

Marital Infertility and Primary Sterility in a Native Pacific Islands Population

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Abstract—Analyses of reproductive histories from a family record register for 5,193 Chamorro women living in 1897 indicate that less than 7.5 percent of premenopausal married women at risk failed to produce offspring by 1942. Since up to one-third of all Chamorro females died before reaching an age of reproductive maturity and even more would never marry, population growth was only made possible by high levels of fertility in extramarital relationships and among married women who produced an average of nearly 8 children each during their reproductive lifespans. Socio-cultural patterns surrounding marital and sexual practices played an important part in reducing effective population size to such a limited number of ancestors of the modern Chamorro population.

Introduction

The failure by some members of a potential breeding population to produce any offspring reduces effective population size (N_e) and significantly affects levels of variance in the fertility component (I_r) of Crow's Index of the opportunity for natural selection. Because of limited reliable data and of inherent difficulties in determining among many of possible causes, relatively little attention has been given to extending our understanding of the role of infertility in microevolutionary processes. By focusing here on a non-Western population, the native Chamorro population of the island of Guam, this paper contributes to a scant body of available information relating to the extent, nature and possible causes of infertility and infecundity among non-Western, historical populations.

Historical demographers usually have dealt with reproductive histories of Euro-American women not practicing modern methods of birth control and assumed "at risk" to coital exposure in first marriages. These constraints may underestimate completed fertility (Menken *et al.* 1986) and, in any case, may fail to even greater degree in approximating prevailing sexual and marital practices in non-Western societies. Accordingly, the materials presented here are examined, first, with similar restrictions for purposes of comparability, but also in a less constricted manner in order to seek a more specific understanding of female infertility patterns in this native population.

This study shares with other investigations the difficulties of inferring sterility or infecundity, ". . . the physiological incapacity to produce a live birth" (Bongaarts & Potter 1983: 41), from actual reproductive performance, or fertility, data. The nature of these historical data effectively precludes, for example, distinguishing infertile and apparently sterile women who may have experienced conceptions which did not result in live births because of fetal rather than maternal abnormalities. In like fashion, it is doubtful that any historical population failed to practice some form of contraception or induced abortion, albeit the effectiveness of whatever methods employed was less successful in so-called

Table 1. Native population of Guam, 1897: age and sex distribution

Date of Birth	Males		Females		Total		Sex Ratio
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	
1987-93	746	7.64	781	7.99	1,527	15.63	95.5
1982-88	656	6.71	620	6.35	1,276	13.06	105.8
1887-83	487	4.99	548	5.61	1,035	10.59	88.9
1882-78	455	4.66	541	5.54	996	10.20	84.1
1877-73	476	4.87	563	5.76	1,039	10.64	84.5
1872-68	423	4.33	494	5.06	917	9.39	85.6
1867-63	337	3.45	390	3.99	727	7.44	86.4
1862-58	226	2.31	246	2.52	472	4.83	91.9
1857-53	139	1.42	169	1.73	308	3.15	82.2
1852-48	137	1.40	211	2.16	348	3.56	64.9
1847-43	123	1.26	208	2.13	331	3.39	59.1
1842-38	116	1.19	164	1.68	280	2.87	70.7
1837-33	116	1.19	130	1.33	246	2.52	89.2
1832-28	79	0.81	68	0.70	147	1.51	116.2
1827-23	43	0.44	37	0.38	80	0.82	116.2
1822-18	9	0.09	10	0.10	19	0.19	90.2
1817-13	7	0.07	8	0.08	15	0.15	87.5
<1813	1	0.01	5	0.05	6	0.06	20.0
Total	4,576	46.84	5,193	53.16	9,769	100.00	88.1
Unknown date of Birth	197		267		464		73.8
Grand Total	4,773		5,460		10,233		87.4

“natural fertility” populations than among most modern groups. In consequence of these and related shortcomings, the findings here, as in comparable studies, necessarily overestimate sterility and infecundity levels.

Materials and Background

The materials used in this study consist of (1) a linked family register developed from the Spanish census of all residents of Guam alive on December 31, 1897; and (2) births, deaths and marriages recorded between October 1901 and December 1941 under the auspices of the United States Navy administration. I have augmented these materials with ethnographic information and sources derived from restricted private records. The computerized data register has been extended by extrapolating from vital registrations to reconstruct missing materials. For example, unrecorded birth dates have been determined in some cases, from marriage and/or death records, particularly for those born or dying from 1898 to the latter quarter of 1901. I estimate that the total register, from which individuals without at least one identified native parent have been excluded, is more than 90 percent complete. It does, however, lack full information about most individuals who were born and also died or those who expired during the period January 1, 1898–October 1901. The register also lacks complete data for those relatively few natives who emigrated permanently from Guam during this period.

At least 30,000 natives lived on Guam, the largest island in the Marianas Islands chain in the northwest Pacific, at the time of first Spanish contact in 1521. Spanish efforts at missionization and colonization began in 1668 and caused the population to decrease, reaching its nadir in the latter half of the 1700s when less than 2,000 natives were recorded (Underwood 1973). In the ensuing years, immigrants from the nearby Caroline Islands, from the Philippine Islands, and a lesser number of expatriates from various European countries and the United States, as well as migrants from Japan and China, settled on the island, some intermarrying with native women. By 1856, the population numbered over 9,500, of which nearly half died during the smallpox epidemic of that year. By 1897, the remaining survivors of the epidemic and their descendants, augmented by perhaps a hundred more recent immigrants, surpassed the numbers reported for 1856, with 10,233 natives residing on Guam at the time of the Spanish census of December 1897 (Table 1).

Results and Discussion

Of 5,193 females with known birthdate alive in December 1897, 5,156 survived to the age of 15 years or older, and of this latter number at least 72.5 percent (3,738) were exposed at some time before 1942 to the risk of becoming pregnant (Table 2). Less than 10 percent of this at-risk group (352) failed to produce at least one child, and even this number is inflated by the incomplete reproductive records of older cohorts for whom some offspring borne and dying before 1897 were not recorded. Nearly 22 percent (818) of ever-fertile women produced children outside of recognized unions.

Because of the incompleteness of some of these reproductive histories, particularly for older cohorts, and a total lack of information about date of marriages(s) for older

Table 2. Fertility and infertility patterns of native Guamanian women alive in 1897, by date of birth

Date of Birth	(a) No. Alive in 1897	(b) No. Dying before age 15 years	(c)* Maximum No. Surviving to age 15 yrs. or older	(d) No. Never- Married, Never Fertile Women	(e) No. of Potential "at risk" Women (c - d)	(f) No. of Never Married Fertile Women	(g)** No. of Ever- Married Fertile Women	No. of Fertile Women (f + g)	No. of Ever- Married, Never Fertile Women
1813	5		5	2	3	—	2	2	1
1813-17	8		8	7	1	—	1	1	—
1818-22	10		10	9	1	—	1	1	—
1823-27	37		37	16	21	5	7	12	9
1828-32	68		68	26	42	5	30	35	7
1833-37	130		130	38	92	12	61	73	19
1838-42	164		164	40	124	21	88	109	15
1843-47	208		208	49	159	22	114	136	23
1848-52	211		211	49	162	27	115	142	20
1853-57	169		169	34	135	23	97	120	15
1858-62	246		246	60	186	20	145	165	21
1863-67	390		390	68	322	44	241	285	37
1868-72	494		494	92	402	48	320	368	34
1873-77	563		563	136	427	50	346	396	31
1878-82	541		541	159	382	37	310	347	35
1883-87	548		548	150	398	36	335	371	27
1888-92	620	12	608	179	429	46	360	406	23
1893-97	781	25	756	304	452	35	382	417	35

* Includes an unknown number of individuals dying during the inter-regnum period, 1898-1901.

** Includes 234 women bearing children before entering a fertile union and 153 widows bearing children out of wedlock.

women, the records of 4,176 women formally wed between 1901 and 1941 were then examined (Table 3). Overall, 771 of these marriages produced no offspring, but 63 of these childless unions were prematurely interrupted by spousal death, 107 marriages took place less than two years before the end of the reporting period, and 81 infertile unions involved women who were 45 years of age or older at marriage and were either menopausal or presumably experiencing premenopausal declines in fecundity. In order to focus more clearly on identifying primary sterility and estimating infecundity levels, I then analyzed the records of women with known birthdates who had entered into first marriages (Table 4).

Of the 3,917 women with known birthdate, 3,341 (85.3 percent) entered a first marriage with a previously unwed husband. Among the latter women, 87 percent (2,893) had borne one or more children by the end of the reporting period. Of those 448 women recorded as in infertile unions (Table 5), 46 had entered into marriages terminated by the death of one or both spouses within two years of the date of marriage, the time period within which 91.3 percent of fertile couples had produced at least one child. An additional 20 infertile marriages took place after the wife had passed her 45th birthday, and 76 marriages were contracted less than two years before the end of the reporting period. Of the remaining 306 women in infertile unions, 67 had borne or would bear by 1941 at least one child outside of marriage or in a subsequent formal or consensual union. In other words, 239, or 7.2 percent of 3,341 first-married women of all ages can be estimated as the total of effectively sterile, or estimated infecund, women in this sample.

Despite somewhat different methodologies among these studies, a comparison of the results of the appropriate segments of this investigation with those reported from studies made in historical Euroamerican societies reveals a shared trend of increase in proportions of infertile unions with age at marriage, with, however, a significant difference noted for older cohorts (Table 6). Elsewhere (Underwood, in preparation), I argue that this difference primarily reflects differences in coital practices, with high levels of sexual activity continuing into relatively advanced ages among Chamorros.

I have also attempted to uncover in this investigation a proximate estimate of the proportion of sterile and of infecund women and not merely an estimate of the proportions of infertile unions. As indicated, only 6.1 percent (239/3917) of Chamorro women at risk, married and remaining wed for at least two years between 1901 and 1941, had failed to produce offspring during this period. Further, of all 1,279 women born between 1883 and 1897 and known to be at risk—those for whom reproductive histories were essentially complete by 1941—only 85, or 6.6 percent, had never produced offspring.

Since an appreciable part, at least 22 percent, of female Chamorro fertility resulted from extramarital sexual activity and nearly one-third of all first births to married couples occurred within less than nine months after date of marriage, the prevailing level of extramarital sexual unions was evidently high. The primary ethnographic source (Thompson 1941), on the other hand, emphasized the strength of cultural values surrounding a virginity cult and of behavioral practices intended to prevent premarital sexual liaisons. I can only surmise from this apparent contradiction that if the fecundity level of females engaged in extramarital activities was at least as high as that of their formally-wed cohorts, some 93 to 94 percent of never-married, never-fertile women were likely never exposed or at risk of impregnation.

Table 3. All Guamanian marriages by wife's date of birth (WDOB), Guam 1901–1941

WDOB	Age Group at DOM for Birth Cohorts							No DOB	Total
	< 20	20–24	25–29	30–34	35–39	40–44	45 +		
<1860						2	22		24
1860–64					1	16	11		28
1865–69				3	15	19	9		46
1870–74			11	36	35	15	10		107
1875–79		19	66	49	11	14	13		172
1880–84	16	115	82	36	29	10	11		299
1885–89	100	130	50	26	5	10	10		331
1890–94	150	164	91	26	13	3	7		454
1895–99	180	170	34	34	28	6			452
1900–04	140	192	92	63	25	1			513
1905–09	97	169	114	57	4				441
1910–14	170	250	84	4					508
1915–19	186	225	19						430
1920–24	85	26							111
>1924	1								1
Total known									
DOB	1125	1460	643	334	166	96	93		3917
%	28.7	37.3	16.4	8.5	4.2	2.5	2.4		100.0
Grand Total	1125	1460	643	334	166	96	93	259	4176
%	26.9	35.0	15.4	8.0	4.0	2.3	2.2	6.2	100.0

Mean age at date of marriage = 24.0 years.

Table 4. Fertile first marriages by wife's date of birth and age at marriage, Guam 1901–1941

WDOB Year	Wife's Age Group at Date of Marriage							UNK	Total
	< 20	20–24	25–29	30–34	35–39	40–44	45 +		
< 1860							1		1
1860–64									
1865–69				1	3	2	1		7
1870–74			4	16	13	2			35
1875–79		13	42	25	1	2			83
1880–84	15	92	58	23	8		1		197
1885–89	89	113	38	15	3	2	1		261
1890–94	151	146	64	12	4	1			378
1895–99	161	137	22	17	5	1			343
1900–04	127	171	62	27	4				391
1905–09	100	166	72	22	1				361
1910–14	152	213	54	5					424
1915–19	162	174	3						339
1920–24	60	12							72
> 1924	1								1
Totals	1018	1237	419	163	42	10	4		2893
Unknown DOB								141	3034

Mean age at marriage = 21.9 years.

Table 5. Non-fertile first marriages by wife's date of birth and age at marriage, Guam 1901–1941

WDOB Year	Wife's Age Group at Date of Marriage							UNK	Total
	<20	20–24	25–29	30–34	35–39	40–44	45+		
<1860							2		2
1860–64						3	3		6
1865–69				2	4	7			13
1870–74			3	2	7	7	3		22
1875–79		3	8	5	3	6	5		30
1880–84	3	8	8	6	5	2	1		33
1885–89	8	10	4	3		5	4		34
1890–94	7	12	6	3	3	1	2		34
1895–99	14	13	3	10	7	3			50
1900–04	11	10	12	7	7	1			48
1905–09	3	10	9	7					29
1910–14	10	23	15						48
1915–19	14	38	15						67
1920–24	19	13							32
>1924									
Totals	89	140	83	45	36	35	20		448
Unknown DOB								93	541

Mean age at marriage = 27.0 years.

Table 6. Comparisons of marital infertility patterns in Guam, 1901–1941, and in some historical Euroamerican populations

Data Source	<20 years	20–24 years	25–29 years	30–34 years	35–39 years	40–44 years	45+ years	Total
Guamanian women with known birth dates	1125	1460	643	334	166	96	93	3,917
All non-fertile unions	89	140	83	45	36	35	20	448
Percent (b/a) 100	7.9	9.6	12.9	13.5	21.7	36.5	21.5	11.4
Infecund married women	60	80	41	26	19	13	—	239
Percent (c/a) 100	5.3	5.5	6.4	7.8	11.4	13.5	—	6.1
Some comparative studies in historical Euroamerican populations.								
(1) Henry 1965, in Bongaarts & Potter 1983–Percent	3	5	8	15	32	69		
(2) Vincent, in Leridon 1977–Percent	4	6	10	16	33	69		
(3) Menken & Larson, in Menken <i>et al.</i> 1986–Percent	5.7	9.3	15.5	29.6	63.6			
(4) Trussell & Wilson, in Menken <i>et al.</i> 1986–Percent	4.6	9.1	16.6	25.4	62.2			

Table 7. Preliminary summary: female Guamanians born and dying, 1901–1941

Date of Birth	Age at Death									Total Deaths	Total Surviving	Total Born
	0–4 Yrs.	5–9 Yrs.	10–14 Yrs.	15–19 Yrs.	20–24 Yrs.	25–29 Yrs.	30–34 Yrs.	35–39 Yrs.	40–44 Yrs.			
1901–04	229	22	5	7	17	21	20	8		329	430	759
1905–09	381	29	22	25	35	32	33	4		561	709	1270
1910–14	401	34	13	25	32	33	1			539	770	1309
1915–19	274	85	11	23	22	1				416	1035	1451
1920–24	341	21	14	17	2					395	1085	1480
1925–29	340	35	10							385	1136	1521
1930–34	288	13	1							302	817	1119
1935–39	182	2								184	615	799
1940–41	21									21	160	181
Unknown											7	7
Total	2457	241	76	97	108	87	54	12		3132	6764	9896
% of all births	24.8	2.4	0.8	1.0	1.1	0.9	0.5	0.1		31.6	68.4	

It follows from the above that some 30 percent of women (1,418 of 5,156 females recorded in 1897) who survived to the age of at least 15 years likely never had opportunity (lack of exposure) to transmit their genes to offspring, while up to 7 percent of all adult females were probably infecund. Of 6,269 females born between 1901 and 1924, 1,882, or 30 percent, died before attaining 15 years of age (Table 7). Thus, the loss of genetic potential from lack of opportunity approximated the level of loss from mortality among those of prereproductive years. Indeed, the recovery of the population during this, and presumably in earlier, historical periods, was made possible only by the prevailing low level of infecundity and the high level of fertility among the surviving minority, some $\frac{1}{3}$ of all females ever born and also at risk, who produced on average nearly 8 children each in the course of their reproductive lifespans. That effective population size, N_e , may be only one-third that of the total number of potential progenitors is not an unusual finding (Underwood 1979: 125–129), but the extent to which that reduction is in major part a consequence of cultural patterns surrounding sexual and marital practices has not been widely appreciated.

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