secondary education* (senior secondary school, A Level); *post-secondary* (National certificate of education or ordinary national diploma, Nursing, Bachelors degree, Masters or higher)
Dependency ratio	• None	This is constructed as a ratio of dependents (individuals below 15- and above 65-years of age) to all household members
Female share of household	• None	This is constructed as a ratio of females to total household members in the household
Number of adult women in household	• None	This is constructed from information on age (>15 years; >15 & <65) and gender (i.e. female)
Household size	(No survey question)	Count of number of individuals in the household roster
Urban locality	Sector (Urban/ Rural)	Dummy variable constructed for urban locality
Wealth scores	None	Principal component analysis (PCA) is used to create these wealth scores, using durable assets, and housing characteristics

Employment status of household head	• During the past 7 days, have you worked for someone who is not a member of your household? • During the past 7 days, have you worked on a farm owned or rented by a member of your household…or have you cultivated livestock belonging to yourself or family member? • During the past 7 days, have you worked on your for yourself or in a business enterprise belonging to you or someone in your household?	Dummy variable for employed is constructed if there is an affirmative response to any of these questions. Comparative group is individuals who responded 'no' to all three questions At the household level, construction restricted to household head At the individual level, this is constructed as a dummy variable for whether a child's parents work or not
Household Annual Expenditures (i.e. food and total) in USD	None	Food expenditure includes purchased foods, values of food received as gifts, values of food consumed from own production and daily expenditures on meals away from home Total expenditure includes consumption and non-consumption expenditure Per capita values imply expenditures divided by household size
Livestock ownership	How may [Animals] are owned by your household now?	Tropical Livestock Units (TLU) are calculated. Conversion scales are: cattle = 0.7, sheep = 0.1, goats = 0.1, pigs = 0.2, chicken = 0.01.
Religious denomination of household heads	What religion are you?	Dummy variables for Christianity, Muslim and Traditionalists.
Shocks	Has the household been affected by this shock in the past 5 years?	Dummy variable constructed from presence of idiosyncratic shocks including; death/disability/ illness/ departure of a working adult, death of someone who sends remittances, loss of an important contact, job loss, nonfarm business failure, theft of crops, cash or livestock, destruction of harvest, destruction of dwelling
Land size (logged)	No question	Land measurement in square metres (GPS)
Zones	Zone	Dummy variables for north central, north east, north west, south east, south west and south west