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Article abstract

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Demography and Polygyny in a Southern Sudanese Agro-pastoralist Society

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Survey data from eight Toposa villages were used to examine the demographic effects of polygyny upon this Southern Sudanese agro-pastoralist population. Direct age-standardization of fertility rates revealed lower fertility for women in polygynous unions, as measured by maternal age and marital duration. Indirect techniques of mortality estimation indicated higher childhood mortality for offspring of polygynous marriages. The underlying rationale for these demographic differentials is attributed to Toposa social structure, including the economic value of women, gerontocracy and residential patterns.

Les données d'un sondage de huit villages toposasiens ont servi de base pour examiner les effets démographiques de la polygamie sur cette population pastorale du sud de Soudan. La standardisation de la fréquence de la fécondité, mesurée par l'âge des femmes et la durée du mariage, indique que la fécondité d'une femme d'un mariage polygame est moins élevée. Les techniques indirectes pour estimer la mortalité indiquent que la mortalité infantile augmente chez les enfants issus de mariages polygames. La raison pour les différences démographiques est attribuée à la structure sociale toposasienne, incluant la valeur économique des femmes, la gérontologie et les tendances résidentielles.

One of the most prevalent and long-standing traditions in sub-Saharan African culture is polygyny. Anthropologists have recognized that the desire for additional wives can translate into social differentiation (Spencer, 1976, 1980), additional political alliances (Almagor, 1978) and economic gain (Spencer, 1975). That these advantages are well-known to males in traditional sub-Saharan societies is exemplified by Phillips' introduction to the text, *Survey of African Marriage and Family Life:*

> Where the traditional outlook still prevails, the possession of a number of wives is normally a sign of importance and success in life and—for this and other reasons—is something which the average African man would achieve if he could; in other words, monogamy is for the majority who are monogamous, a matter of necessity rather than choice (1953: XIV).

Recognition of the interrelationship of African polygyny and demography dates to the early twentieth century and focused on the linkage of polygyny and gerontocracy (Rivers, 1914; Fraser, 1919). The study of African polygyny in relation to demographic rates dates to Culwick and Culwick's (1939) findings of higher fertility in polygynous versus monogamous marriages in Tanganyika. Similar findings are attributed to early and universal marriage patterns associated with polygyny (Sembajwe, 1979). Yet most studies note lower fertility for monogamous unions (cf. Dorjahn, 1959; Isaac, 1980) with proposed causal mechanisms including large spousal age differences suggesting decreased coital frequency due to loss of male vigor (Nag, 1962), the presence of a long postpartum abstinence period made feasible by the availability of alternate female sexual partners, and the spread of venereal diseases among multiple wives (Page and Lesthaeghe, 1981; Bean and Mineau, 1986).

Biological differences have also been hypothesized for infant and child mortality, with the thought that offspring of polygynous marriages would feature better survival due to the presence of surrogate mothers originating with Albert Schweitzer (1941). Isaac and Feinberg (1982) offered an alternative hypothesis; that child mortality would be higher for polygynous unions due to increased exposure to infectious disease arising from the presence of multiple households within the same compound.

In 1984 a household survey of eight Toposa villages in Kapoeta District, Equatoria Province, Southern Sudan, provided an opportunity to examine the effects of polygyny on the fertility and mortality regimes of these agro-pastoralists. Carried out under the auspices of the United Nations Children's Fund (UNICEF), the survey's goals were to determine infant and childhood mortality levels and delineate possible mortality differentials. This last factor was not realized, even though standarly employed variables, including maternal education, breastfeeding duration, heating sources, and toilet facilities were employed. For this largely egalitarian society such variables proved homogeneous, giving invariant results. However, one notable feature of Toposa society was the high rate of polygyny, with a Toposa husband possessing on average almost two wives ($x = 1.93$, Range = 1-11)

This feature, coupled with the failure of commonly employed variables to determine relative childhood mortality risks, led to the decision to investigate the Toposa data to ascertain possible effects of polygyny on fertility and mortality regimes.

The Study Population

The Toposa of Southern Sudan are Nilo-Hamitic agro-pastoralists. Numbering approximately 50,000 people, they inhabit the Sudanic savannah plains of the southeastern corner of the Democratic Republic of the Sudan. Dependence upon millet agriculture enables them to be the only sedentary Nilo-Hamitic group in Sudan. Their settlement pattern features large patrilineal villages characterized by fenced enclosures containing households, granaries and livestock, with the last consisting of cattle and goats.

For the Toposa, as well as many other East African societies, polygyny is an integral facet of society based on economic and social rationale. In Toposa society additional wives mean direct economic benefits, since females almost exclusively form the agricultural labor force, while male labor centers on animal husbandry. In addition to constituting agricultural and household labor wives represent a means of making and keeping political allegiances between clans, as well as accruing social prestige for males. Toposa cultural manifestations of these factors include brideprice (cited as between 3-10 head of cattle, plus small stock, by Gulliver and Gulliver (1968: 91)), and female child betrothal. As in the neighboring, better known Samburu culture (Spencer, 1973, 1976), gerontocracy in Toposa society is closely linked to polygyny. An earlier analysis (Roth, 1988) of 951 Toposa married males showed a significant age gradient with respect to number of wives. Men aged sixty years or above had an average of 4.8 wives, while those aged 20-29 had an average of 1.2. In addition, this study revealed a significant correlation ($r = +0.842$, $p<0.001$) between number of co-wives and overall family size.

All this suggests that older men who can acquire multiple wives who will in turn produce children effectively control the means of production and reproduction of Tuposa society. These findings also indicate a high potential for polygyny to influence Toposa demography, via differential fertility and family size.

Materials and Methods

To assess this influence the family data were analyzed with polygyny as a primary variable. These surveys of Toposa villages were conducted by enumeration teams from the Ministry of Economics and Planning, Democratic Republic of the Sudan. Using a standardized questionnaire, teams gathered demographic, familial and socio-economic data on 1,051 families representing 9,452 people. Relevant to this study were questions on maternal histories seeking information on mothers' age, children ever born, number of children died, marital duration, and number of co-wives. In addition, household size, sex and age composition were detailed for each compound surveyed.

To measure fertility female mean parity by both maternal age and marital duration was calculated. Availability of both measures alleviated the problem of utilizing cross-sectional data (marital status) to quantify longitudinal fertility, as women may be monogamous and polygynous at different times in their lives. This potential problem was also addressed by use of Direct Age-Standardization, with the goal of separating mere age and time composition differences between monogamous and polygynous samples from true underlying rate differences. The former are termed Compositional Effects, the latter Residual Effects, and they are defined (Mueller *et al.*, 1977: 137) as:

(1) Compositional Effect = (CR-AR)

(2) Residual Effect = (AR-SR)

where:
CR = Crude Rate

AR = Adjusting Rate

SR = Standardizing Rate

Following Direct Standardization of rates component analysis was used to derive these effects using the formula:

(3) CR - SR = (CR-AR) + (AR-SR)

For mortality, indirect mortality estimation techniques were used to calculate infant and childhood mortality levels. These followed the basic formula devised by Brass and Coale (1968: 109):

(4) $q(x) = K(i)D(i)$

where:
q(x) = cumulative probability of dying from birth to age x

D(i) = proportion dead among children ever born for maternal age i

K(i) = a multiplying factor

In this relationship the rate and age of childbearing determine the distribution and exposure to risk of death for children classified by maternal age. Multiplying factors fit mortality to fertility patterns, based on ratios of average parity of women 15-19 to those age 20-24, and for women 20-24 compared to those 25-29 (termed P1/P2, P2/P3). Improvements in this approach include multiple regression formulae devised by Trussell (1975) which fit observed mortality data to Coale and Demeny's (1968) model life tables. Generalized versions provided by the United Nations (1983: 82) were used in the form:

(5) $K(i) = a(i) + b(i)(P_1/P_2) + c(i)(P_2/P_3)$

where a, b, and c are regression coefficients provided for the "South" family of model life tables.

Results

Table 1 presents data on mean parity for both maternal age and marital duration for monogamous and polygynous unions. The former represent women in the reproductive period of the life cycle, aged 15-49. The latter consist of seven five-year periods, starting with 0-4 and ending with 30-34. These different approaches to sample formation result in the numerically different sample sizes recorded. The last line in each section denotes age- and period-adjusted mean parity achieved by direct standardization of age- and period-specific mean parity values upon opposite samples.

Table 1. Mean parity by maternal age, marital duration and marital form.

	Monogamous		Polygynous
A)	Maternal Age	A)	Maternal Age
	No. of women = 466		No. of women = 1,844
	No. of children = 1,683		No. of children = 5,871
	μ Parity = 3.612		μ Parity = 3.184
	Standard deviation = 2.227		Standard deviation = 2.601
	Age adjusted μ Parity = 3.344		Age adjusted μ Parity = 3.469
B)	Marital Duration	B)	Marital Duration
	No. of women = 483		No. of women = 1,697
	No. of children = 17,797		No. of children = 6,793
	μ Parity = 3.721		μ Parity = 3.985
	Standard deviation = 2.394		Standard deviation = 2.520
	Age adjusted μ Parity = 4.096		Age adjusted μ Parity = 3.637

Results are non-uniform, with monogamous women having slightly lower overall fertility than their polygynous counterparts, when measured by maternal age, but higher fertility when measured via marital duration. These gross differences were subjected next to component analysis, as shown in Table 2. Residual effects for polygynous fertility levels were lower than monogamous rates, regardless of

Table 2. Component analysis of polygynous fertility rates standardized upon monogamous age structures.

Calculated by	Fertility Rate (CR)	Crude Rate (SR)	Standardizing Rate (AR)	Adjusted Compositional[1] Effect	Residual[2] Effect
Maternal Age	3.184	3.612	3.469	-0.285***	-0.143**
Marital Duration	3.985	3.727	3.637	+0.348***	-0.084+

[1]Compositional Effect = (CR - AR)
[2]Residual Effect = (AR - SR)
+ = non significant, p>0.05
** = p<0.01
*** = p<0.001

whether these were measured in terms of maternal age or marital duration. Construction of a standard error for the polygynous samples permitted calculation of probability levels to test compositional and residual effects for statistical significance. Compositional effects for both measures of mean parity were highly significant ($p<0.001$), denoting large differences in sample compositions. For residual effects only maternal age was significantly different ($p<0.01$).

The finding that maternal age, rather than marital duration, is the prime determinant of Toposa fertility differentials suggests the first of the three factors previously cited as underlying lower polygynous fertility levels, large spousal age differences, as the main causal agent.

To further test this impression, husband-wife age differences were recorded separately for first wives, second wives, and third or higher wife orders. Arranged in this manner, Table 3 shows a pattern of increasing spousal age differences for first wives (both monogamous and polygynous), second wives, and third and above order wives. In all cases Student's t-tests revealed significantly ($p<0.001$) different age distributions for each succeeding wife order. These differences arise from the association of polygyny with gerontocracy in Toposa society. Wealthy male elders are commonly the head of polygynous households, since they can afford the brideprice associated with each marriage and possess the political power and status sought by the bride's family. Young women therefore frequently enter polygynous marriages with much older men, accounting for the increasing age difference between junior, or non-first order, wives shown in Table 3.

Pronounced spousal age differences serve to dampen fertility in two ways. First, age-related loss of male sexual vigor may result in decreased coital frequency, a situation compounded by the presence of multiple wives. Secondly, large age differences mean increased risk of husband mortality relative to younger wives, reducing duration of sexual exposure in societies like the Toposa where widow remarriage is prohibited.

The suggestion that large spousal age differences, rather than the rapid spread of venereal disease, are responsible for lower fertility is strengthened by the finding of a low number of zero parities and a high rate of age-specific fertility in older (35+) women. The former suggests little primary sterility, while the latter indicates low rates of secondary sterility. Finally, the lack of a long post-partum abstinence period in Toposa society negates the impact of this factor in determining Toposa fertility levels.

Table 3. Husband-wife age difference as by wife order, total sample.

Years Difference	Wife Order 1	2	≥=3
0-4	250	22	7
5-9	408	87	25
10-14	154	117	52
15-19	65	104	66
20+	67	179	339
No.	944	509	489
μ	8.189	17.507	26.431
S.D.	6.300	10.265	12.031
	t = 21.372***	t = 12.622***	

***p<0.001

As an initial step in comparing mortality patterns for monogamous and polygynous unions Table 4 presents data on children ever born, children died, and proportional measures of children dead by maternal age [D(i)]. The last two columns denote likelihood ratio chi-square values (L2) and degrees of freedom based on patterns of age-specific births and deaths. No statistics were calculated for the first interval, due to small cell sizes. For remaining intervals a significant total likelihood ratio value ($p<0.001$) was revealed. Partitioning the total value by age intervals demonstrated that the first intervals, representing child mortality (ages 3-5) contributed disproportionally to these totals.

This pattern of differential childhood mortality is retained when data are transformed into life table measures as shown in Table 5. These show consistently higher mortality [q(x)] values for offspring of polygynous marriages. Linear interpolation of 15 values with the Coale and Demeny (1968) South model life tables yielded an average life expectancy at birth of 52.2 for the monogamous sample and 42.3 for the polygynous, a mortality differential of 9.9 years.

Table 4 Mortality Measures by Maternal Age and Marital Form

	Monogamous			Polygynous				
Maternal Age	Children Ever Born	N Died	Proportion Died Di	Children Ever Born	N Died	Proportion Died Di	Likelihood Ratio Chi-Square	d.f.
15-19	3	1	0.3333	25	5	0.2000		
20-24	113	15	0.1327	325	63	0.1938	2.249	1
25-29	456	65	0.1425	1,265	277	0.2190	12.975**	1
30-34	284	55	0.1937	1,139	315	0.2766	21.095**	1
35-39	422	118	0.2746	1,334	363	0.2721	0.365	1
40-44	225	59	0.2622	788	231	0.2931	0.830	1
45-49	180	49	0.2622	995	329	0.3307	2.444	1
Totals	1,683	362		5,871	1,583		39.958**	6

** p<0.0.001

These results accord with the hypothesis of Isaac and Feinberg (1982) that child mortality would be higher for polygynous unions due to greater exposure to infectious disease within the same compound. Toposa society fits this model, with all wives of a polygynous union living within the same fenced enclosure. Polygynous family size ($n = 539$, $\mu = 12.564$, s.d. $= 6.238$) is significantly ($t = 24.847$, $p<0.001$) larger than for monogamous unions ($n = 512$, $\mu = 5.234$, s.d. $= 2.295$), suggesting increased risk of infectious disease as a result of larger family size in a restricted area. This risk is elevated by the lack of sanitation facilities and the proximity of livestock. As noted for other livestock owning peoples (cf. Smucker *et al.*, 1980) such proximity also raises the danger of infectious disease caused by the increased presence of zoonoses.

Table 5. Life Table Measures by Maternal Age and Marital Form.

		Monogamous				Polygynous			
		Proportion	Conversion	Probability	Survivorship				
Maternal Age	Offspring Age	Died (Di)	Factor (Ki)	of Dying q(x)	Values l(x)	Died (Di)	Factor (Ki)	of Dying q(x)	Values l(x)
15-19	1	0.3333	-	-	-	0.2000	-	-	-
20-24	2	0.1327	1.0309	0.1368	0.8632	0.1938	1.1185	0.2168	0.7832
25-29	3	0.1425	1.0174	0.1450	0.8550	0.2190	1.0478	0.2295	0.7705
30-34	5	0.1937	1.0280	0.1991	0.8009	0.2766	1.0387	0.2873	0.7127
35-39	10	0.2746	1.0473	0.2876	0.7124	0.2721	1.0510	0.2860	0.7140
40-44	15	0.2622	1.0257	0.2689	0.7311	0.2931	1.0281	0.3013	0.6987
45-49	20	0.2722	1.0121	0.2755	0.7245	0.3307	1.0151	0.3357	0.6643

Monogamous: $P_1/P_2 = 0.1814$, $P_2/P_3 = 0.4684$

Polygynous: $P_1/P_2 = 0.0803$, $P_2/P_3 = 0.3854$

Summary and Discussion

Analysis of Toposa fertility levels revealed that polygynous marriages feature lower rates than monogamous unions, as measured by both maternal age and marital duration. Component analysis of direct age- and period-standardized rates indicated fertility based on maternal age was significantly different from the monogamous sample, while marital duration-based fertility was not. Increasing age differences between husbands and higher order wives, resulting in decreased coital frequency and increased likelihood of female widowhood, was posited as the causal factor in lowering polygynous rates. Indirect mortality analysis revealed lower survival rates for children of polygynous unions. The resulting large childhood mortality differential was attributed to increased exposure of both human and animal vectors of infectious disease caused by the social pattern of multiple dwellings and keeping of livestock within family compounds.

In a recent review of the study of polygyny in demography Bean and Mineau (1986) decried the gross comparison of polygynous versus monogamous samples, citing the potential for obfuscating underlying social and biological features. Examples given included the African tradition of obtaining additional wives in high sterility areas when the first wife fails to bear children and differences in education between traditional first wives and literate, higher order wives. However, in the present case such conditions do not apply. Both primary and secondary sterility rates appear to be low, and no women, regardless of marital form, have any education. In the Toposa polygyny, rather than hiding cultural factors, actually provides a framework for examination of the economic role of women, residential patterns and the social importance of gerontocracy. The importance of polygyny as an investigative variable was further highlighted by the inability of standardly used demographic variables to delineate differences in these largely egalitarian peoples. As such polygyny remains a vital variable for the biological and social study of traditional African societies.

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