Demographic Limits of Nineteenth-Century Mormon Polygyny

Davis Bitton and Val Lambson

What percentage of nineteenth-century Mormons practiced polygyny? Estimates of the answer have evolved as have the methods of posing the question.[1] In 1885, Church leaders John Taylor and George Q. Cannon wrote that "the male members of our Church who practice plural marriage are estimated as not exceeding but little, if any, two per cent, of the entire membership of the Church."[2] Expressing the number of practicing males as a fraction of the entire Church population, including members outside of Mormon Country, was no doubt intended to generate a low-sounding figure.

Leonard Arrington and Davis Bitton estimated general or overall polygyny prevalence to be 5 percent of husbands and 12 percent of wives.[3] These estimates resulted from an effort to express the earlier claim of 2 percent in a more readily interpretable form. They were not based on actual marriage data. Subsequent data-based studies, some of which are cited in appendix A, suggested that Mormon polygyny prevalence was considerably higher than had been supposed. The fraction of Mormon males with more than one wife was estimated to fall between 13 and 33 percent, depending on the time and place. Estimates of the fraction of Mormon females in polygynous relationships ranged between 25 and 56 percent.

Polygyny is not unique to nineteenth-century Mormons. Of the 1,170 societies recorded in Murdock's Ethnographic Analysis, polygyny is present in 850, or about 73 percent of them.[4] Estimates of prevalence for the examples listed in appendix A range as high as 76 percent of husbands (in Ijebu, Nigeria in 1952) and 72 percent of wives (in Mosogat and Igueben, Nigeria, in 1977–78).[5]

In what follows, we use a simple demographic model to derive mathematical limits on polygyny prevalence. These limits provide benchmarks from which to assess whether polygyny prevalence in a given context is high or low compared to what is sustainable. If prevalence is high, the model may suggest where to look for reasons. Furthermore, where data are of low quality, the benchmarks provide a check on the reliability of the reported prevalence.[6]

Several theories of polygyny are available.[7] The analysis here is in the spirit of a statement by Eugene Hillman, a Catholic missionary who spent years among the Masai tribe in North Tanzania: "Polygyny is generally practiced only where there is a surplus of marriageable-age women in relation to marriageable-age men. . . . The major reason for a surplus of marriageable-age women, however, is the notable discrepancy in the chronological ages of men and women when they actually get married. Women marry relatively early in life, while men marry relatively late."[8]

Women's tendency to marry at younger ages than men means that, even if each age cohort exhibits the same number of males as females, there will be more females of marriageable age.[9]

The argument is illustrated in figures 1a and 1b. Figure 1a shows a hypothetical, perfectly symmetric population pyramid. The number of males in each age group is given by the length of the bar to the left of the center point (labeled zero), and the number of females of each age cohort is measured to the right. Each five-year cohort is about 15 percent larger than the prior cohort, reflecting population growth rates of about 3 percent per year. If people marry only within their cohorts, the ratio of marriageable men to marriageable women is one, and thus there is little room for polygyny.

If men delay marriage relative to women, however, the effect is similar to shifting the pyramid as in Figure 1b, where each male cohort is compared to the younger female cohort. The result is a ratio of about 115 marriageable-age females to 100 marriageable-age males, even though the overall number of females and males is the same.

The difference in marriageable ages has not been universally accepted as a proximate cause of polygyny. For example, Chojnacka argued that such reasoning reverses cause and effect.[10] However, the tendency of women to marry older men is observed in monogamous cultures as well, suggesting that polygyny does not cause (though it may exacerbate) the difference in marriageable ages.[11]

Given the difference in marriageable ages, population growth adds to the imbalance by increasing the size of the youngest cohorts of marriageable females. In this sense, polygyny is self-reinforcing: allowing more women to marry increases the growth rate and exacerbates the imbalance.[12]

Figure 1a

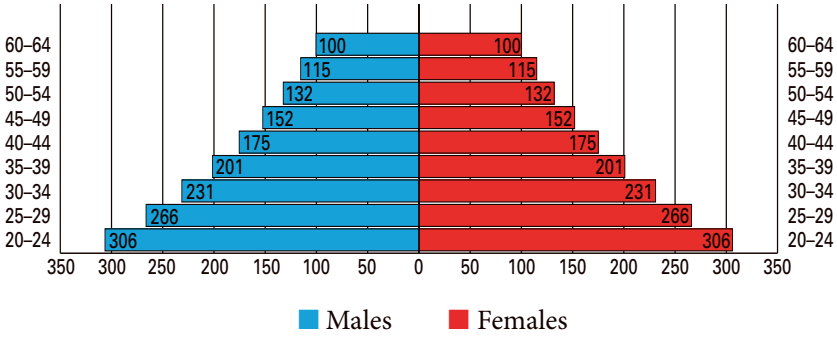
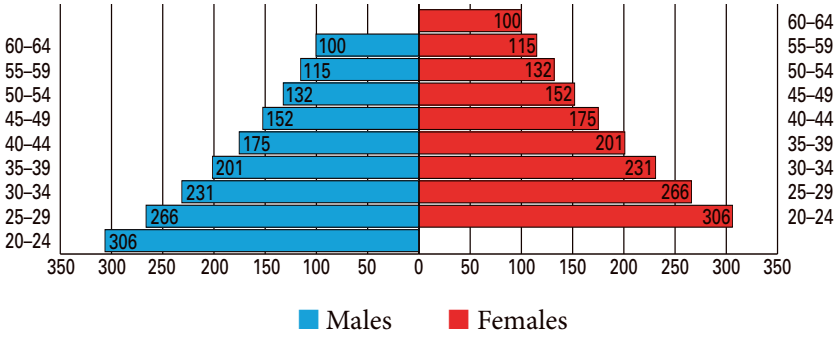


Figure 1b



Mortality also has an effect. Typically more males than females are born, but infant mortality is significantly higher among males. Furthermore, males die disproportionately in wars and occupational accidents. In some contexts, these effects are counterbalanced by female infanticide and adult mortality due to childbirth complications.

Migration can be a factor as well.[13] The analysis is complicated by temporary emigration, as when males of marriageable age leave for a period of years for employment, military service, or—as was common in nineteenth-century Mormondom—church assignment.

Our simple demographic model suggests that, given the parameters observed in nineteenth-century Utah, polygyny prevalence in excess of 15 to 20 percent of males and 25 to 30 percent of females is implausible. Of course, pockets of higher percentages, offset by lower percentages elsewhere, are possible. St. George was apparently one of those pockets.

The next section informally describes our definition of sustainable polygyny prevalence. We then explain the implications of sustainability for estimating demographic limits on polygyny prevalence. Finally, we apply the framework to nineteenth-century St. George, find that polygyny prevalence was above sustainable levels, and offer some conjectures on how the high prevalence might be explained.

Sustainable Polygyny Prevalence

A formal description of our simple demographic model is in appendix C. This section contains an informal discussion. We define sustainable polygyny prevalence to have two properties: (1) it must be mathematically consistent with the population growth it generates, and (2) it cannot exhibit an excessive number of unmarried males.

The first property rules out temporarily high prevalence. For example, a new colony settled by polygynous families with many wives would have high prevalence, but it would tend to revert to lower levels of polygyny rather quickly, constrained by the ratio of females to males born in subsequent cohorts. The original prevalence of polygyny in the colony could not persist without continued immigration of females or emigration of males.

The second property rules out levels of polygyny prevalence requiring large numbers of unmarried males. As a purely mathematical proposition, it is always possible for all marriageable females to live in polygyny: all the marriageable women could marry the same man or, more plausibly, each husband could marry two wives (with one husband marrying a trio of wives if the number of marriageable women is odd). If there are equal (and even) numbers of marriageable-age males and marriageable-age females,

then the latter approach exhibits 50 percent of men and 100 percent of husbands, women, and wives in polygynous marriages. However, this requires 50 percent of men to remain bachelors, which is not plausible. With this in mind, we require that sustainable polygyny prevalence be consistent with actual marriage rates, if they are available, or with all marriageable adults being married, if data on actual rates are not available.

The demographic limits derived below maximize polygyny prevalence subject to sustainability. They require that polygynous families have only two wives and that all widows and divorcees remarry. They almost certainly err on the side of being too large, so if observed prevalence exceeds these limits, then it is most likely a temporary phenomenon driven by specific historical circumstances.

Demographic Limits of Polygyny

To illustrate the limits of sustainable polgyny, suppose population grows at 3 percent annually and that women are five years younger when they first marry than men are. Then, ignoring all other factors, each marriageable female cohort will exhibit approximately 116 women for every 100 men in the male cohort that is five years older. The highest sustainable polygyny prevalence corresponds to 16 two-wife families and 84 one-wife families from each group of 100 marriageable men and 116 marriageable women. Thus, at most, 16 percent (16/100) of husbands are polygynists and approximately 28 percent (32/116) of wives are married to polygynists. Figure 2 exhibits the results of similar calculations for other growth rates and marriageable age differences.

It is interesting and instructive to compare these limits to observed polygyny prevalence where it is practiced. Estimates of polygyny prevalence for a variety of times and places appear in appendix A, where they are divided into four categories: (1) nineteenth-century Mormons,

Figure 2
Upper Bound on Polygyny Prevalence (Husbands, Wives)

	d=3	d=5	d=10	d=15
g=2%	(6%, 11%)	(10%, 19%)	(22%, 35%)	(35%, 51%)
g=3%	(9%, 17%)	(16%, 28%)	(34%, 51%)	(51%, 72%)

Notes: d is the difference in marriageable ages (in years) and *g* is the annual population growth rate. The percentage pairs list the maximum percentage of husbands and wives, respectively.

(2) sub-Saharan Africans, (3) North Africans/Middle Easterners, and (4) nineteenth-century Native Americans. For each category and each sex, figure 3 summarizes the distribution of polygyny prevalence across the cases recorded in appendix A. Thus, for example, the maximum prevalence recorded in appendix A for husbands in sub-Saharan African cultures is 76 percent (which comes from Ijebu in Nigeria in 1952), and the mean prevalence for husbands across the sub-Saharan cultures represented in appendix A is 35 percent. Under each percentage in figure 3 is the marriageable age difference necessary to generate the observed prevalence given a growth rate of 3 percent.

Taking the population growth rate as given has the virtue of simplicity. However, at the cost of more complexity and higher data requirements, more insights can be gained from explicitly modeling the determinants of population growth. Such a model is outlined in appendix C. It derives population growth rates from observed fertility, mortality, migration, and marriage patterns, thus taking into account the feedback effects of polygyny on population growth. Simple calculations generate the relative numbers of males, husbands, females, and wives who are alive in a given time period. These in turn determine the limits on sustainable polygyny prevalence given the underlying (age-specific) fertility, mortality, migration, and marriage patterns. In the next section, we apply the growth model to the case of the nineteenth-century Mormon settlement of St. George.

Nineteenth-Century St. George, Utah

This section relies heavily on Larry Logue's fine case study,[14] which provides reliable estimates of polygyny prevalence: 30 percent of husbands in 1870 and 33 percent of husbands in 1880. It also provides some of the parameter values required to compare observed polygyny prevalence with its theoretical limits. Other parameter values have been imported from elsewhere. The result is figure 4. The data used to construct figure 4 are in appendix B.

The first line of figure 4 reports the limits on prevalence consistent with the fertility (by age) of wives in monogamous households in St. George from 1861 to 1880, mortality (by age and sex) in St. George over the same time period, and marriage patterns in Cache Valley in 1880. The second and third lines differ from the first in their fertility data. The second row uses the fertility (by age) of wives in polygynous households in St. George. The third row uses natural fertility, defined as the expected fertility with no effort to control conception.[15] Figure 4 suggests that fertility in St. George, whether of wives in monogamous or polygynous households, was not different enough from natural fertility to affect the results.

Figure 3
Summary Statistics for Polygyny Estimates (See Appendix A)

		Mean	*Median*	*Max*	*Min*
Nineteenth-century Mormons	Husbands' Prevalence	21%	22%	33%	5%
	Implied Age Difference	7	7	10	2
	Wives' Prevalence	31%	27%	56%	12%
	Implied Age Difference	6	5	12	3
Sub-Saharan Africans	Husbands' Prevalence	35%	31%	76%	7%
	Implied Age Difference	11	10	20	3
	Wives' Prevalence	33%	34%	72%	4%
	Implied Age Difference	7	7	16	1
North Africans and Middle Easterners	Husbands' Prevalence	4%	4%	12%	2%
	Implied Age Difference	2	2	4	1
Nineteenth-century Native Americans	Husbands' Prevalence	12%	12%	24%	5%
	Implied Age Difference	4	4	8	8

Figure 4
Limits on Polygyny Prevalence

	Data Sources			**Prevalence**			
	Fertility	*Mortality*	*Marriage*	*Men*	*Hus-bands*	*Women*	*Wives*
1	SGm	SG	C	12%	15%	20%	26%
2	SGp	SG	C	12%	15%	21%	27%
3	N	SG	C	12%	15%	20%	27%
4	N	US 1900	C	24%	32%	37%	49%
5	N	SG	H1	15%	15%	25%	25%
6	N	SG	H2	24%	24%	39%	39%

Note: The abbreviations are: SGm (St. George monogamous), SGp (St. George polygamous), N (Natural fertility), C (Cache Valley), US 1900 (Historical Statistics of the United States). Finally, H1 and H2 assume all males over 25 and 20, respectively, and all females over 20 and 15, respectively, are married. Data used for the construction of this table are available in appendix B. Calculations were by MAPLE version 7.

Using natural fertility, mortality in St. George, and marriage patterns in Cache Valley as a baseline, the final three rows consider the effects of changing mortality or of changing marriage patterns, other things being equal.

Line 4 of figure 4 estimates the effects on the baseline of changing the mortality patterns from those of St. George 1861–1880 to those of the broader United States in 1900. The effects are substantial because St. George exhibited atypical mortality patterns for the time. First, the harshness of the environment made survival more difficult. Second, the mechanism by which settlers were chosen and the ways the settlers adapted to the hardships of the area were probably relatively more conducive to male than to female survival.[16] Table B2 in appendix B, which lists the mortality rates both for St. George in 1861–1880 and for the broader United States in 1900, confirms that male mortality was relatively low in St. George, reducing the imbalance between men and women. Thus, plausible polygyny prevalence is lower for St. George than it would be if mortality patterns had been more like those of the general United States.

The final two lines of figure 4, lines 5 and 6, explore more extreme marriage propensities. Line 5 assumes that all men over age twenty-five and all women over age twenty are married. Line 6 assumes that all men over age twenty and all women over age fifteen are married.[17] A higher marriage propensity of young women increases sustainable polygyny prevalence to a striking degree, both directly and indirectly through the increased population growth rate resulting from higher fertility.

Migration is another possible determinant of polygyny prevalence: if, for example, immigration is significantly skewed toward females, then greater polygyny prevalence would be possible. There is some evidence that immigration was balanced enough for such effects to be ignored. For example, William Mulder reported that of 19,017 British immigrants to Utah between 1841 and 1868, 47 percent were male, 47.5 percent were female, and the remainder were unspecified infants.[18] On the other hand, Kathryn Daynes's analysis of Manti demographics provides some evidence that the "relatively high number of plural marriages in the frontier period could not have occurred without the influx of immigrants from outside Utah."[19] The effect of migration may well have exacerbated the imbalance. The anti-Mormon cartoons of the late nineteenth century depicted large numbers of female converts immigrating to Utah, where they were taken into harems by cruel Mormon males. Allowing for exaggeration and stereotyping, there may have been some basis for this claim. It seems plausible that more than 50 percent of those converting to Mormonism (or most any other religion) were female. Unfortunately, due to data limitations, migration must be ignored.

Logue's direct estimates of the percentage of husbands in polygynous households in St. George are 30 percent in 1870 and 33 percent in 1880 and are thus much higher than the theoretical limits. In this case, the data are very reliable, suggesting that one should look for transitory factors to explain the unsustainably high polygyny prevalence. These are not hard to find for St. George, which was part of a general plan to occupy a large area of land by strategically colonizing it. St. George was one of the least desirable settlements due to its harsh desert climate. Those willing to accept an assignment to settle in St. George were very committed Mormons, and those who remained in St. George after having experienced such conditions firsthand were more committed still. Very committed Mormons were much more likely to practice polygyny than were others. So it is likely that the higher-than-sustainable prevalence reflected the composition of the incoming settlers and that polygyny would have declined over time as the settlement approached a demographic steady state, even in the absence of external pressure to abolish the practice.

Summary and Remarks

Women's tendency to marry older men, along with other factors, induces an imbalance in the marriage market. An understanding of this tendency can inform the analysis of marriage institutions, including those of monogamous cultures. Specifically, a substantial preponderance of marriageable women relative to marriageable men must result in at least one of the following three phenomena: (1) large numbers of never-married women, (2) large numbers of sometimes-married women, or (3) polygyny.

The practice in the modern industrialized world, where the third outcome is prohibited by law, is naturally a combination of the first and second outcomes. Tax incentives, changing mores, and broader opportunities for women have combined to create a significant number of marriageable women who remain single by choice. At the same time, high divorce rates allow high turnover in the marriage market, a practice sometimes referred to as serial polygamy. However, even when polygyny is both legally and socially acceptable, there are mathematical limits to its prevalence. Figures 2 and 3 suggest that, in the long run, polygyny by more than 20 percent of husbands and 30 percent of wives is on the high end of what is mathematically plausible, unless the difference in marriageable ages is very large.

Appendix A
Polygyny Prevalence Estimates for Various Times and Places

Estimates of Nineteenth-Century Mormon Polygyny Prevalence

Husbands
Blackhurst (1990):
Utah County, 1860, 15%
Utah County, 1870, 13%
Logue (1988):
St. George, 1870, 30%
St. George, 1880, 33%
Smith/Kunz (1976):
Men listed in Esshom (1913), *Pioneers and Prominent Men of Utah*, 28%

Wives
Blackhurst (1990):
Utah County, 1860, 29%
Utah County, 1870, 25%
Cornwall et al (1993):
Salt Lake City, 1860, 56%
Daynes (2001):
Manti, 1860, 44%.

Estimates of Sub-Saharan African Polygyny Prevalence

Husbands
Chojnacka (1980):
Uratta, Nigeria, 1977–78, 29%
Ika Clan, Nigeria, 1977–78, 33%
Mosogar & Igueben, 1977–78, 49%
Iwo, Nigeria, 1977–78, 30%
Kabba, Nigeria, 1977–78, 33%
Driesen (1972):
Abeokuta, Nigeria, 1952, 51%
Ijebu, Nigeria, 1952, 76%
Ibadan, Nigeria, 1952, 61%
Ife, Nigeria, 1952, 75%
Ilesha, Nigeria, 1952, 64%
Ondo, Nigeria, 1952, 68%
Ife Division, Nigeria, 1968, 53%
Ukaegbu (1977):
Ngwaland, 1974, 16%
Central Niger Delta, 1974, 23%
Dahomey (Benin), 1974, 31%
Niger, 1974, 22%
Zaire, 1974, 17%
Guinea, 1974, 38%
Sudan, 1974, 16%
Tanzania, 1974, 21%
Ngwa Igbo, Nigeria, 1974, 16%
Dorjahn (1958):
Kolifa Mayoso, Sierra Leone, 1955, 43%
Kolifa Mayoso, Sierra Leone, 1963, 40%
Kolifa Mayoso, Sierra Leone, 1976, 38%
Magburaka, Sierra Leone, 1963, 34%
Magburaka, Sierra Leone, 1976, 26%
Klomegah (1997):
Ghana, 1988, 32%
Verdon (1983):
Eweland, Ghana, 1971, 16%
Kuper (1975):
Botswana, 28%
Sween (1974):
Cameroon (Pahouin-Betis), 1962, .45%
Cameroon (Bamileke), 1962, 4%
Cameroon (Douala), 1962, 10%
Cameroon (Northerners), 1962, 10%

Wives
Chojnacka (1980):
Uratta, Nigeria, 1977–78, 50%
Ika Clan, Nigeria, 1977–78, 53%
Mosogar & Igueben, 1977–78, 72%
Iwo, Nigeria, 1977–78, 49%
Kabba, Nigeria, 1977–78, 54%
Olusanya (1971):
Ife, Nigeria, 1966–67, 33%
Oyo, Nigeria, 1966–67, 28%
Five rural areas, E. Nigeria, 1966–67, 43%
Ukaegbu (1977):
16 Ngwa Igbo villages, E. Nigeria, 1974, 34%

Wives *(cont.)*
Ware (1979):
Ibadan, Nigeria, 1973, 46%
Aborampah (1987):
Rural/Ibadan, W. Nigeria, 1974–75, 52%
Dorjahn (1958):
Kolifa Mayoso, Sierra Leone, 1955, 65%
Kolifa Mayoso, Sierra Leone, 1963, 61%
Kolifa Mayoso, Sierra Leone, 1976, 60%
Dorjahn (1958, 1988):
Magburaka, Sierra Leone, 1963, 55%
Magburaka, Sierra Leone, 1976, 44%
Klomegah (1997):
Ghana, 1988, 56%
Timaeus (1998):
Benin, 1977–82, 35%
Burkino Faso, 1990–93, 51%
Burundi, 1986–90, 12%
Cameroon, 1977–82, 40%
Cameroon, 1990–93, 39%
Central African Republic, 1993–96, 29%
Cote d'Ivoire, 1977–82, 41%
Cote d'Ivoire, 1993–96, 37%
Ghana, 1977–82, 34%
Ghana, 1986–90, 33%
Ghana, 1993–96, 28%
Guinea, 1993–96, 50%
Kenya, 1977–82, 30%
Kenya, 1986–90, 23%
Kenya, 1993–96, 20%
Lesotho, 1977–82, 9%
Liberia, 1986–90, 38%
Madagascar, 1990–93, 4%
Malawi, 1990–93, 32%
Mali, 1986–90, 45%
Mali, 1993–96, 44%
Namibia, 1990–93, 13%
Niger, 1990–93, 36%
Nigeria, 1977–82, 43%
Nigeria, 1990–93, 41%
Rwanda, 1977–82, 18%
Rwanda, 1990–93, 14%
Senegal, 1977–82 , 49%
Senegal, 1986–90, 47%
Senegal, 1990–93, 47%
Sudan (northern), 1977–82, 17%
Sudan (northern), 1986–90, 20%
Tanzania, 1990–93, 28%
Togo, 1986–90, 52%
Uganda, 1986–90, 34%
Uganda, 1993–96, 30%
Zambia, 1990–93, 18%
Zimbabwe, 1986–90, 16%
Zimbabwe, 1993–96, 19%
Ezeh (1997):
Central Kenya, 1977–78, 13%
Central Kenya, 1989, 8%
Central Kenya, 1993, 7%
Nairobi, Kenya, 1977–78, 22%
Nairobi, Kenya, 1989, 15%
Nairobi, Kenya, 1993, 11%
Eastern Kenya, 1977–78, 24%
Eastern Kenya, 1989, 20%
Eastern Kenya, 1993, 14%
Rift Valley, Kenya, 1977–78, 25%
Rift Valley, Kenya, 1989, 20%
Rift Valley, Kenya, 1993, 19%
Western Kenya, 1977–78, 38%
Western Kenya, 1989, 28%
Western Kenya, 1993, 26%
Coast Kenya, 1977–78, 32%
Coast Kenya 1989, 34%
Coast Kenya, 1993, 29%
Nyzana, Kenya, 1977–78, 42%
Nyzana, Kenya, 1989, 37%
Nyzana, Kenya, 1993, 26%
Mulder (1989):
Kipsigis of Kenya, 1982–83, 60%
Whiting (1993):
Loita Hills, Kenya, 1966–73, 61%
Itembe, Kenya, 1966–73, 45%
Oyugis, Kenya, 1966–73, 45%
Nyansongo, Kenya, 1966–73, 22%
Keumbu, Kenya, 1966–73, 33%
Kisa, Kenya, 1966–73, 23%
Kaliloni, Kenya, 1966–73, 15%
Ngecha, Kenya, 1966–73, 9%
Besteman (1995):
Somalia, 1987–88, 41%

Estimates of North African and Middle Eastern Polygyny Prevalence

Husbands
Chamie (1986):
Algeria, 1948, 3%
Algeria, 1954, 2%
Algeria, 1966, 2%
Bahrain (nationals), 1981, 5%
Egypt, 1947, 3%
Egypt, 1960, 4%
Iraq, 1957, 7%
Jordan (east bank), 1979, 4%
Kuwait (nationals), 1965, 7%
Kuwait (nationals), 1970, 9%
Kuwait (nationals), 1975, 12%
Lebanon, 1971, 4%
Libya, 1954, 3%
Libya, 1964, 3%
Libya, 1973, 3%
Morocco, 1952, 7%
Syria, 1960, 4%
Syria, 1970, 4%
Syria, 1976, 2%
Tunisia, 1946, 5%
United Arab Emirates, 1975, 6%
Yemen, 1975, 5%
Behar (1991):
Istanbul, Turkey, 1885, 3%
Istanbul, Turkey, 1926, 2%

Wives
Varea (1996):
Marrakech, Morocco, 9%

Estimates of Native American Polygyny Prevalence

Husbands
Nutini (1965):
San Bernardino Contla, Mexico, 1960–61, 9%
Hallowell (1938):
Berens River, 1875, 15%
Island Bands, 1875, 20%
Cross Lake, 1875, 20%
Berens River, 1876, 19%
Island Bands, 1876, 6%
Cross Lake, 1876, 24%
Berens Lake, 1877, 13%
Island Bands, 1877, 5%
Cross Lake, 1877, 16%
Berens River, 1878, 12%
Island Bands, 1878, 8%
Cross Lake, 1878, 12%
Berens River, 1879, 12%
Island Bands, 1879, 7%
Cross Lake, 1879, 9%
Berens River, 1880, 11%
Island Bands, 1880, 7%
Cross Lake, 1880, 9%
Berens River, 1881, 12%
Island Bands, 1881, 7%
Cross Lake, 1881, 5%
Moore (1991):
Cheyenne Indians, Great Plains, 1880, 17%
Hern (1992):
Shipibo of Peru, 1983–84, 9%

Wives
Hern (1992):
Shipibo of Peru, 1983–84, 10%

Sources for Studies Cited in Appendix A

Aborampah, Osei-Mensah. "Plural Marriage and Fertility Differentials: A Study of the Yoruba of Western Nigeria." *Human Organization* 46 (1987): 29–38.

Behar, Cem. "Polygyny in Istanbul, 1885–1926." *Middle Eastern Studies* 27 (1991): 477–86.

Besteman, Catherine. "Polygyny, Women's Land Tenure, and the 'Mother-Son Partnership' in Southern Somalia." *Journal of Anthropological Research* 51 (1995): 193–213.

Blackhurst, Wallace Gardner. "Wealth, Polygamy, and Fertility in a Polygamous Society." PhD dissertation, University of Chicago, 1990.

Chamie, Joseph. "Polygyny among Arabs." *Population Studies* 40 (1986): 55–66.

Chojnacka, Helena. "Polygyny and the Rate of Population Growth." *Population Studies* 34 (1980): 91–107.

Cornwall, Marie, Camela Courtright, and Laga Van Beek. "How Common the Principle? Women as Plural Wives in 1860." *Dialogue: A Journal of Mormon Thought* 26 (1993): 139–53.

Daynes, Kathryn M. *More Wives Than One: Transformation of the Mormon Marriage System, 1840–1910.* University of Illinois Press, 2001.

Dorjahn, Vernon R. "Fertility, Polygyny, and Their Interrelations in Temne Society." *American Anthropologist* 60 (1958): 838–59.

———. "Changes in Temne Polygyny." *Ethnology* 27 (1988): 367–90.

Driesen, I. H. Vanden. "Some Observations on the Family Unit, Religion, and the Practice of Polygyny in the Ife Division of Western Nigeria." *Africa* 42 (1972): 44–56.

Esshom, Frank. *Pioneers and Prominent Men of Utah, Comprising Photographs, Genealogies, Biographies: The Early History of the Church of Jesus Christ of Latter-day Saints.* Salt Lake City: Utah Pioneers Book, 1913.

Ezeh, Alex Chika. "Polygyny and Reproductive Behavior in Sub-Saharan Africa: A Contextual Analysis." *Demography* 34 (1997): 355–68.

Hallowell, A. Irving. "The Incidence, Character, and Decline of Polygyny among the Lake Winnipe Cree and Salteaux." *American Anthropologist* 40 (1938): 235–56.

Hern, Warren M. "Polygyny and Fertility among the Shipibo of the Peruvian Amazon." *Population Studies* 46 (1992): 53–64.

Klomegah, Roger. "Socio-Economic Characteristics of Ghanaian Women in Polygynous Marriages." *Journal of Comparative Family Studies* 28 (1997): 73–88.

Kuper, Adam. "Preferential Marriage and Polygyny among the Tswana." In *Studies in African Social Anthropology,* ed. Meyer Fortes and Sheila Patterson. London: Academic Press, 1975.

Logue, Larry. *A Sermon in the Desert.* Urbana: University of Illinois Press, 1988.

Moore, John H. "The Developmental Cycle of Cheyenne Polygyny." *American Indian Quarterly* 15 (1991): 311–26.

Mulder, Monique Borgerhoff. "Marital Status and Reproductive Performance in Kipsigis Women: Re-evaluating the Polygyny-Fertility Hypothesis." *Population Studies* 43 (1989): 285–304.

Nutini, Hugo G. "Polygyny in a Tlaxcalan Community." *Ethnology* 4 (1965): 123–47.

Olusanya, P. O. "The Problem of Multiple Causation in Population Analysis, with Particular Reference to the Polygamy-Fertility Hypothesis." *Sociological Review* 19 (1971): 165–78.

Smith, James E., and Phillip R. Kunz. "Polygyny and Fertility in Nineteenth-Century America." *Population Studies* 30 (1976): 465–80.

Sween, Joyce, and Remi Clignet. "Type of Marriage and Residential Choices in an African City." *Journal of Marriage and the Family* 36 (1974): 780–93.

Timaeus, Ian M., and Angela Reyner. "Polygynists and Their Wives in Sub-Saharan Africa: An Analysis of Five Demographic and Health Surveys." *Population Studies* 52 (1998): 145–62.

Ukaegbu, Alfred O. "Fertility of Women in Polygynous Unions in Rural Eastern Nigeria." *Journal of Marriage and the Family* 39 (1977): 397–404.

Varea, C., E. Crognier, D. Bley, G. Boetsch, A. Baali, and M. K. Hilali. "Polygyny and Fertility in Morocco: The Effect of Marital Instability." *Human Evolution* 11 (1996): 1–10.

Verdon, Michel. "Polygny, Descent, and Local Fission: A Comparative Hypothesis." *Journal of Comparative Family Studies* 14 (1983): 1–22.

Ware, Helen. "Polygyny: Women's Views in a Transitional Society, Nigeria 1975." *Journal of Marriage and the Family* 41 (1979): 185–95.

Whiting, John W. M. "The Effect of Polygyny on Sex Ratio at Birth." *American Anthropolgist* 95 (1993): 435–42.

Appendix B: Data

Table B1 exhibits the age-specific fertility rates used in the construction of figure 4. The first two lines are Larry Logue's estimates for wives in monogamous and polygynous households, respectively, for St. George, Utah, during 1861–80.[20] These estimates can be compared to natural fertility rates—that is, fertility in the absence of attempts to limit fertility—calculated by Coale and Trussell.[21] Natural fertility is not defined for the 15–19 age group, so, somewhat arbitrarily, it has been set to the corresponding St. George birth rate, as marked with an asterisk.

Table B1: Age-Specific Birth Rates (Births Per Woman-Year)

	15–19	*20–24*	*25–29*	*30–34*	*35–39*	*40–44*	*45–49*
St. George (m)	.445	.415	.371	.407	.339	.169	.019
St. George (p)	.482	.435	.399	.361	.326	.198	.029
Natural Fertility	.482*	.460	.431	.395	.322	.167	.024

Table B2: Age- and-Sex-Specific Mortality (Probability of dying during age interval conditional on having reached it.)

	St. George 1861–1880[22]		**US 1900**[23]	
Age	*men*	*women*	*men*	*women*
0–4	.290	.277	.244	.209
5–9	.033	.036	.019	.019
10–14	.016	.019	.019	.019
15–19	.016	.019	.029	.029
20–24	.009	.040	.029	.029
25–29	.009	.040	.040	.040
30–34	.038	.034	.040	.040
35–39	.038	.034	.052	.048
40–44	.031	.059	.052	.048
45–49	.031	.059	.076	.069
50–54	.059	.091	.076	.069
55–59	.059	.091	.135	.123
60–64	.059	.044	.135	.123
65–69	.059	.044	.263	.241
70–74	.218	.106	.263	.241
75–79	.218	.106	.497	.469
80–85	1.000	1.000	1.000*	1.000*

The two estimates of mortality reported in table B2 are Larry Logue's estimates for St. George from 1861 to 1880,[24] and the estimates for the United States in 1900 are from the Historical Statistics of the United States.[25] To make the age groups consistent across sources, the U.S. mortality estimates for the 80- to 85-year-old group are rounded to one, marked with an asterisk. Older age groups are ignored. This inaccuracy is of inconsequential magnitude, since the older age groups are small and contribute negligibly to fertility.

The marriage data in table B3 are from Hatch.[26] Unfortunately, Hatch reports marriage data only for the ages 20–49, so some extrapolation is required to construct the missing age groups. We assume the percentage of 15- to 19-year-olds married is half of the percentage of 20- to 24-year-olds married, and that the same percentage of individuals over 49 are married as for people of ages 45–49. These extrapolated entries are marked by asterisks in table B3.

Table B3: Percent Married, Cache Valley, 1880

Age	*Men*	*Women*
15–19	16.3*	38.0*
20–24	32.6	76.0
25–29	77.9	88.7
30–34	87.8	94.8
35–39	93.9	96.0
40–44	96.8	92.7
45–49	94.1	88.3
50+	94.1*	88.3*

Finally, we assume that the fractions of male and female births were similar in nineteenth-century Mormondom to those in the United States in 1998: 51.2 percent and 48.8 percent, respectively.[27]

Appendix C
A Simple Model of Population Growth

Let $d_{f\alpha}$ be the fraction of age α females who die, let $i_{f\alpha}$ be immigration of age α females as a percentage of the age α female population, and let $m_{f\alpha}$ be the fraction of age α females who are married. (Similar variables for males substitute m for f.) Normalize the size of the newly born cohort to one, let φ be the fraction of female newborns, and let b_α be the fertility rate for wives of age α.

Let $\{N_m^t, N_h^t, N_f^t, N_w^t\}$ be the numbers of men, husbands, women, and wives, respectively, at time *t*. A stationary (or steady-state) population path is a sequence $\{N_m^t, N_h^t, N_f^t, N_w^t\}_{t=1}^{\infty}$ such that

$$\{N_m^{t+1}, N_h^{t+1}, N_f^{t+1}, N_w^{t+1}\} = \{(1+g)N_m^t, (1+g)N_h^t, (1+g)N_f^t, (1+g)N_w^t\}$$

for *g* satisfying

$$1 = \Sigma_\alpha \varphi (1+g)^{-\alpha} s_{f\alpha} m_{f\alpha} b_\alpha$$

where $s_{f\alpha} = \Pi_\alpha(1 - d_{f\alpha} + i_{f\alpha})$. Now define $N_m = \Sigma_\alpha(1-\varphi)(1+g)^{-\alpha}s_{m\alpha}$, $N_h = \Sigma_\alpha(1-\varphi)(1+g)^{-\alpha}s_{m\alpha}m_{m\alpha}$, $N_f = \Sigma_\alpha\varphi(1+g)^{-\alpha}s_{fm}$, and $N_w = \Sigma_\alpha\varphi(1+g)^{-\alpha}s_{f\alpha}m_{f\alpha}$.

Polygyny prevalence is defined to be sustainable if it does not exceed $(N_w - N_h)/N_m$, $(N_w - N_h)/N_h$, $2(N_w - N_h)/N_f$, and $2(N_w - N_h)/N_w$, for men, husbands, women, and wives, respectively.

Davis Bitton was Professor Emeritus of History at the University of Utah at the time of his death in 2007. His PhD was from Princeton University, where his specialty was the French Renaissance. He was a founding member of the Mormon History Association and served as its president in 1971–72, and from 1972 to 1982 he was the Assistant Church Historian for The Church of Jesus Christ of Latter-day Saints. His research in Mormon history is broad and well known. Among his award-winning works are *George Q. Cannon: A Biography* (1999) and, with Leonard Arrington, *The Mormon Experience: A History of the Latter-day Saints* (1979).

Val Lambson (who can be contacted via email at byustudies@byu.edu) is Professor of Economics at Brigham Young University. His PhD is from the University of Rochester. He has published in the *American Economic Review*, the *Journal of Economic Theory*, and the *Review of Economic Studies*, among others, and most recently in the *Review of Economics and Statistics*. Although his research is almost exclusively in economic theory, he enjoys interacting with historians and geographers on occasion.

Val Lambson is grateful to his late uncle and coauthor, Davis Bitton, both for his collaboration on this research and for his example of a faithful scholar's life well lived. This paper has benefitted from discussions with Ben Bennion, Lee Bean, Matthew Butler, Richard Butler, Scott Condie, Kathryn Daynes, Sally Gordon, Charles

Hatch, Tim Heaton, Richard Jensen, Lars Lefgren, Larry Logue, Grant McQueen, Brennan Platt, Norman Thurston, and Dan Westesen. Kristen Glenn and Ty Turley contributed able research assistance. Early financial support from the Joseph Fielding Smith Institute for Latter-day Saint History is gratefully acknowledged.

1. Prior research includes Lowell "Ben" Bennion, "The Incidence of Mormon Polygamy in 1880: 'Dixie' versus Davis Stake," *Journal of Mormon History* 11 (1984): 27–42; Davis Bitton, "Mormon Polygamy: A Review Article," *Journal of Mormon History* 4 (1977): 101–18; Melvyn Hammarberg, "A Sampling Design for Mormon Utah, 1880," *Journal of Interdisciplinary History* 7, no. 3 (1977): 453–76; Stanley S. Ivins, "Notes on Mormon Polygamy," *Western Humanities Review* 10, no. 3 (1956): 229–39; Patricia Lyn Scott and Maureen Ursenbach Beecher, "Mormon Women: A Bibliography in Progress, 1977–1985," *Journal of Mormon History* 12 (1985): 113–39; and Patricia Lyn Scott, "Mormon Polygamy: Bibliography 1977–1992," *Journal of Mormon History* 19 (1993): 133–55. See also the appropriate entries in James B. Allen, Ronald W. Walker, and David J. Whittaker, *Studies in Mormon History, 1830–1997: An Indexed Bibliography* (Urbana: University of Illinois Press, 2000). ^

2. "Epistle of the First Presidency, April 4, 1885," in *Messages of the First Presidency,* comp. James R. Clark, 6 vols. (Salt Lake City: Bookcraft, 1965–75), 3:11. ^

3. Leonard J. Arrington and Davis Bitton, *The Mormon Experience: A History of the Latter-day Saints* (New York: Knopf, 1979), 199. ^

4. See Theodore C. Bergstrom, "On the Economics of Polygyny," manuscript, 1994, available at http://www.econ.ucsb.edu/~tedb/Evolution/polygyny3.pdf; and John Hartung, "Polygyny and Inheritance of Wealth," *Current Anthropology* 23 (1982): 1–12. ^

5. See appendix A. By contrast, examples of polyandry are rare and the classification is debatable. See Melvyn Goldstein, "Stratification, Polyandry, and Family Structure in Central Tibet," *Southwestern Journal of Anthropology* 27 (1971): 64–74; Gerald D. Berreman, "Himalayan Polyandry and the Domestic Cycle," *American Ethnologist* 2 (1975): 127–38; and Cynthia M. Beall and Melvyn C. Goldstein, "Tibetan Fraternal Polyandry: A Test of Sociobiological Theory," *American Anthropologist* 83 (1981): 5–12. ^

6. The practice of using available data and a theoretical model to infer values of unavailable or unreliable data is well established. See Carole Popoff and D. H. Judson, "Some Methods of Estimation for Statistically Underdeveloped Areas," in *The Methods and Materials of Demography,* ed. Jacob S. Siegel and David A. Swanson, 2d ed. (New York: Elsevier Academic Press, 2004), 603–41. ^

7. See, for example, H. Chojnacka, "Polygyny and the Rate of Population Growth," *Population Studies* 34 (1980): 91–107; Gary S. Becker, *A Treatise on the Family* (Cambridge: Harvard University Press, 1981), 38–65; John H. Bushnell and Donna D. Bushnell, "Sociocultural and Psychodynamic Correlates of Polygyny in a Highland Mexican Village," *Ethnology* 10 (1971): 44–55; Steven F. Faux and Harold L. Miller Jr., "Evolutionary Speculations on the Oligarchic Development of Mormon Polygamy," *Ethology and Sociobiology* 5, no. 1 (1984): 15–31; Linda Mealey, "The Relationship between Social Status and Biological Success: A Case Study of the Mormon Religious Hierarchy," *Ethology and Sociobiology* 6, no. 4 (1985): 249–57; and Michèle Tertilt, "Polygyny, Fertility, and Savings," *Journal of Political Economy* 113 (2005): 1341–71. ^

8. Eugene Hillman, "Polygyny Reconsidered," in *The Renewal of Preaching: Theory and Practice,* ed. Karl Rahner, vol. 33 of Theology in the Age of Renewal: Pastoral Theology (Glen Rock, N.J.: Concilium, 1968), 176. ^

9. Kathryn M. Daynes, "Single Men in Polygamous Society: Male Marriage Patterns in Manti, Utah," *Journal of Mormon History* 24 (1998): 109, makes a similar argument. ^

10. Chojnacka, "Polygyny and the Rate of Population Growth," 105, also asserted that "polygyny could not be practised indefinitely unless the proportion of polygynous unions varies on a cyclical basis." This conjecture is contradicted by the analysis below. ^

11. The tendency is arguably genetic. See David M. Buss and Michael F. Barnes, "Preferences in Human Mate Selection," *Journal of Personality and Social Psychology*, 50 (1986): 559–70, and Donald Symons, *The Evolution of Human Sexuality* (New York: Oxford University Press, 1979). ^

12. This assumes that wives in polygynous households do not have significantly lower fertility than wives in monogamous marriages. This assumption is defensible: for example, Chojnacka, "Polygyny and the Rate of Population Growth," 93, asserted that "the results [of demographic studies] have invariably shown insignificant variation in fertility." See also Lee L. Bean and Geraldine P. Mineau, "The Polygyny-Fertility Hypothesis: A Re-evaluation," *Population Studies*, 40, no. 1 (1986): 67–81; Lee L. Bean, Geraldine P. Mineau, and Douglas L. Anderton, *Fertility Change on the American Frontier* (Berkeley and Los Angeles: University of California Press, 1990); F. Nii-Amoo Dodoo, "Marriage Type and Reproductive Decisions: A Comparative Study in Sub-Saharan Africa," *Journal of Marriage and the Family* 60 (1988): 232–42; and H. V. Muhsam, "Fertility of Polygamous Marriages," *Population Studies* 10 (1957): 3–16. ^

13. As with the age of marriageability, the direction of causality is not obvious: a polygynous society could cause emigration of males who are unable to find wives at home. ^

14. Larry M. Logue, *A Sermon in the Desert: Belief and Behavior in Early St. George, Utah* (Urbana: University of Illinois Press, 1988). ^

15. Ansley J. Coale and T. James Trussel, "Model Fertility Schedules: Variations in the Age Structure of Childbearing in Human Populations," *Population Index* 40, no. 2 (1974): 185–258, quoted by Logue, *Sermon in the Desert,* 73. ^

16. See Logue, *Sermon in the Desert,* 97–101. ^

17. Although this may seem extreme, it appears to be appropriate for Manti, Utah, in 1860. See Kathryn M. Daynes, *More Wives Than One: Transformation of the Mormon Marriage System, 1840–1910* (Urbana: University of Illinois Press, 2001), 108–9. ^

18. William Mulder, *Homeward to Zion: The Mormon Migration from Scandinavia* (Minneapolis: University of Minnesota Press, 1957), 108–9, quoted in Daynes, *More Wives Than One*, 261 n. 33. ^

19. Daynes, *More Wives Than One,* 114. ^

20. Logue, *Sermon in the Desert,* 74, 77. ^

21. Coale and Trussel, "Model Fertility Schedules," 185–258, cited in Logue, *Sermon in the Desert,* 73. ^

22. Logue's ten-year probabilities were converted to five-year probabilities (assuming a constant death rate over the ten-year interval) by solving $r_5 + (1 - r_5)r_5 = r_{10}$ where rt is the probability of dying during the t-year interval if one is alive at the start of it. ^

23. The probability of death is $r + r(1 - r)^1 + r(1 - r)^2 + r(1 - r)^3 + r(1 - r)^4$ for a five-year period with constant annual death rate, *r*. The source reports deaths per thousand for individuals in an age cohort during the year 1900. ^

24. Logue, *Sermon in the Desert,* 94. ^

25. U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition, Part 1, 61–62. ^

26. Charles M. Hatch, "Land, Inheritance, and Family in the Formation of Mormon Towns: Tables, Figures, and Maps," mimeo, 1982, copy in author's possession. ^

27. See National Center for Health Statistics, National Vital Statistics Reports, vol. 48, no. 3, available at http://www.cdc.gov/nchs/products/nvsr.htm#vol48. ^