DEMOGRAPHY© Volume 24, Number 4 November 1987

# INTERGENERATIONAL TRANSMISSION OF RELATIVE FERTILITY AND LIFE COURSE PATTERNS

**Douglas L. Anderton**
Department of Sociology, Population Research Center, University of Chicago, 1126 E. 59th Street, Chicago, Illinois 60637
**Noriko O. Tsuya**
East–West Population Research Institute, East–West Center, 1777 East–West Road, Honolulu, Hawaii 96848
**Lee L. Bean**
**Geraldine P. Mineau**
Department of Sociology, University of Utah, Salt Lake City, Utah 84132

## INTRODUCTION

In many countries fertility trends over the last century have been characterized by sustained declines and the dissemination of a relatively sophisticated contraceptive knowledge. Many possible avenues for the dissemination of such knowledge exist among contemporary populations. There has, however, been only limited success in confirming the anticipated central role of the family as a social institution providing for the dissemination of this knowledge across generations.

> The relationship of age, size of parental family and sex preference with the fertility of couples are well documented. In specific and capsule form: age at marriage is inversely associated with size of completed family; family size between two successive generations is correlated . . . Though documented, none of these associations is impressively strong nor are the reasons for all of the associations entirely clear. (Westoff, Potter, and Sagi, 1963:198)

Recent studies have approached the modest significance of familial fertility associations by implicitly assuming that intergenerational correlations are merely weak reflections of covariates of fertility such as status, education, and so on, which are also transmitted through the family. These studies attempt to identify the transmission of specific fertility determinants through familial lines and establish the connection within and across generations between the covariates studied and fertility behavior.

Two features central to the theoretical arguments of the present paper stand in contrast to these earlier efforts. First, we argue that the family has historically been a primary locus for the intergenerational transmission of fertility-determining behavior, including marriage and contraceptive practices, rather than emphasizing the transmission of less direct socioeconomic determinants of fertility through the family. Second, we suggest that fertility behaviors transmitted through the family are behavioral propensities relative to prevailing social behavior. That is, a mother with lower fertility than her peers is more likely to transmit fertility-reducing behavior that will result in her daughter's also achieving lower fertility than others in the daughter's generation. This approach allows for the possibility of population-wide fertility changes across generations unrelated to familially transmitted behavior.

This focus neither disputes nor addresses the possibility that the socioeconomic determinants of fertility are transmitted in the family. We suggest, however, that earlier studies may have understated the family's role in transmitting fertility behavior by failing to distinguish such effects from population-wide trends and by placing inadequate emphasis on the direct correlation of behavioral propensities across generations.

The theoretical orientation here is also somewhat different from previous research addressing fertility behavior and levels across generations more directly. Many studies on intergenerational transmission of fertility behavior have been designed to examine the transmission of fecundity (Huestis and Maxwell, 1932; Imaizumi, Nei, and Furosho, 1970). We are concerned with the more sociological question of the degree to which fertility patterns in successive generations may be used to infer the transmission of behavior (Berent, 1953; Duncan et al., 1965; Kantner and Potter, 1954; Wise and Condie, 1975). In this paper we argue that subcohorts that restrict family size, relative to other subcohorts, will provide an early exposure and socialization of daughters to restricted family sizes. The indirect sources of intergenerational fertility correlation through other proximate determinants of childbearing and specific intergenerational effects on the fertility timing of daughters are further elaborated.

As far back as the turn of this century, researchers were interested in intergenerational fertility patterns (Pearson and Lee, 1899). Early studies stressed genetic transmission of fecundity and even attributed transmission of fertility norms and preferences to heredity. Huestis and Maxwell stated that "there are probably genetic differences in the desire for children as well as in ability to have them, comparable to differences in height, body build, and the like" (1932:77). In contrast, recent studies have investigated socioeconomic influences on intergenerational fertility patterns or social transmission of fertility values, norms, and preferences between generations.

Using cross-sectional data from a 1946 study of family limitation in Britain, Berent (1953) found a positive but weak correlation between family sizes of 1,451 couples who had been married for at least 15 years and those of their parents. This correlation held when controls for social class, contraceptive use, and wife's or husband's family size of origin were introduced; and wife's family size of origin was found to have a stronger relationship than husband's with the couple's own family size.

In contrast, Kantner and Potter (1954), using data from the Indianapolis Study of Fertility, found that the association between fertility of the couples and that of their parents was negligible. They attributed this lack of correlation to the highly selective nature of the sample. Couples studied were urban residents, were highly educated, and spent their early years of marriage during the Depression. Their parents lived in rural areas and were less educated. The study implies that relationships between family size of origin and procreation are affected by differences in socioeconomic status between successive generations. Similarly, examining the data from two national samples, Duncan et al. (1965) found that the weak relationship between family sizes of two successive generations may be partially mediated by other variables, such as intergenerational differences in educational level and duration of marriage.

Later studies have generally supported the weak positive relation. Ben-Porath (1975) confirmed that husband's family size of origin had a modest positive effect on his own family size. Similarly, Johnson and Stokes (1976), using data from a 24-year longitudinal study of women in Pennsylvania, found that family size of origin had a weak positive effect on family size of procreation. Their study indicated that the relationship was stronger among first-born women and those who did not experience intergenerational change in life style.

Thornton (1980) analyzed families in the Panel Study of Income Dynamics and found a modest relationship in intergenerational fertility. His findings, however, suggested a more substantial association in ideal family sizes across generations. A recent study by Thornton et al. (1986) used data from Taiwan and extended prior studies emphasizing socioeconomic correlates by attempting to separate the direct and indirect effects of parental education and occupation on children's fertility preferences.

Adding to these social scientific findings, Garn (1980) offered evidence on physiological and genetic determinants of fertility. Intergenerational continuity in fertility was found when the effects of intergenerational similarity in life style were controlled. Garn argued that such similarity in fertility patterns, if found, is partially caused by genetic transmission of fecundity, which is seen as having principal effects through age at menarche. To the extent that age at menarche is lower than the age at marriage (as we presume in the current case), however, the genetic effects on intergenerational fertility are less dramatic fluctuations in fecundity after menarche, and these are secondary to behavioral influences.

Several recent historical studies are also relevant to the topic under investigation. Using family reconstitutions from English parish registers in the 16th–19th centuries, Langford and Wilson (1985) found no evidence of an association between the fecundity of daughters and that of their mothers. Again, results suggest that fertility associations are perhaps more fruitfully viewed as a product of behavioral transmissions. Levine (1982) also anticipated the present study in discussing age of marriage in a reconstitution of Shepshed, Leicestershire, over the period 1600–1851. Although he discussed fertility effects of intergenerationally correlated marriage ages in absolute levels, parts of the analysis controlled for population levels in fertility, thereby stressing relative behavioral dispositions.

In summary, most of these recent studies agree that family sizes of successive generations are positively but weakly related. They offer various suggestions on the significant factors affecting the relationship. More recent studies tend to minimize the role of genetic heritability and point to the potential fruitfulness of examining the intergenerational transmission of fertility norms, values, and preferences, that is, behavioral dispositions.

Familial transmission of norms and tastes are more likely to produce intergenerational continuity of fertility patterns if means for fertility control are available. The technology of fertility limitation, however, has changed dramatically over the last century, so younger generations are likely to have access to more efficient means of regulation. In any longitudinal study, the fertility of successive cohorts will unquestionably be influenced by the changing techniques and efficacy of contraception. It seems essential to extend prior studies by examining the intergenerational correlation of fertility control "relative" to the woman's own age-graded peers.[1] That is, daughters from cohorts with access to more effective methods of control may vary in their use of fertility limitation both by the means available and by behavioral socialization. Given the hypothesized importance of cohort influences, we would expect the strength of association between the fertility of successive generations to be greater for measures of relative fertility than for measures of actual fertility. The examination of cohort influences, however, also requires an evaluation of other intermediate fertility determinants, which may vary across cohorts.

One proximate fertility determinant affecting intergenerational patterns, even in populations without efficacious control, is age at marriage. The duration of fertility exposure is largely determined by age at marriage, longevity of a couple, and stability of marital union. If there is a positive intergenerational correlation in age at marriage, it might in turn be a result of familial transmission of family-building dispositions. Clearly, to discuss patterns of intergenerational fertility, one should separate the effects of age at marriage and exposure to childbearing from fertility behavior over the duration of exposure.

Another possible fertility transmission source involves the exposure of the daughter to younger siblings and the specific childbearing patterns of her mother. That is, if a woman has many younger siblings, her own marriage may be postponed while she helps care for them or hastened by a desire to leave the household more quickly. On the other hand, a woman with many younger siblings may be more likely to play the role of a second mother; she will thereby have greater exposure to—and a stronger likelihood to adopt—her family's fertility norms and preferences.

Instead of emphasizing continuities in socioeconomic life styles, for example, the present paper addresses the direct relationship between fertility and fertility behavior of mothers and daughters. The basic hypotheses are (1) that the relative propensity to control family sizes in one generation is transmitted to the following generation and (2) that transmission of fertility levels across generations is in part a result of the transmission of specific fertility-determining life-course behaviors across generations.

## ANALYSES

The data are derived from the Mormon Historical Demography project's set of computerized family genealogies. Aggregate-level measures suggest that the initial cohorts of the study population followed a "natural fertility" schedule, with successive cohorts adopting fertility limitation (Bean, Mineau, and Anderton, 1983; Mineau et al., 1984; Willigan et al., 1982). Birth spacing also played a significant role in the Utah fertility transition (Anderton and Bean, 1985; Anderton et al., 1984). Thus the data cover a period of substantial intergenerational change in fertility behavior. Because the data include linked family histories for successive generations of mothers and daughters, they provide an opportunity to study actual intergenerational childbearing experiences. Thus we avoid the limitations of prior studies, which have had to use "sib size" (Westoff, Potter, and Sagi, 1963) or paternity data (Ben-Porath, 1975) in the absence of precise measures of fertility of mothers and daughters.

The importance of identifying siblings and examining the fertility of more than one child in the second generation within family size groups of the first generation is particularly important during periods of transition from large to small families. First and last daughters from a large family, for example, may be exposed to the same values in the family with respect to family size; but if they belong to different cohorts, they may be exposed to different means of fertility control, social norms, and socioeconomic conditions. To assess the importance of cohort effects, we compare in table 1 the completed fertility of first daughters and last daughters by mother's completed family size and mother's birth cohort.[2] Clearly daughters who were the last-born child tend to have lower fertility than first-born daughters. Tabulations for all daughters are of their mean fertility when more than one linked daughter is present. For first-born daughters, the table confirms a positive association between mother's and daughter's family sizes. First-born daughters are, of course, more nearly from cohorts similar to that of the mother and tend to be more homogeneously grouped in cohorts about 20 years after the mother's cohort. For last-born daughters, however, who are presumably more heterogeneous, the pattern of fertility association is indeterminate. These dramatic differences in fertility by birth order support our argument that intergenerational correlations in fertility may be profitably explored through correlation of fertility relative to birth cohorts, or age-graded peers, of women.

Table 1.—Fertility (mean completed family size) of Daughters by Mother's Fertility and Birth Cohort

| Mother's birth cohort | Mother's completed family size | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | All | 1–4 children | | | 5–8 children | | | 9 or more children | | |
| | Mean[a] | Mean[a] | S.D.[b] | N[c] | Mean[a] | S.D.[b] | N[c] | Mean[a] | S.D.[b] | N[c] |
| | | | | | First-Born Child Was Daughter | | | | | |
| 1830 | 8.91 | 9.33 | 2.25 | 6 | 8.38 | 2.42 | 21 | 9.03 | 2.89 | 72 |
| 1840 | 8.24 | 6.88 | 2.29 | 17 | 7.81 | 2.54 | 52 | 8.63 | 2.89 | 118 |
| 1850 | 7.59 | 7.54 | 2.46 | 28 | 7.56 | 2.83 | 115 | 7.62 | 3.19 | 205 |
| 1860 | 6.37 | 4.72 | 2.45 | 58 | 5.98 | 3.02 | 203 | 7.15 | 2.88 | 226 |
| Total | 7.29 | 6.04 | 2.81 | 109 | 6.82 | 3.00 | 391 | 7.80 | 3.05 | 621 |
| | | | | | Last-Born Child Was Daughter | | | | | |
| 1830 | 7.48 | 8.40 | 2.72 | 10 | 6.81 | 2.73 | 27 | 7.70 | 3.23 | 40 |
| 1840 | 6.26 | 7.43 | 3.48 | 14 | 6.56 | 3.07 | 46 | 5.87 | 2.82 | 80 |
| 1850 | 5.00 | 5.76 | 3.17 | 29 | 5.13 | 2.40 | 85 | 4.78 | 2.45 | 147 |
| 1860 | 4.22 | 4.37 | 2.30 | 41 | 4.11 | 2.23 | 184 | 4.29 | 2.12 | 185 |
| Total | 5.05 | 5.68 | 3.12 | 94 | 4.91 | 2.63 | 342 | 5.03 | 2.66 | 452 |
| | | | | | All Daughters | | | | | |
| 1830 | 8.32 | 8.83 | 2.18 | 18 | 7.86 | 2.70 | 149 | 8.47 | 2.48 | 415 |
| 1840 | 7.43 | 7.06 | 2.72 | 34 | 7.23 | 2.74 | 219 | 7.52 | 2.68 | 633 |
| 1850 | 6.46 | 5.98 | 2.77 | 73 | 6.44 | 2.78 | 482 | 6.49 | 2.72 | 1,196 |
| 1860 | 5.47 | 5.06 | 2.40 | 142 | 5.14 | 2.60 | 893 | 5.72 | 2.52 | 1,412 |
| Total | 6.37 | 5.82 | 2.73 | 267 | 5.99 | 2.84 | 1,743 | 6.60 | 2.77 | 3,656 |

*Note:* Total number whose first-born was a daughter = 1,121; total number whose last-born was a daughter = 888; total number with daughters = 5,666.

[a] This column gives daughters' mean completed family size.

[b] This column gives the standard deviation of daughters' mean completed family size.

[c] This column gives the number of mothers.

In table 2, we examine the distribution of mothers and daughters relative to the median births for their respective cohorts. Each woman is allocated to one of three groups: (1) low—completed fertility was two or more children less than the median for all women in the birth cohort; (2) medium—completed fertility was equal to ±1 child from the median for other women in the same birth cohort; and (3) high—completed fertility was two or more children greater than the median for all women in the birth cohort.

Because we are examining a population marked by a dramatic decline in fertility across cohorts, we expect (1) a greater proportion of daughters than mothers to have relatively low fertility. For the 1830–1839 cohort, only 15 percent of the mothers have relatively low fertility, but 25 percent of their daughters do; and for other mother cohorts, the comparisons are 15:26, 18:26, and 15:23. In addition we expect (2) the daughters of low fertility mothers to be more likely to have relatively low fertility. For low fertility mothers in the 1830–1839 cohort, 33 percent of daughters

Table 2.—Daughter's Relative Fertility by Mother's Relative Fertility and Birth Cohort

| Mother's birth cohort and relative fertility | Daughter's relative fertility: Low | | Medium | | High | | Total | |
|---|---|---|---|---|---|---|---|---|
| | % | Mean CEB | % | Mean CEB | % | Mean CEB | % | *N* |
| 1830–1839 | | | | | | | | |
| Low | 32.56 | 4.95 | 24.11 | 4.72 | 23.32 | 4.66 | 25.0 | 210 |
| Medium | 43.41 | 8.07 | 37.81 | 8.06 | 43.44 | 7.98 | 41.0 | 343 |
| High | 24.03 | 11.42 | 38.08 | 11.09 | 33.24 | 11.28 | 33.9 | 284 |
| Total | 15.4 | | 43.6 | | 41.0 | | | |
| *N* | 129 | | 365 | | 343 | | | 837 |
| 1840–1849 | | | | | | | | |
| Low | 32.09 | 4.05 | 24.70 | 4.05 | 24.31 | 3.83 | 25.6 | 327 |
| Medium | 42.78 | 7.31 | 41.90 | 7.07 | 36.81 | 7.12 | 39.7 | 507 |
| High | 25.13 | 10.94 | 33.39 | 10.59 | 38.87 | 10.73 | 34.7 | 443 |
| Total | 14.6 | | 39.6 | | 45.7 | | | |
| *N* | 187 | | 506 | | 584 | | | 1,277 |
| 1850–1859 | | | | | | | | |
| Low | 30.16 | 3.24 | 28.0 | 3.1 | 22.29 | 3.21 | 26.0 | 650 |
| Medium | 39.46 | 5.98 | 40.28 | 5.79 | 41.05 | 5.92 | 40.5 | 1,011 |
| High | 30.38 | 9.64 | 31.65 | 9.67 | 36.65 | 9.88 | 33.5 | 838 |
| Total | 17.6 | | 40.3 | | 42.0 | | | |
| *N* | 441 | | 1,008 | | 1,050 | | | 2,499 |
| 1860–1869 | | | | | | | | |
| Low | 32.89 | 2.50 | 24.30 | 2.46 | 19.16 | 2.51 | 23.3 | 801 |
| Medium | 41.78 | 4.86 | 49.21 | 4.77 | 46.31 | 4.90 | 46.7 | 1,610 |
| High | 25.33 | 8.92 | 26.49 | 8.69 | 34.53 | 8.91 | 30.0 | 1,034 |
| Total | 15.4 | | 38.6 | | 46.1 | | | |
| *N* | 529 | | 1,329 | | 1,587 | | | 3,445 |

*Note:* Low = 2 or more children less than median for all women in cohort; medium = ±1 child from median for other women in cohort; high = 2 or more children greater than median for all women in birth cohort. CEB = children ever born. *N* = number of daughters.

have relatively low fertility, whereas 24 percent fall in the relatively high fertility group. The expected difference is found for the 1840–1849 cohort of mothers and for the 1860–1869 cohort, but not for the 1850–1859 cohort. We also expect (3) the daughters of relatively high fertility mothers to have relatively high fertility. The data indicate that 33 percent of daughters with high fertility mothers in the first cohort have relatively high fertility, whereas only 23 percent have low fertility: this pattern is consistent for each of the other cohorts of mothers. These intergenerational patterns of fertility correlation are stronger in our population than are the similar patterns for absolute fertility levels (e.g., right panel of table 1).

Finally, given the control for cohort fertility levels, we suggest that under the prediction that relative family size determines relative family size across generations—controlling for the decline in aggregate fertility levels—there should be no significant difference in the cohort-specific relative family-size distribution of mothers and daughters. This is the case for the marginal distributions in table 2. If relative fertility were not strongly correlated across generations, one might see changes in the dispersion or skew of relative fertility distributions across generations.

The simple tabulations lend support to our basic argument of a correlation in intergenerational fertility patterns. To examine this further, we turn to our second hypothesis of specific relationships between fertility-determining behaviors across generations.

Most studies of intergenerational fertility are based on cross-sectional data, with information for both generations derived from surveys of second-generation family members. When daughter's fertility behavior is analyzed this study design introduces a bias because a large family size for a first-generation woman generates a greater probability that more than one of her offspring will be sampled. The linked generational data used here allow us to study a second-generation sample controlled for the size of the family of orientation (see Preston, 1976).[3]

Table 3 presents average values for events to daughters relevant to their fertility histories (i.e., age at marriage, average closed birth interval, age at last birth, and children ever born) by their birth cohort and by measures of their prior fertility or family history. Since we wish to explain cohort differences in absolute fertility levels, which are presumably a result of differences in proximate determinants of fertility and fertility behavior, we return to the use of absolute, rather than relative, measures for daughter's fertility history. Daughter's parity-specific fertility history at the beginning of each birth interval is operationalized through mean interval of prior births (excluding the first interval), first birth interval, and age at marriage. The fertility influences that daughters were exposed to in early life are still appropriately regarded relative to alternative childbearing patterns within the mother's cohort. Daughter's family history is therefore operationalized through mother's relative children ever born, relative age at marriage and number of younger siblings, nested within daughter's birth cohort.

All four columns show patterns of change over time that would be expected in a fertility transition population, that is, generally, increasing age at marriage, increasing average birth intervals, decreasing age at last birth, and decreasing numbers of children ever born. Daughter's previous fertility history also has effects largely as expected. Longer mean birth intervals are correlated with a lower average family size. A small group of women having very short birth intervals (89 women) is also correlated with a smaller family size. Since this group also displayed the youngest age at last birth, they perhaps evidence more effective contraception, allowing completion of childbearing at an earlier age. Finally, women marrying at the youngest or oldest ages have shorter average birth intervals. Among the younger

Table 3.—Daughter's Fertility Characteristics by Her Prior Fertility and Family History

| Variable | Mean age at marriage | Mean birth interval[a] | Mean age at last birth | Mean no. CEB |
|---|---|---|---|---|
| | Fertility History | | | |
| Birth cohort | | | | |
| 1850–1859 | 20.159** | 2.602** | 38.018 | 7.785** |
| 1860–1869 | 20.842** | 2.652** | 38.704* | 7.622** |
| 1870–1879 | 21.467[b] | 2.820[b] | 38.069[b] | 6.830[b] |
| 1880–1889 | 21.770* | 2.945** | 36.800** | 6.017** |
| 1890–1899 | 21.871** | 3.182** | 35.269** | 5.138** |
| 1900–1909 | 20.656** | 3.412** | 32.948** | 4.527** |
| Mean prior birth intervals[a] | | | | |
| 18 months or less | | | 28.395** | 4.213** |
| 18–24 months | | | 34.465[b] | 7.139[b] |
| More than 24 months | | | 37.075** | 5.980** |
| First birth interval | | | | |
| 12 months or less | | 2.918** | 36.694** | 6.426** |
| 12–24 months | | 3.057[b] | 36.124[b] | 5.671[b] |
| More than 24 months | | 3.278** | 35.603* | 4.476** |
| Age at marriage | | | | |
| 20 or under | | 2.961** | 35.631** | 6.868** |
| 21–24 | | 3.062[b] | 36.327[b] | 5.722[b] |
| Over 24 | | 2.961* | 37.829** | 4.635** |
| | Family History | | | |
| Mother's relative family size[c] | | | | |
| Low | 21.797* | 3.080 | 36.318 | 5.725 |
| Medium | 21.584[b] | 3.014[b] | 36.413[b] | 5.891[b] |
| High | 21.163** | 2.930* | 36.326 | 6.151** |
| Mother's age at marriage | | | | |
| Low | 20.916** | 2.957* | 36.516 | 6.271** |
| Medium | 21.629[b] | 3.041[b] | 36.233[b] | 5.781[b] |
| High | 22.132** | 3.038 | 36.295 | 5.634 |
| Number of younger siblings by daughter's birth cohort | | | | |
| 1850–1869 | | | | |
| Less than 4 | 20.664[b] | 2.624[b] | 38.541[b] | 7.685[b] |
| 4 or more | 20.863 | 2.705 | 38.662 | 7.542 |
| 1870–1889 | | | | |
| Less than 4 | 21.630[b] | 2.879[b] | 37.290[b] | 6.360[b] |
| 4 or more | 21.708 | 2.932 | 37.233 | 6.241 |
| 1890–1909 | | | | |
| Less than 4 | 22.006[b] | 3.200[b] | 35.201[b] | 5.023[b] |
| 4 or more | 21.359** | 3.257 | 34.448** | 4.970 |

[a] Excludes interval to first birth.
[b] Reference group.
[c] Children ever born (CEB) relative to median for mother's cohort: low < median − 1; medium = median ± 1; high > median + 1.
* Significantly different from reference group at 0.05 level.
** Significantly different from reference group at 0.005 level.

marrying group, this may reflect greater fecundity, and among the older group, an attempt to achieve family sizes more quickly in face of a delayed initiation of childbearing. Such an interpretation would be consistent with the observed correlation between age at marriage and age at last birth, with younger-marrying women terminating childbearing at a younger age. Younger-marrying women do, however, achieve larger family sizes than those marrying at older ages.

Intergenerational correlations among proximate fertility determinants are also readily seen in table 3. Daughters coming from relatively large family sizes tend to marry earlier, have shorter mean interbirth intervals, terminate childbearing earlier, and have larger family sizes. The only statistically significant relations among these variables are those of mother's family size with daughter's age of marriage and family size. Mother's who married later also tended to have daughters who married later, had longer birth intervals, had an earlier age of termination, and had a smaller family size. Again, the principal significant relationships appear to involve age at marriage and completed family size, suggesting that the relationship of mother's to daughter's fertility may have been through an indirect association of age at marriage. In fact, differentials by mother's age of marriage appear stronger than those by completed family size.

Daughters with a larger number of older siblings are more likely to have mothers in earlier cohorts with larger family sizes, whereas they themselves are more likely to be in later cohorts, since they were among the last-born children. To control for possible cohort biases related to generational length, the effect of a larger number of younger siblings is nested, or compared, within daughter's birth cohorts. In this comparison, daughters with a larger number of younger siblings married earlier, had longer interbirth intervals, terminated childbearing at an earlier age, and had smaller completed family sizes. These relationships, however, are not generally significant.

From this evidence on completed fertility histories, we can suggest that proximate determinants play a significant role in intergenerational fertility correlation. Mother's relative age at marriage and daughter's age at marriage are substantially related in a positive manner. This indirect relationship of age at marriage may be responsible for a large portion of the relationship of mother's relative completed family size with daughter's children ever born. Meanwhile, daughters with exposure to a larger number of younger siblings appear to marry earlier (possibly to leave their parents' households) yet ultimately have smaller, rather than larger, family sizes (possibly desiring to avoid children as a result of their exposure to younger siblings).

Just as our examination of proximate determinants sheds some light on the possible mechanisms of intergenerational fertility transmission, more may be seen if one examines intergenerational influences on the sequential event histories of childbearing. Intergenerational fertility effects, such as those arising from exposure to younger siblings, may be obscured by the foregoing tabulations if they affect early fertility decisions more heavily than those at higher parities. In addition, the analysis of fertility timing provides insight into the indirect effects of intergenerational influences. For example, once the indirect effect of mother's relative age at marriage is taken into account, is there an additional effect of mother's relative family size on subsequent fertility decisions of the daughter? Similarly, once the early fertility history of the daughter is established, are later decisions explained by this early history without further reference to characteristics of mother's fertility? To investigate such questions, the sequential duration variables of childbearing—that is, age at marriage and parity-specific birth intervals—are subjected to a proportional hazard analysis.

Table 4 presents the coefficients of proportional hazard regressions of each of the

Table 4.—Proportional Hazard Coefficients of Fertility Timing Regressed on Daughter's Prior Fertility and Family History

| Covariates | Daughter's timing variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Age at marriage | Birth interval | | | | | | | | |
| | | First | Second | Third | Fourth | Fifth | Sixth | Seventh | Eighth | Ninth |
| | | | | Fertility History | | | | | | |
| Age at prior birth | | | | | | | | | | |
| 25 or under | | | 0.3300** | 0.2544** | 0.3776** | 0.4832** | 0.1988* | 0.4817 | — | — |
| 26–30 | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 31–35 | | | 0.0433 | −0.1142* | −0.3408** | −0.3833** | −0.3566** | −0.3879** | −0.2408* | −0.3319 |
| Over 35 | | | 0.1351 | 0.3671** | −0.1863* | −0.4919** | −0.4803** | −0.6564** | −0.4009** | −0.5569** |
| First birth interval | | | | | | | | | | |
| 12 mo. or less | | | | 0.1070** | −0.0133 | −0.0199 | −0.0016 | 0.0423 | 0.0105 | −0.0337 |
| 12–24 mo. | | | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Over 24 mo. | | | | −0.0647 | −0.0119 | 0.1239* | 0.0827 | 0.1758* | 0.0582 | 0.1323 |
| Age at marriage | | | | | | | | | | |
| 20 or less | | 0.0904** | 0.0919** | −0.0214 | −0.1528** | −0.1867** | −0.1440** | −0.2830** | −0.0527 | −0.0155 |
| 21–24 | | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Over 24 | | −0.1454** | 0.2679** | 0.1521** | 0.2587** | 0.3065** | 0.3627** | 0.2411** | 0.2854** | 0.1865 |
| | | | | Family History | | | | | | |
| Mother's family size | | | | | | | | | | |
| Low | −0.0116 | 0.0051 | −0.0788* | −0.0617* | −0.0836* | −0.0178 | −0.0053 | 0.0259 | −0.0961 | 0.1641* |
| Medium | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| High | 0.0788* | 0.0648* | 0.0858** | 0.0983** | 0.0158 | 0.0420 | 0.0536 | 0.0289 | −0.0370 | 0.1797* |
| Mother's age at marriage | | | | | | | | | | |
| Low | 0.1717** | 0.0455 | 0.0570* | 0.0513 | 0.0637* | −0.0140 | −0.0393 | 0.0223 | −0.0196 | −0.0744 |
| Medium | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| High | −0.1187** | 0.0229 | 0.0303 | 0.0544 | 0.0016 | −0.0444 | −0.0293 | −0.0401 | 0.0187 | 0.0424 |
| No. of younger siblings (within daughter's birth cohort) | | | | | | | | | | |
| GE4 vs LT4 (1850–1869) | −0.1861** | −0.0790* | −0.2054** | −0.2022** | −0.2092** | −0.2324** | −0.0872* | 0.0083 | 0.0032 | −0.0213 |
| GE4 vs LT4 (1870–1889) | −0.0152 | 0.0062 | −0.0885** | −0.0206 | −0.0419* | −0.0187 | −0.0141 | −0.0287 | −0.0304 | −0.0276 |
| GE4 vs LT4 (1890–1909) | 0.0374* | 0.0010 | −0.0791** | −0.1078** | −0.0674** | −0.0525* | −0.0540 | −0.1006* | 0.0238 | −0.0091 |
| Global chi-square | 136.42‡ | 55.14‡ | 107.94‡ | 165.45‡ | 197.27‡ | 214.21‡ | 105.04‡ | 95.43‡ | 27.73† | 27.56† |

* Significant at 0.05 level. ** Significant at 0.005 level. † Model effects significant at 0.01 level. ‡ Model effects significant at 0.001 level.

daughter's fertility history interval measures (i.e., age at marriage and parity-specific birth intervals) on her prior fertility and family history variables. Birth cohorts are excluded from the model to avoid their artificially accounting for variation in other proximate fertility determinants and because cohort-related biases were not evident when these results were compared with results that included birth cohorts. Similarly, multicollinearity forces a selection of either first birth interval or mean prior interval excluding the first to enter the model. Since prior literature on first birth interval suggests its importance as a determinant of subsequent fertility history, this variable was selected for inclusion. Proportionality of effects in the model was also confirmed. To interpret coefficients of the model, note that a negative (positive) coefficient represents a proportionally lower (higher) risk of conception over time and thus a longer (shorter) birth interval.

Daughter's age at prior birth was included as a control for age-related fecundity in regressions for all higher order birth intervals. This control conforms to expectations in that older ages at the initiation of the interbirth interval lower the hazard of conception. In contrast to many previous studies, however, first birth interval appears to have only sporadic relationship with later interbirth intervals. This lack of significance may be due to the greater explanation afforded through age at marriage. A daughter's young age at marriage initially increases her risk of conception but ultimately lessens the risk of conception at higher parities. This shift may result from a higher initial fecundity among marriages at younger ages followed by a relative delay between later births from biological or intentional reduction of fecundity.

When we look at intergenerational influences, the indirect effects of transmission of age at marriage can again be seen. Mother's relative age at marriage is strongly and positively related to daughter's age at marriage. In turn, once daughter's age at marriage is entered into the model for birth intervals, there is little further effect of mother's age at marriage. This demonstrates that the effects of mother's age at marriage are subsumed in the indirect relation with daughter's age at marriage. At lower parities, however, the effect of mother's relative children ever born on daughter's fertility timing is not entirely explained through the relation in age at marriage. Until women reach parities above four children (i.e., where the sample is restricted by self-selection to higher fertility women), there is a significant negative association between mother's family size and birth intervals of the daughter, a finding consistent with a positive association in intergenerational completed family size.

In addition, there is a positive relation between exposure to large family sizes during childhood and birth intervals. Coefficients presented for this variable represent a contrast of a large, as compared with a small, number of younger siblings, controlling for daughter's birth cohort as discussed earlier. Again this suggests the plausibility of an argument that those coming from large families were in no haste to replicate their recent exposure to younger children. The magnitude of this relationship at lower parities also supports the notion that these effects are limited to earlier parities and are obscured in tabulations that aggregate across childbearing (e.g., table 3).

## SUMMARY AND DISCUSSION

Our analysis has addressed three specific aims. First, we have evaluated the commonly hypothesized relationship between the fertility behavior of mothers and that of their daughters. Second, we have examined an underlying hypothesis that simultaneously operating, and therefore confounding, cohort effects may provide an explanation for the weak relationships found in many prior studies. Third, we have examined the ability of both cohort-specific intermediate fertility determinants and mother's relative fertility behavior to explain specific fertility-timing patterns of daughters.

Tabular and multivariate analyses support the strong possibility that both fertility behavior and indirect associations regarding timing of fertility-related life-course events are transmitted intergenerationally. Both forms of analysis show that cohort-specific influences are substantial and that intergenerational relationships may be more readily elaborated through the examination of fertility relative to cohort levels. Thus our analyses confirm both the hypothesized intergenerational fertility association and the hypothesized cohort-specific effects. The associations of mother's relative fertility with daughter's relative fertility, absolute fertility, and parity-specific fertility timing are all greater in our population than are the associations with mother's absolute fertility.

After confirming the significance of cohort-specific influences on the intergenerational transmission of fertility, we have sought to explain the absolute fertility of daughters both by intermediate fertility determinants, which may account for cohort differences, and by the intergenerational influences substantiated after controlling for cohort effects. When the effects of mother's relative fertility and age of marriage are considered, our results support the positive associations of these variables with daughter's fertility and age at marriage, respectively, found in previous studies. The resulting indirect negative association between mother's age at marriage and daughter's completed family size is similarly indicated. Our findings also suggest that exposure to a large family, and specifically a larger number of younger siblings (controlling for cohort biases), diminishes the pace of childbearing at lower parities.

In addition, any explanation involving the purposeful action of a daughter to adjust fertility in correspondence to her experiences as a child must suggest that she adopts either a desired family size (level) or a disposition (pattern) of fertility. Given the remarkable decline in fertility in our study population, it is neither reasonable to expect a mother's fertility level to be adopted nor unreasonable to expect a behavioral disposition to be more likely to affect a daughter's later fertility. Whether this finding would hold for populations with less dramatic fertility declines is a subject for further empirical investigation.

It is also not surprising that across cohorts, some of which have low contraceptive efficacy or practice (Anderton et al., 1984), a substantial portion of the association in intergenerational family size is attributable to transmission of age at marriage patterns. Although these effects are large, they do not entirely account for intergenerational associations of fertility behavior. Whether these effects are motivated by similar socioeconomic environs is beyond the scope of the current analysis. The results strongly suggest, however, that a further understanding of intergenerational fertility correlations may be gained through independent studies stressing the factors behind such an intergenerational transmission of nuptiality patterns.

A similar conclusion must be reached regarding the exposure of daughters to a large number of younger siblings. The common assumption that such exposure will result in a greater propensity for childbearing is not borne out by our provisional findings. It seems no less reasonable to suggest that women recently exposed to the tasks of caring for large numbers of siblings would avoid, rather than repeat, such an experience. Again, the findings suggest that further studies of sibship experience and subsequent fertility are desirable.

Finally, all three of our major findings (i.e., the import of relative fertility, proximate determinants, and younger sibship exposure) are important not only for completed family sizes but for the actual patterns of fertility timing. Given previous studies that have suggested the potential importance of birth spacing in this transition population (Anderton and Bean, 1985), and the possibility that these intergenerational influences may be strongest early in childbearing, it appears reasonable to suggest that intergenerational fertility transmission may be one source of behavior affecting fertility over the entire duration of childbearing.

Our analyses make use of a unique source of intergenerational fertility data over the course of a fertility transition. Together, the findings support the recent trend in studies of intergenerational fertility to turn from questions of genetic heritability of fecundity to questions of intergenerational behavior transmission. We believe our results go further by suggesting that many substantial questions may be raised, approached, and resolved, despite the generally weak nature of intergenerational correlations found in prior studies. One clear direction suggested for future research is simply to examine relative fertility levels as evidence for intergenerational transmission of behavioral dispositions extending beyond population-wide shifts in behavior. Another direction, if transmission of behavioral propensities is to provide a strong alternative or supplement to theories stressing less direct correlates of behavior across generations, is to clarify both correlates and life-course implications of specific intergenerational behavioral associations.

## NOTES

[1] While the present paper was under review, Thornton et al. anticipated a similar need in stating, "The association between intergenerational relationships and reproductive behavior may be attenuated in our statistical analysis, because the adoption of contraception and decline of fertility in Taiwan have been very rapid, outpacing several dimensions of familial change" (1986:194).

[2] Females born from 1830 through 1869 who had entered the genealogical files as wives were selected and restrictions were applied to create an appropriate study population. Cases were excluded based on the following: quality checks of data (3 percent), divorce (<1 percent), death of either spouse before wife reaches age 45 (6 percent), and multiple marriages (remarriage and polygyny; 45 percent). Once-married couples (husband and wife married only one time) make up 40 percent of married women born in 1830–1839 and increase to 65 percent for the 1860–1869 cohort. About 28 percent of married women in the 1830–1839 cohort were married to a polygamist, decreasing to 7 percent in the 1860–1869 cohort. Using the resulting set of about 15,000 mothers, we excluded just over half without a daughter who met similar criteria. Mothers with no traceable daughters had an average of 7.8 children, consisting of 55 percent sons, 13 percent daughters with no marriage record (including early deaths), 27 percent daughters without fully traceable genealogical records, 4 percent not once married, and about 1 percent including those not surviving to age 45, with no children, or with data errors. Roughly 7,000 women remained for the analyses in this paper. For initial tabulations a final control for age at marriage was introduced; 10 percent of families were eliminated because the mother married outside the range of ages 10–24, and 9 percent were eliminated because daughters married outside that range. The initial tabulations then use 5,668 mothers and their 8,058 traceable daughters, representing 13,726 women.

[3] Our examination of fertility behavior across generations requires slightly different data constraints, but these had only a minimal effect on the selection of the sample population. Beginning with the selected sample of 7,000 women, restrictions on the age at marriage were relaxed and additional restrictions involving the presence of all necessary dates for event history analyses were imposed. Daughters were required to have between 2 and 13 children to allow analysis of interbirth intervals. This alternative sample for more detailed studies resulted in a nearly equivalent sample size of 5,638 linked cases (where only one daughter's record is sampled), representing 11,276 women without duplication of mothers.

## ACKNOWLEDGMENTS

This research was supported by National Institutes of Health Grant HD-15455 and University of Chicago Public Health Service Biomedical Research Grant funds. The comments of Dennis Hogan at the University of Chicago were extremely helpful.

## REFERENCES

Anderton, D. L., and L. L. Bean. 1985. Birth spacing and fertility limitation: A behavioral analysis of a nineteenth century frontier population. *Demography* 22:169–183.

Anderton, D. L., L. L. Bean, J. D. Willigan, and G. P. Mineau. 1984. Adoption of fertility limitation in an American frontier population: An analysis and simulation of socio-religious subgroups. *Social Biology* 13:140–159.

Bean, L. L., G. Mineau, and D. Anderton. 1983. Residence and religious effects on declining family size: An historical analysis of the Utah population. *Review of Religious Research* 25:91–101.

Ben-Porath, Y. 1975. First-generation effects on second-generation fertility. *Demography* 12:397–405.

Berent, J. 1953. Relationship between family sizes of two successive generations. *The Milbank Memorial Fund Quarterly* 31:39–50.

Dunca, O. D., R. Freedman, J. M. Coble, and D. P. Slesinger. 1965. Marital fertility and size of family of orientation. *Demography* 2:508–515.

Garn, S. M. 1980. Continuities and change in maturational timing. Pp. 113–162 in O. G. Brim, Jr., and J. Kagan (eds.), *Constancy and Change in Human Development*. Cambridge, Mass.: Harvard University Press.

Huestis, R. R., and A. Maxwell. 1932. Does family size run in families? *Journal of Heredity* 23:77–79.

Imaizumi, Y., M. Nei, and T. Furosho. 1970. Variability and heritability of human fertility. *Annals of Human Genetics* 33:251–259.

Johnson, N. E., and C. S. Stokes. 1976. Family size in successive generations: The effects of birth order, intergenerational change in lifestyle, and familial satisfaction. *Demography* 13:175–187.

Kantner, J. F., and R. G. Potter, Jr. 1954. Social and psychological factors affecting fertility. XXIV: The relationship of family size in two successive generations. *The Milbank Memorial Fund Quarterly* 32:294–311.

Langford, C. M., and C. Wilson. 1985. Is there a connection between a woman's fecundity and that of her mother? *Journal of Biosocial Science* 17:437–443.

Levine, D. 1982. For their own reasons: Individual marriage decisions and family life. *Journal of Family History* 7:255–264.

Mineau, G. P., D. L. Anderton, L. L. Bean, and J. D. Willigan. 1984. Evolution differentielle de la fecondite et groupes sociaux religieux: L'exemple de l'Utah au XIX siecle. *Annales de Demographie Historique* pp. 220–236.

Pearson, K., and A. Lee. 1899. On the inheritance of mankind. *Royal Society of London Philosophical Transactions* Ser. A, Vol. 192.

Preston, S. H. 1976. Family sizes of children and family sizes of women. *Demography* 13:105–114.

Thornton, A. 1980. The influence of first generation fertility and economic status on second generation fertility. *Population and Environment* 3:51–72.

Thornton, A., R. Freedman, T.-H. Sun, and M.-C. Chang. 1986. Intergenerational relations and reproductive behavior in Taiwan. *Demography* 23:185–197.

Westoff, C. F., R. G. Potter, Jr., and P. C. Sagi. 1963. *The Third Child*. Princeton, N.J.: Princeton University Press.

Willigan, J. D., G. P. Mineau, D. L. Anderton, and L. L. Bean. 1982. A macrosimulation approach to the investigation of natural fertility. *Demography* 19:161–176.

Wise, J. M., and S. J. Condie. 1975. Intergenerational fertility throughout four generations. *Social Biology* 22:144–150.