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Polygynous marital structure and child survivorship in sub-Saharan Africa: Some empirical evidence from Ghana

Stephen Obeng Gyimah

Department of Sociology, Queen's University, Kingston, Ontario K7L 3N6, Canada

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ABSTRACT

Although studies have found children in married families to have better health outcomes than those in other family types, this strand of research implicitly views marriage as monolithic and, by default, monogamous as found in western industrialized societies. In polygynous cultures, there is a need to make a distinction between polygynous and monogamous families, because these marital arrangements might imply varying levels of parental support necessary for optimum child outcomes. Using pooled children's data from the 1998 and 2003 ($N = 4938$) Ghana Demographic and Health Surveys, this study investigates the effects of polygynous marital structure on child survivorship and assesses whether the effect is uniform over the entire childhood period. In models that did not allow for age-specific effects of polygyny, children in polygynous marriages were found to have an elevated risk of death. Further analysis revealed that only older children experienced the survival disadvantages associated with polygyny.

In recent years, social scientists have increasingly emphasized the substantial impact of family structure on children's health (Bennett, 1992; Bhuiya & Chowdhury, 1997; Heaton, Forste, Hoffmann, & Flake, 2005). In North America, children in nontraditional families have been found to have poorer outcomes compared with those in intact families with both biological parents living in the home. Differential resources have been identified as one of the main processes through which family structure affects child outcomes (Ross, Mirowsky, & Goldsteen, 1990; White & Rogers, 2000). With respect to child health and survival in particular, the presence of a spouse is believed to increase the resources necessary for optimal child outcomes.

Despite the considerable body of research on the influence of family structure on child outcomes, most analyses have been restricted to comparisons between children in married families and those in other family types. A key limitation of this line of research in societies characterized by widespread polygyny is the implicit view of marriage as monolithic and, by default, monogamous, as found in Western industrialized societies. As Adams (2004) noted, although some progress has been made toward understanding family structures in various cultures, the scholarship has been dominated by information from western societies. Polygyny in particular constitutes one of the most distinctive features of African marriages, and although it is declining in frequency, it is still widely practiced and accounts for about 20–50% of all marriages (Caldwell & Caldwell, 1990; Westoff, 2003). Homogenizing married women in such cultures could conceal subtle but important factors that might impact on child outcomes. In the context of sub-Saharan Africa, there is a need to make a distinction between polygynous and monogamous family structures, because these marital arrangements imply varying levels of the parental support that is necessary for optimum child outcomes. A study in Kenya, for example, found significant differences in per capita resources between polygynous and monogamous households (Gage, 1997). These differences could arguably have an effect on child health and survival. The question of interest therefore is whether the

E-mail address: gyimahs@queensu.ca

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presence of other women in the conjugal unit alters the presumed health advantages of marriage on children.

Although some work has been done on the link between polygyny and child survivorship (Chisholm & Burbank, 1991; Chojnacka, 1980; Isaac & Feinberg, 1982; Strassmann, 1997), it has been based mostly on localized studies that in most cases do not include rigorous empirical assessments (for exceptions, see Amankwa, Eberstein, & Schmertmann, 2001; Amey, 2002). Furthermore, prior empirical work has given little consideration to the possibility that the effects of polygyny may not be uniform over the entire childhood period. Even though a recent study in Nigeria examined the effect of polygyny on different segments of the mortality curve, the approach adopted in that study precluded an explicit statistical test of age-specific differences (Ukwuani, Cornwell, & Suchindran, 2002). It is the aim of this study to address these concerns and to contribute to the limited body of empirical work on the subject in sub-Saharan Africa. Specifically, this paper assesses the nature of the association between marital type and child survivorship in Ghana, a society historically characterized by widespread polygyny (see Timaeus & Reynar, 1998) and therefore an ideal setting for this study.

Theoretical perspectives on polygyny and child survival

Although there is little substantive theory linking polygyny and child survival in particular, the mostly anthropological literature has suggestions on the underlying mechanisms linking polygyny and child survival (Amankwa et al., 2001; Chisholm & Burbank, 1991; Hames, 1996; Isaac & Feinberg, 1982). Drawing from this discourse, two competing paradigms can be identified. The first posits that polygyny impairs child survivorship; the other proposes that it enhances child survivorship. Although these paradigms cannot be directly tested given the limitations of the data, they provide the organizing framework for this study.

The first school links polygyny with high child mortality through resource constraints, paternal investment, and selectivity. The resource constraint thesis is premised on the notion that the usually large polygynous households are associated with fewer resources per head, an effect that may adversely impact on child health and survival. Exploratory analysis of information on currently married women from the 2003 Ghana Demographic and Health Survey (GDHS), for example, indicated a mean household size of 8.6 for those in polygynous marriages, compared with 5.6 for their counterparts in monogamous marriages. Although wealth may be a decisive factor for a man in securing multiple wives in many polygynous cultures, few may have sufficient resources to effectively support multiple conjugal units (Mulder, 1992). As a result, wealth per capita may be lower even as household wealth is higher. This hypothesis has been substantiated by qualitative studies that indicate fewer assets for women in polygynous marriages than for their counterparts in monogamous marriages (Chojnacka, 1980; Hames, 1996). The resource stress may lead to overcrowding and poor living conditions that could potentially increase the vulnerability of children in polygynous families to diseases and perhaps death. In a recent study in Ghana, for example, the risk of childhood diarrhea was about 43% higher among children in polygynous households than with those in monogamous households (Gyimah, 2003). Lack of resources can also limit access to modern health care, particularly with the "cash-and-carry" system introduced in much of sub-Saharan Africa as part of the World Bank/IMF-sponsored Structural Adjustment Programs of the 1980s.

Strassmann (1997) has theorized that polygyny has a harmful effect on child survival as a result of low paternal investment. In a prospective study among the Dogon of Mali, Straussmann argued that because polygynous fathers produce many offspring, each particular child is less important to their lifetime reproductive success, whereas monogamous fathers have a greater stake in the survival of their children. This argument implies that children in polygynous households may not be well catered for and may therefore be exposed to a higher risk of death than their counterparts in monogamous households.

The selectivity thesis is the third pathway supporting a negative effect of polygyny. It argues that rural residents and less educated women are more likely to be in polygynous marriages (Westoff, 2003). Such women tend to be more traditional and are often less likely to participate in modern maternal and child health programs. In Kenya, for example, Gage (1997) found that children in polygynous marriages were less likely to be fully immunized than their counterparts in monogamous unions. Mothers in polygynous families may be more likely to hold on to customary childcare practices that are inimical to the welfare of their children. This may be particularly true in the case of Ghana, where certain customs and rituals impinge negatively on children's nutritional status and health (Gyimah, 2006).

The second school associates polygyny with enhanced child survivorship, primarily through factors such as longer breastfeeding patterns and interbirth intervals, as well as cowife social and economic cooperation. Amankwa et al. (2001), for example, contended that polygyny represented indigenous population adaptation with presumed positive effects on maternal and child health. According to Amankwa (1997), polygyny reduces the risk of infant mortality through a host of intermediate factors such as prolonged breastfeeding and longer durations of the interbirth intervals that are relevant for child health and survival. Longer birth spacing has a positive impact on maternal and child health through the dynamics of the *sibling competition* and *maternal depletion* hypotheses (Palloni & Millman, 1986). As a result, it is theoretically reasonable to expect polygyny to enhance child survivorship. Anthropological evidence in polygynous cultures also suggests that cowives often cooperate in providing social and economic support to each other, which could bear positively on the health and survival of their children (Chisholm & Burbank, 1991). The rivalry and competition among cowives, which often characterize polygynous marriages, may also motivate each mother to make considerable efforts to guarantee the survival of her children (Amey, 2002).

Hypotheses

Even though these paradigms seem to offer contradictory views on the nature of the association between polygyny and child survival, available evidence generally supports the view that polygyny is deleterious to survival. Indeed, some studies suggest that the presumed positive pathways through which polygyny may enhance child survivorship are not empirically supported. In a study in Nigeria, for example, Adewuyi (1987) found no dramatic difference in the mean length of the interbirth interval and breastfeeding duration between women in monogamous and polygynous marriages. With respect to cowife cooperation, some recent work suggests that such support may be waning on the basis of the increasing tendency of spousal separation (Gage, 1995). Even in co-residential contexts, the relationship is often acrimonious as a result of the husband's preferential treatment of particular spouses and their children. In such contexts, polygynous women generally tend to support their own children rather than those of their cowives (Oni, 1996).

Consistent with existing work, in this study children in polygynous households are expected to have a higher risk of death than children in monogamous households. Additionally, it is contended that the effects of polygyny may depend on the segment of the childhood mortality curve considered. Specifically, the harmful effects of polygyny are expected to be more pronounced in later childhood, primarily because the presumed protective effects have less impact on survivorship at this stage.

Variables and measurement

As the main independent variable in this study, polygyny is measured by the self-reports of married women in response to a question on the number of additional spouses their husbands had. A very small proportion (0.06%) indicated that they did not know if their husbands had other wives, and these were excluded from further analyses. Those who indicated that their husbands had no other wives were coded as monogamous, and those whose husbands had other wives were coded as polygynous. Theoretically, a more coherent approach to understanding the effect of polygyny on child survivorship is to measure the type of marital union at the birth and during the upbringing of the child. This derives from the fluidity of marriages in the African context, as every monogamous marriage is potentially polygynous, and vice-versa (Ezeh, 1997). The major methodological hurdle is to discern whether a mother's marital type reflects the conditions in which her children were born and raised. To circumvent the problem and potentially minimize this bias, I followed the approach adopted by Amey (2002) by further restricting the analysis to only children of currently married women in their first union. The outcome variable is the risk of death in childhood, measured in discrete intervals of under 1 month, 1–5 months, 6–11 months, 12–23 months, and 24 months and older.

Besides polygyny, a number of factors are traditionally known to affect child mortality (Gyimah, 2006; Palloni & Millman, 1986; Sear, Steele, McGregor, & Mace, 2002). These include maternal age at birth, birth interval, single or multiple birth, sex and birth order of child, breastfeeding duration, mother's education, household size and facilities, place of residence, and religion. Moreover, as will be discussed later and shown in Table 2, children in polygynous and monogamous families tend to differ considerably on these factors, which therefore needed to be controlled in order to estimate the net effect of polygyny. Table 1 presents the conceptualization and operationalization of the control variables.

The biodemographic controls considered include maternal age at birth, length of preceding birth interval, gender and birth order of child, and duration of breastfeeding.

Table 1
Operationalization and description of variables.

Variable	Description and operationalization
Type of marital union	Dummy variable coded 1 if the child's mother is in a polygynous union (reference = monogamous union)
Age of child	Age of child at interview categorized into discrete periods under 1 month; 1–5 months; 6–11 months; 12–23 months; 24 months and above (reference = 6–11 months because it is the low point of the risk)
Twin birth	Dummy variable coded 1 if child is a multiple birth and 0 for singleton (reference)
Mother's age at birth of child	Age of mother at the birth of child categorized into three groups as under 20 years, 20–29 years (reference); 30 years and above.
Birth order of child	Birth order of child
Female child	Dummy variable coded 1 if child is female and 0 if male (reference)
Preceding birth interval	Measured as the duration (in months) between previous and current birth, categorized as under 24 months; 24–36 months; above 36 months; Births (reference).
Duration of breastfeeding	Measured as a categorical variable. Missing data were first imputed by EM method. To reduce the endogenous bias, breastfeeding duration in the interval preceding the interval of observation is used as the predictor of survival to that interval.
Mother's education	Highest educational attainment of mother grouped into no education (reference), primary education; secondary and above.
Household Wealth	A summative index derived from presence of household amenities (treated water, flush toilet, finished floor, radio, fridge, TV, bicycles)
Place of residence	Rural-urban place and north-south region of residence was combined with categories urban-north; urban-south (reference); rural-north; rural.
Religion	Religious affiliation of mother coded into three groups as Christian (reference); Moslem; Traditional/other.
Ethnicity	Ethnic affiliation of mother categorized as Akan (reference); Ewe; Ga-Adangbe; Guan/other; Mole-Dagbani.
Husband lives elsewhere	A dummy for the residential arrangement of spouse coded 1 if husband lives elsewhere and 0 otherwise (reference).
Number of children in household	Number of children under age 5 in household.
Year of survey	A dummy variable coded 1 for 2003 survey and 0 for 1998 survey (reference).

Table 2
Percentage distribution of children (0–59 months) by marital type and selected characteristic.

	Type of marital union		Total
	Monogamy	Polygyny	
Type of marital union			
Monogamy	–	–	75.3
Polygyny	–	–	24.7
Mother' education			
No education	43.9	74.4	51.4
Primary	18.9	13.0	17.2
Secondary and above	37.6	12.6	31.4
Place of residence			
Urban-Northern Ghana	3.4	5.6	3.9
Rural-Northern Ghana	28.8	58.8	34.7
Urban-Southern Ghana	24.9	7.8	20.0
Rural-Southern Ghana	45.8	27.9	41.4
Mean household wealth index	2.5	2.2	2.4
Mother's age at birth of child			
Under 20 years	18.2	11.2	16.5
20–29 years	50.5	40.8	48.1
30 years and above	31.3	48.0	35.4
Multiple birth	3.9	2.9	3.7
Female child	49.1	49.8	49.3
Preceding birth interval			
Under 24 months	10.4	10.3	10.1
24–36 months	26.0	29.0	26.7
Above 36 months	36.5	46.5	39.0
First births	27.1	14.1	23.9
Breastfeeding duration			
0–6 months	18.5	16.7	18.1
7–11 months	11.3	11.9	11.5
12–23 months	44.2	36.4	42.2
More than 23 months	26.0	35.0	28.2
Ethnicity			
Akan	34.3	34.0	34.2
Ewe	10.7	10.5	10.6
Ga-Adangbe	6.2	5.6	6.0
Mole-Dagbani	40.4	41.8	8.3
Guan/other	8.4	8.2	40.8
Religion			
Christian	61.9	61.4	61.8
Moslem	19.8	21.6	20.2
Traditional/none	18.3	17.0	18.0
Cumulative proportion of children at end interval			
under 1 month	0.97	0.98	0.97
1–5 months	0.96	0.96	0.96
6–11 months	0.94	0.94	0.94
12–23 months	0.92	0.93	0.93
24 months and above	0.91	0.89	0.90
Mean number of children under 5 years	1.7	2.4	1.8
Year of survey			
1998	44.2	46.5	44.7
2003	55.8	53.5	55.3
Total sample	3717	1221	4938

Notes: Based on pooled data from 1998 to 2003 children's GDHS.

It is pertinent to mention that these biodemographic factors may also be expressed as cultural or ethnic specific traits, because their realized levels in a given group may depend on the prevailing norms. The relationship between child mortality and maternal age at birth has been found to be nonlinear, as there is an age band in which reproductive risks are at a minimum. In general, children born to very young mothers are associated with high mortality risk because of physiological immaturity combined with the psychosocial stress that accompanies teen births. The high risk at older ages is attributed to maternal depletion associated with pregnancy complications and repeated childbirths.

The duration of breastfeeding has also been found to be a significant correlate of child survival. Infants who are breastfed for longer periods not only have normal growth but are also protected against malnutrition, diseases, and infections. It needs to be recognized, however, that the effect of breastfeeding duration on infant mortality is endogenous, because children breastfed for 6 months, for example, must have survived to that age. An attempt has been made to reduce the endogenous effect of breastfeeding by using a series of dummies to indicate that a child survived to the lower bound of a specified age segment. Breastfeeding duration in the interval preceding the interval of observation is used as the predictor of survival for that interval. For example, breastfeeding at 1–5 months is used as the predictor of survivorship among those aged 6–11 months. With respect to the preceding birth interval, the probabilities of child survival are significantly lower among closely spaced infants. The theoretical pathway has been explained through the dynamics of sibling competition and maternal depletion syndrome (Gyimah, 2005). Also, the risk of death has been found to be higher among multiple births. Although research in Asia suggests significant mortality risk for female children, such gender differences have not been found in sub-Saharan Africa.

The socioeconomic and geographic controls include maternal education, a derived household wealth index, and region and place of residence. The role of maternal education in reducing mortality among young children has been well recognized around the world. A number of theoretical links have been identified. First, educated women are less likely to experience childhood deaths, supposedly because they have a better understanding and appreciation for health-related matters. Studies in diverse regions of the developing world have also found higher mortality rates in rural areas. The general presumption is that rural-urban residence distinguishes clearly between poor and good sanitation, housing structure, and availability of health resources. In Ghana, not only are rural populations disadvantaged socioeconomically, but they are historically underserved in health infrastructure and health personnel (Brown, 1986). Like most developing countries, Ghana also shows a marked north-south regional imbalance in development, with roots in the historical and developmental processes of the country. Generally, the level of socioeconomic development is more advanced in the south (Greater Accra, Eastern, Central Volta, Western, Ashanti, and Brong-Ahafo regions) than the north (Northern, Upper East and Upper West region), resulting in a marked imbalance in accessibility to health services. In this study, the role of region and place of residence is taken into account by creating a new variable denoted Urban-south, Urban-north, Rural-south, Rural-north. On the basis of prior research, controls for ethnicity, religion, number of young children in the household, and residential pattern of husband are also included in the study (Gyimah, 2006, 2007). Although other covariates such as immunization status and episodes of malaria and diarrhea are important to understanding survival status, these variables are not available for all children in the GDHS and as such were not used in this paper.

Method

Data from the 1998 and 2003 GDHS children's file were used for the study. These surveys, respectively, represent the third and fourth cycles in a series of similar surveys undertaken by the Ghana Statistical Service in collaboration with Macro International, beginning in the late 1980s. Both surveys are nationally representative, stratified, self-weighting probability samples of women in the reproductive ages of 15–49 years. Although not explicitly designed to evaluate a polygyny–child mortality nexus, the surveys have information on personal, household, birth, and marital characteristics and can be used to examine the research question.

The sample sizes were 4843 and 5691 women in 1998 and 2003, respectively. The 1998 sample contributed a total of 3298 children, whereas the 2003 sample had 3488 births in the 5 years preceding the survey. An advantage of repeat surveys such as the GDHS is that because of the similar sampling techniques and questions, the data can be pooled for detailed analysis, which is the approach taken in this paper. Following previous work (see Gyimah, 2006, 2007), the present study is restricted to births that occurred 5 years before the surveys, for the following reasons. First, the quality of information on such births is better than that for births that occurred many years ago which tend to be associated with a higher likelihood of displacement of vital events such as age at death for deceased children. Also, focusing on recent births reduces the problems associated with period effects of child mortality. Lastly, it also warrants that maternal and household characteristics relate to current conditions. To minimize the bias associated with the measurement of polygyny, the analysis is restricted to children of currently married women in their first union. This restriction yielded an effective sample size of 4938 children from the pooled file.

Because most children were censored at the time of the survey, an event history model was used to account for censoring in the estimation of exposure time. In the GDHS, age at death, reported in days and months, is subject to heaping at certain ages. A discrete formulation of time was therefore preferred to a continuous one. Discrete time hazard models require that episodes be split into periods of risks (Singer & Willett, 2003). Because the risk of childhood death fluctuates by age, time was unevenly split into five risk groups of under 1 month, 1–5 months, 6–11 months, 12–23 months, and 24 months and older. These intervals were chosen because of the considerable variation in mortality rates over the first year of a child's life (see Sear et al., 2002). For the toddler and later childhood periods, mortality fluctuates less by age, so longer intervals were chosen. Each child thus contributed one observation for each age interval that she/he started, resulting in total of 20,239 person periods.

An important characteristic of the data that needed to be analytically taken into account was its nested structure. GDHS data typically have a hierarchical structure, mainly as a result of randomly sampling groups in the population, with children nested within mothers. In the present analysis, 3540 mothers contributed a total of 4938 children to the sample, yielding a mean of 1.4 children per woman. Children of the same mother are expected to be more alike, at least in part because they share common characteristics (genetic, behavioral, sociocultural), thus violating the independence assumption of conventional models. Indeed, a number of recent studies have found strong association in mortality risks of children of the same mother (e.g., Sear et al., 2002). Thus, unless some allowance is made for within-mother correlation, standard statistical methods are no longer valid, as they generally underestimate the variance. To account for heterogeneity and within-mother correlation, a multilevel discrete time logit model with children nested in mothers was used. As Sear et al. pointed out, this approach allows for correction in mortality risk between siblings by specifying mother-specific random effect. The multilevel discrete time logit model is specified as:

$$\log\left(\frac{h_{ijt}}{1-h_{ijt}}\right) = \alpha_t + \beta' X_{ij} + \mu_j$$

where $\log(h_{ijt}/1-h_{ijt})$ is log odds of child i of mother j dying at period t; α_t is the effect of age (duration) on mortality, which in this paper is modeled by including a series of dummies indexing the five periods; X_{ij} is a vector of explanatory variables and β' is a vector of corresponding regression coefficients; and μ_j is the mother-level random effect assumed to be normally distributed with zero mean and variance $= \sigma_u^2$. For intuitive interpretation, the coefficients can be transformed by exponentiation (e^{β}) and interpreted as relative risk. If the relative risk associated with a particular covariate is greater than one, it indicates that children with that attribute have a higher risk of death than those in the reference category, whereas the reverse is true if the risk ratio is less than one. A useful measure to evaluate the extent of mother-level variance is the intra-class correlation interpreted as the correlation between latent mortality risks for a pair of children from the same mother. For binary logit models, this is defined as $\rho = \mu_u^2/\mu_u^2 + \pi^2/3$, where μ_u^2 is the estimated mother-level variance and $\pi^2/3$ is the variance of a standard logistic distribution (see Pebley, Goldman, & Rodríguez, 1996). The GLLAMM program as implemented in STATA is used for the estimation of the model (for description and technical details, see Rabe-Hesketh, Pickles, & Skrondal, 2004; Rabe-Hesketh & Skrondal, 2005).

Results

Table 2 presents detailed descriptive statistics of the sample by marital type. Although descriptive, these results highlight some differences between children in polygynous and monogamous families. On one hand, there is evidence that children whose mothers are highly educated, live in wealthier households, and reside in the Urban-south are less likely to be in polygynous marriages than monogamous ones, confirming the selectivity thesis. These differences are quite striking. For example, more than 70% of children in polygynous households have mothers with no formal education, whereas only 13% have mothers with at least secondary education. This finding sharply contrasts with the proportion of children (about 38%) in monogamous marriages whose mothers have at least secondary education. Also noteworthy are the ethnic differences; about 42% of those in polygynous marriages are Mole-Dagbanis. On the other hand, a slightly higher proportion of children in polygynous families tend to be breastfed for a slightly longer period than their monogamous counterparts, although the differences are not significant. It needs to be noted that these differences between polygynous and monogamous families would have a significant bearing on child survival.

To illustrate the consistency of the effect of polygyny, Fig. 1 shows the survival functions of children distinguished by type of marital union for the 2003 and 1998 samples. The difference in survivorship between monogamous and polygynous unions seems more pronounced in later childhood, supporting the hypothesis that the effect of polygyny may not be uniform over the entire childhood period. Perhaps the non-significance of the findings in recent work in Ghana that examined only the neonatal and the infant stages (Amankwa et al., 2001) may be attributed to the failure to model the age-specific effects.

The association between marital type and child survival as shown in Fig. 1 may, however, be spurious. As seen in Table 2, children in polygynous and monogamous households differ considerably on other factors that affect survival. The results in Table 3, which show the unadjusted effects of the control variables on under-5 mortality, are mostly consistent with extant research. The risk of childhood death is highest in the neonatal period but declines with age, although nonlinearly. Additionally, lower mortality rates are discernible among children of highly educated mothers as well as those in wealthier households. Survival probabilities are also considerably lower among children in the Urban-north, Rural-north, and Rural-south. Gender does not seem to significantly affect the risk of childhood death; this finding is consistent with prior research in sub-Saharan Africa (Arnold, 1997; Hill & Upchurch, 1995). The effects of the biodemographic variables are also consistent with theoretical predictions. For children with teenage mothers, for example, the risk of death is about 54% higher than that for children whose mothers are 20–29 years old. The effect of breastfeeding is more pronounced in the early stages of life. Shorter birth intervals also associate with higher risk of death, although the effects are not significant.

Overall, the bivariate results in Table 3 suggest significant associations between the control variables and child survivorship. Given the relationships between the control variables and marital structure discussed in Table 2, however, the question arises as to whether polygyny has an independent effect on child survival net of these variables. The multivariate models presented in Table 4 explore whether the marital difference in survivorship could be attributed to the control variables. Model 1, the null model, explores mother-level mortality clustering with only the duration variables. The results indicate significant mother-level variance with an intraclass correlation of 0.13,

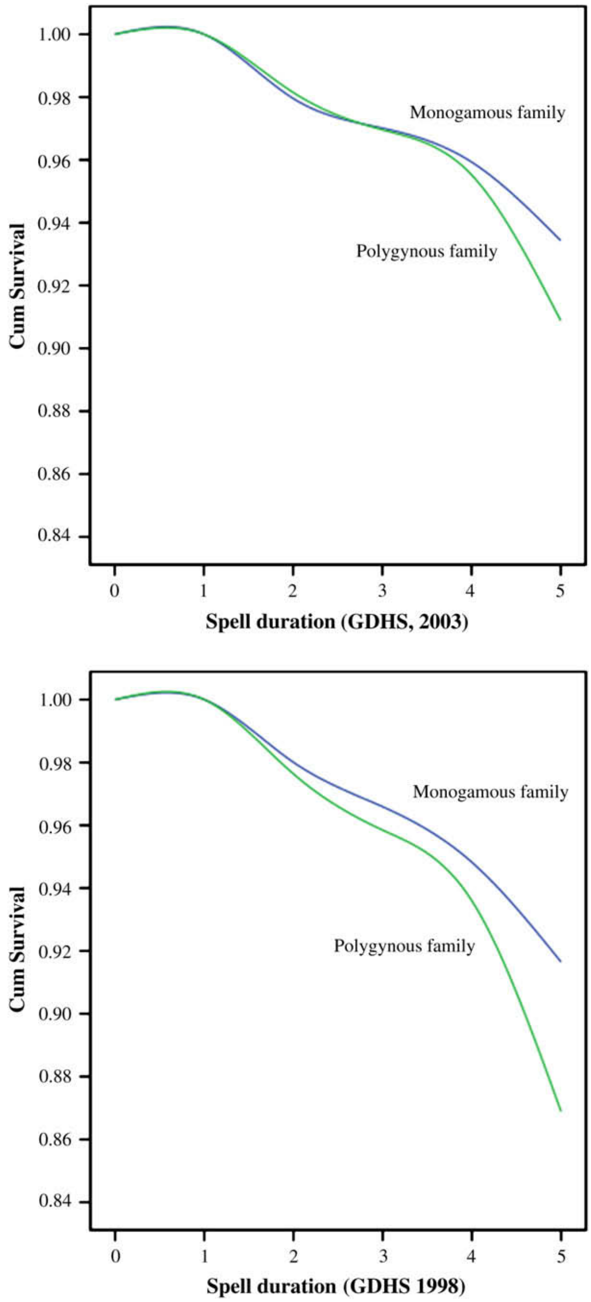

Fig. 1. Child survivorship by monogamous and polygynous marital structure, 1998 and 2003 GDHS. *Notes*: I recognize that each of the samples has different composition overtime owing to shifts in population characteristics as well as sampling variability. While these compositional changes are not of primary interest to this study, the approach advocated by Firebaugh (1997) regarding pooled data was followed and the data passed the tests.

suggesting that about 13% of the variation in under-5 mortality is attributable to mother-level factors. The effects of duration dummies suggest a U-shaped mortality risk, the risk being highest in the neonatal state and after 24 months of age.

Model 2 assesses the risk of childhood death as a function of polygyny net of the control variables, and it also

Table 3
Bivariate results of discrete time logit of child mortality and the control variables, Ghana.

	Unadjusted coefficient
Duration (Age of child: 6–11 months as reference)	
Under 1 months	1.10***
1–5 months	0.12
12–23 months	0.25
24 months and above	0.44*
Multiple birth (singleton as reference)	1.12***
Female child (male as reference)	−0.10
Birth order of child	−0.03
Breastfeeding duration (24 months + as reference)	
0–6 months	3.90***
7–11 months	1.53***
12–23 months	0.87***
Preceding birth interval (first birth as reference)	
Under 24 months	0.31*
24–36 months	−0.18
37 months and above	−0.70***
Mother's age at birth of child (20–29 years as reference)	
Under 20 years	0.43**
30 years and above	0.11
Mother' education (no education as reference)	
Primary	−0.20
Secondary and above	−0.40**
Residence (Urban-Southern Ghana as reference)	
Urban-Northern Ghana	0.34
Rural-Northern Ghana	0.74***
Rural-Southern Ghana	0.47**
Household wealth index	−0.08*
Ethnhicity (Akan as reference)	
Ewe	0.13
Ga	−0.56!
Guan/Other	−0.41!
Mole-Dagbani	0.02
Religion (Christian as reference)	
Moslem	−0.18
Traditional/None	0.06
Husband lives elsewhere (same house as reference)	−0.08
Number of children under 5 years in household	−0.98**
Year of survey 2003 (1998 as reference)	−0.05

Statistical significance: ***, $p < 0.001$; **, $p < 0.01$; *, $p < 0.05$; !, $p < 0.10$.
Based on pooled data from the 1998 and 2003 GDHS children's file.

examines whether the mother-level variance could be explained by the observed covariates. There is statistical evidence that controlling for these characteristics results in a significant attenuation in the mother-level variance, such that the within-mother correlation reduces to almost zero. This suggests that the variation in child mortality risk between mothers can be explained by these characteristics. Substantively, the results in Model 2 indicate that polygyny has an independent effect on under-5 mortality net of the control variables. The results suggest that children in polygynous families have a 62% higher (exp 0.48) risk of death than their monogamous counterparts net of the

Table 4
Multilevel discrete time hazard models of polygyny and child mortality in Ghana.

	Model 1	Model 2	Model 3
Age-specific effect (6–11 months as reference)			
Under 1 month	1.08***	1.83***	1.85***
1–5 months	0.11	−1.95***	−2.16**
12–23 months	0.26*	−0.26	−0.21
24 months and above	0.45*	1.21**	0.79*
Type of marital union (monogamy: reference)			
Polygyny		0.48***	0.25
Multiple birth (singleton: reference)		2.18***	2.18**
Mothers' age at birth of child (20–29: reference)			
Under 20 years		0.20	0.20
30 years and above		0.25	0.25
Birth order of child		−0.01	−0.01
Female child (reference: Male)		−0.09	−0.08
Preceding birth interval (first births: reference)			
Under 24 months		0.88***	0.89***
24–36 months		0.38***	0.39!
37 months and above		−0.64**	−0.63**
Breastfeeding duration (after 24 months)			
0–6 months		4.91***	4.95***
7–11 months		2.52***	2.52***
12–24 months		1.81***	1.78**
Mother' education (no education: reference)			
Primary		−0.26	−0.25
Secondary and above		−0.45**	−0.45**
Household wealth index		0.02	0.03
Ethnicity (Akan as reference)			
Ewe		0.09	0.10
Ga		−0.35	−0.34
Guan/other		−0.13	−0.12
Mole-Dagbani		0.06	0.06
Religion (Christian as reference)			
Moslem		−0.19	−0.19
Traditional/none		0.02	0.01
Residence (Urban-Southern Ghana as reference)			
Rural-Northern Ghana		0.50*	0.51*
Urban-Northern Ghana		0.35	0.35
Rural-Southern Ghana		0.71**	0.72**
Number of children in household		−1.33***	−1.34***
Husband lives elsewhere (same house as reference)		−0.22	−0.22
Year of survey (1998: reference)			
2003 survey		0.01	0.01
Polygyny–Age interaction			
Polygyny* under 1 month			0.14
Polygyny* under 1–5 months			0.71
Polygyny* under 12–23 months			−0.12
Polygyny* under 24 months and above			1.19*
Constant	−4.74***	−3.89***	−3.85***
Random part			
Level 2 variance	0.50*	–	–
Intra-mother correlation	0.13	–	–
Log likelihood	−1756.87	−1393.28	−1385.38

Notes: Statistical significance: ***, $p < 0.01$; **, $p < 0.01$; *, $p < 0.05$; !, $p < 0.10$.
Based on pooled data from the 1998 and 2003 GDHS children's file.

control variables. While not all the control variables are statistically significant at conventional levels, the direction of their effects is mostly consistent with existing work in Ghana (Amankwa et al., 2001; Gyimah, 2006, 2007). More importantly, however, Model 2 constrains the effect of polygyny to be identical in each of the five time periods, yielding a hazard function that is equidistant on a logit scale.

Revisiting the second hypothesis and aided by the survival plots in Fig. 1, there are reasons to believe that the effects of polygyny may not be uniform as Model 2 suggests. Model 3 thus tests whether the effect of polygyny is uniform across the entire childhood period by interacting polygyny with the duration variables. The results of this unconstrained model support the hypothesis that the effect of polygyny is not consistent over the entire childhood period. There is evidence of a statistically zero effect of polygyny before 24 months of age. Without accounting for this statistical interaction, it will be tempting to conclude that polygyny uniformly affects the risk of death in childhood, but this is clearly not the case. Perhaps the less pronounced effects of polygyny in early childhood could be attributed to protective factors of polygyny, such as breastfeeding and birth interval duration, that tend to ameliorate the deleterious effect. In later childhood, however, these protective factors have less impact on survivorship and may therefore not provide the buffer effect they offer in early childhood.

Discussion

A major limitation of research on the effects of family structure on child outcomes in the context of sub-Saharan Africa is the implicit assumption that marriage is monogamous. To unravel the effects of family structure on child outcomes in African societies, I have argued for the need to distinguish between monogamous and polygynous marital structures. The need for this distinction derives in part from the remarkable differences in household resources that may significantly impact on child outcomes. Although previous studies have assessed the link between polygyny and child survival in sub-Saharan Africa, they have been mostly based on qualitative work and do not control for potential confounders.

This paper has attempted to resolve the question of whether there are child survival differences between monogamous and polygynous families, using data from the 1998 and 2003 Ghana Demographic and Health Surveys. Guided by previous research, it was expected that children in polygynous households would be at a higher risk of death than children in monogamous households primarily through the effects of resource constraint, paternal investment, and selectivity. Additionally, because the presumed protective effects of polygyny depend on age, the harmful effects of polygyny were expected to be more pronounced in the later childhood period.

Overall, the empirical results support the argument that it is important to distinguish between the two types of marital forms in cultures characterized by polygyny. In Model 2, which did not allow for age-specific effects of polygyny, it was found that mortality was generally elevated for children in polygynous marriages, but there was evidence in Model 3 that this originated from conflating a large effect at older ages with statistically zero effect at younger ages. In much of the literature, differential household resources have been identified as the major pathway through which family structure affects child outcomes. It has been argued that children in married families have, among other things, a larger pool of resources than children in other families (White & Rogers, 2000), hence the better outcomes for such children. The results presented here are consistent with this reasoning, given the differential resources between polygynous and monogamous households. Although several indicators of selectivity and parental resources—such as maternal education, household size, location of residence, and household facilities—were controlled in the multivariate models, polygyny was found to exert an independent effect on child survival. It is important to note, however, that the limitations of the data make it impossible to attribute the lower survival probabilities in polygynous households directly to any of the discussed pathways. The results presented here are somewhat inconsistent with a recent study in Nigeria (Ukwuani et al., 2002), in which survival-enhancing effects of polygyny were found in the post-neonatal period. Without discounting the methodological differences in terms of covariates included and the way the age-specific effects were modeled in the two studies, future work could explore these inconsistencies further.

This study extends research on marital family structure and child well-being by making the case for a distinction between polygynous and monogamous marriages in polygynous cultures. The findings offer insights into the discourse on polygynous marital structure and thus contribute to the cross-cultural literature on family processes. In particular, these results, consistent with the few studies on the subject, suggest the need for a reconsideration of the monolithic view of marriage in polygynous cultures in order to unravel the complex links between marriage and child outcomes. It appears that residing in a polygynous household is associated with lower child survival probabilities, irrespective of parental and household resources. The findings should however be interpreted with some degree of caution, because it is likely that the effects of unmeasured factors, such as parental monitoring and support, not available in the data, may change the effects of marital type reported here. Although this is a limitation, the present study nonetheless provides the base from which further studies can be designed. Future work may assess whether the rank of a wife in a polygynous marriage affects the survival chances of her children. The need for such research derives from studies that suggest that wives in polygynous marriages are preferentially treated by their husbands according to rank.

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