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# The Influence of Kin Proximity on the Reproductive Success of American Couples, 1900–1910

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**ABSTRACT** Children require a large amount of time, effort, and resources to raise. Physical help, financial contributions, medical care, and other types of assistance from kin and social network members allow couples to space births closer together while maintaining or increasing child survival. We examine the impact of kin availability on couples' reproductive success in the early twentieth-century United States with a panel data set of over 3.1 million couples linked between the 1900 and 1910 U.S. censuses. Our results indicate that kin proximity outside the household was positively associated with fertility, child survival, and net reproduction, and suggest that declining kin availability was an important contributing factor to the fertility transition in the United States. We also find important differences between maternal and paternal kin inside the household—including higher fertility among women residing with their mother-in-law than among those residing with their mother—that support hypotheses related to the contrasting motivations and concerns of parents and parents-in-law.

**KEYWORDS** Fertility decline • Kinship • Longitudinal studies • Historical demography • IPUMS

## Introduction

Recent studies of historical populations have found a positive correlation between couples' reproductive success and the proximity of kin (Chapman et al. 2019; Dillon et al. forthcoming; Engelhardt et al. 2019; Hacker and Roberts 2017; Jennings et al. 2012; Rotering and Bras 2015; Willführ et al. 2021; Willführ et al. 2018). Although the causal mechanisms are unclear, the results of these studies are consistent with empirical and theoretical research conducted by evolutionary scholars, who contend that humans are "cooperative breeders." Relative to the offspring of other primates, human children require a large amount of time, effort, and resources to raise. Physical help, financial contributions, medical care, and other types of assistance from kin allow couples to space births closer together while maintaining or increasing child survival (Hrdy 2009; Mace and Sear 2005; Sear and Coall 2011).

Research on the impact of kin proximity on reproduction has focused on modern populations or historical populations with natural fertility patterns. There have been

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fewer studies of how kin influenced demographic outcomes during the fertility transition, which commenced in Europe and parts of North America in the late nineteenth century. In this article, we examine the impact of kin availability on reproductive success in the United States during the early twentieth century, a period when the nation was experiencing a rapid decline in fertility. Our analysis is based on a panel data set of over 3.1 million couples linked between the 1900 and 1910 U.S. censuses. In addition to examining the impact of coresident parents and parents-in-law on the reproductive success of childbearing women, we develop measures of surname kin density and proximity to mothers-in-law outside the household to investigate the impact of wider kin networks on couples' reproduction. Another contribution of our study stems from the unique data available in these two censuses, which allow us to construct conditional models of changes in fertility, child mortality, and net reproduction that adjust for couples' prior reproductive histories and for known correlates of fertility and child mortality. In contrast, most historical studies are limited to measures of net reproduction and suffer selection biases related to their cross-sectional designs (e.g., Hacker and Roberts 2017).

Our results indicate that kin proximity outside the household was positively associated with fertility, child survival, and net reproduction, and suggest that declining kin availability was an important factor in the fertility transition in the United States. We also find significant differences between maternal and paternal kin inside the household, supporting hypotheses related to differences between the motivations and concerns of parents and those of parents-in-law.

## Background

Reproductive success depends on the number of children women give birth to and the number of those children who survive to reproductive age. For most of the nineteenth century, when approximately six in 10 females born in the United States survived to childbearing age, replacement fertility was about 3.4 children per woman. Buoyed by high wages and the widespread availability of inexpensive land, American couples married early and were extraordinarily successful in their reproduction, averaging about 7.0 children per woman at the beginning of the nineteenth century. The mortality transition, which began about 1870, increased female survivorship, lowering replacement fertility to 2.7 children by 1900.[1] Declining nuptiality and the diffusion of marital fertility control, however, lowered the total fertility rate to 3.5 in 1900, just 0.8 children above replacement (Coale and Zelnik 1963; Hacker 2003).

Mortality and fertility differentials widened during the demographic transition, resulting in large disparities in reproductive success among different groups. Studies have found significant relationships between a variety of demographic and other

[1] We estimated replacement fertility using Sardon's approximation (1991), in which replacement fertility is the inverse of the product of the probability of survival to the mean age at motherhood and the proportion of female births. Following Hacker (2003, 2010), we assumed that the mean age of motherhood in the late nineteenth-century United States was approximately 30 years, the proportion surviving to age 30 prior to 1870 was 0.600, and the proportion of female births was 0.488. For 1900, we assumed the proportion surviving to the mean age at childbearing was 0.750.

characteristics—including rural–urban residence, literacy, country of birth, ability to speak English, occupation, and income—and fertility, fertility decline, and child survival. For example, farm couples living in rural areas and foreign-born couples tended to have the highest rates of reproduction, while native-born professional couples living in urban areas tended to have the lowest rates (Dribe et al. 2014, 2020; Hacker and Roberts 2017; Preston and Haines 1991). These findings are consistent with adaptation theories of fertility decline that emphasize the role of economic factors, including child quantity–quality trade-offs associated with increased incomes, urbanization, industrialization, and schooling, and with innovation and diffusion theories that emphasize the importance of such cultural factors as religious secularization (Hacker 2016; Hacker and Roberts 2019).

A potentially important factor overlooked in prior research on the U.S. fertility transition is the possible impact of declining kin availability on fertility. In a pioneering study of surname kin propinquity in the United States, Smith (1989) observed a dramatic decline in kin propinquity between 1790 and 1900. As a result of this decline, New England, once the region with the highest level of kin propinquity in the United States, became the region with the lowest level. Perhaps not coincidentally, the decline in kin propinquity occurred at the same time that couples in New England assumed a leading role in the nation's fertility transition. More recently, Nelson (2018, 2020) has documented a dramatic nationwide decline in surname kin propinquity—measured as the percentage of families living within three households of a family with the same surname on the census manuscript returns—from 29% in 1790 to 7% in 1940, roughly corresponding to the years of the U.S. fertility transition (Figure 1).

Neglect of the potential role of declining kin proximity in the fertility transition is important because kin availability and assistance has proven to be an important factor in couples' reproductive success in a wide variety of geographic and temporal contexts. Although unrelated individuals can assist parents with childcare and provide other types of help, kin tend to provide more assistance (Kramer 2010; Sear and Coall 2011; Turke 1989). Kin also increase couples' reproduction through the transmission of attitudes and behaviors conducive to high fertility, a mechanism known as "kin priming." Although theoretically distinct from kin assistance, kin priming tends to operate in the same direction: proximity to and more frequent interactions with kin are associated with greater reproductive success (Newson et al. 2005; Newson et al. 2007). The "kin influence" hypothesis contends that long-term changes in the proximity of kin were an important evolutionary factor in the decline of fertility. The transition from kin-based communities to non–kin-based social groups, which typically occurs during economic modernization, corresponds with the widening of social networks, less frequent contact with kin, and the evolution of social norms toward attitudes and behaviors less conducive to high rates of reproduction (Newson et al. 2005; Newson and Richerson 2009; Sear and Coall 2011; Turke 1989).

Kin availability may influence demographic behavior, and contribute to fertility and mortality decline, in theoretically distinct ways that are impossible to separate empirically in historical data. Over time, the relationship between kin availability and reproduction is endogenous. During the U.S. demographic transition, declining rates of reproduction meant fewer kin were available in subsequent generations to assist and support childbearing couples. High levels of out-migration (Hall and Ruggles

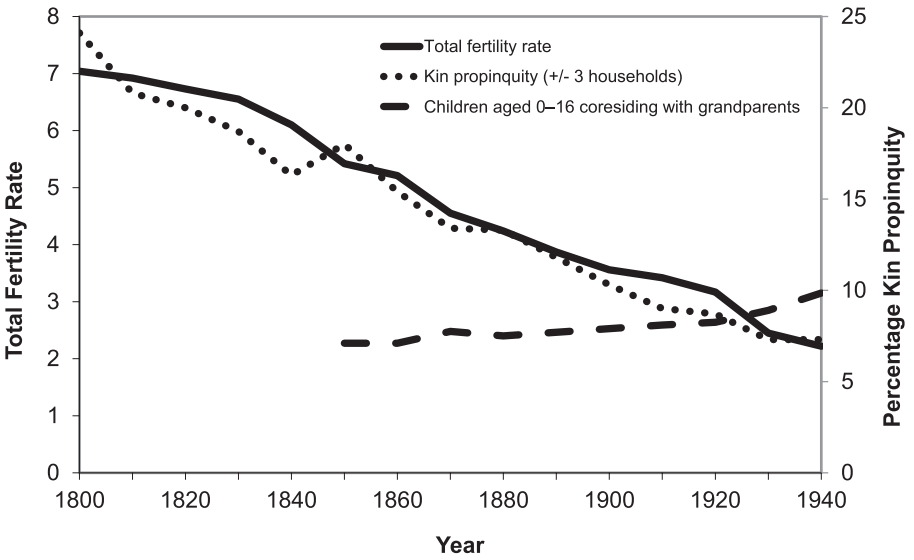


**Fig. 1** Total fertility and paternal kin propinquity in the United States, 1800–1940

2004) further reduced kin availability and the potential number of kin interactions. Expected relationships between reproduction and kin availability, however, are complex; the mean number of different types of kin (e.g., mothers, grandmothers, daughters, granddaughters, sisters, nieces, aunts, and cousins) varies as individuals age and in response to changing patterns of mortality and fertility (Goodman et al. 1974; Murphy 2011). Although the demographic transition likely resulted in fewer proximate kin and kin interactions over time, it also meant that childbearing couples had fewer siblings competing for kin support. Table 1, which denotes the current generation of childbearing couples as G2, their parents' generation as G1, their grandparents' generation as G0, and their children's generation as G3, shows several potential pathways linking demographic change and kin availability during the demographic transition and the expected impact on the reproduction of G2 couples.

If we limit our perspective to the potential availability of parents and parents-in-law and assume out-migration was constant, the known fertility and mortality changes around the turn of the twentieth century are consistent with *increased* parental availability, all else being equal. Lower mortality in G1 relative to G0 increased the probability that G1 parents survived to their G2 children's childbearing years. At the same time, lower fertility in G1 relative to G0 meant that G2 couples had fewer siblings competing for G1 parents' time, resources, and attention. We therefore expect that the mortality and fertility transitions allowed G1 to provide more time and resources toward the rearing of their G3 grandchildren. Although it represents a highly selected population in the United States, the percentage of grandparents residing in the same household as their grandchildren rose modestly in the early twentieth century, consistent with this interpretation. At the same time, however, the demographic transition contributed to the availability of fewer other types of G1 and G2 kin (e.g., aunts, uncles, siblings, cousins).

Migration, however, was not constant. Compared with fertility and mortality, migration is a demographic behavior over which individuals had a greater degree

**Table 1** Potential pathways linking demographic change with kin availability and reproduction during the U.S. demographic transition

| Demographic Context | Expected Impact on Kin Availability and Potential Kin Assistance for G2 Couples Relative to G1 Couples | Expected Impact on the Reproduction of G2 Couples |
|---|---|---|
| Declining Fertility | Increases the potential support from and interaction with parents, as each G2 couple has fewer siblings competing for parents' support and assistance | Positive |
| Declining Fertility | Decreases the potential support from and interaction with G1 aunts, uncles, and other G1 kin, as G1 parents have fewer siblings, cousins, and other G1 kin to assist with subsequent generation | Negative |
| Declining Fertility | Decreases the potential support from and interaction with G2 siblings and cousins, as each G2 couple has fewer siblings, cousins, and other G2 kin | Negative |
| Declining Mean Age at Childbearing | G1 parents and other G1 kin will be younger at birth of G3, allowing G1 to have more healthy years of life expectancy overlapping with G3 | Positive |
| Declining Mortality | More G1 parents will survive their childbearing years, increasing the number of G2 born, which in turn increases the number of G2 siblings competing for G1 parents' support and assistance | Negative |
| Declining Mortality | More G2 will survive to their childbearing years, increasing the number of siblings competing for G1 parents' support and assistance | Negative |
| Declining Mortality | More G1 parents will survive to the birth of G3 | Positive |
| Increasing Migration | Increased migration in G1 and G2 decreases the chances G2 will live in an area with high numbers of G1 and G2 kin, which in turn decreases the potential support from and interaction with G1 and G2 kin | Negative |

*Notes*: Expected impacts are based on assumed changes in fertility, mean age at childbearing, mortality, and migration during the U.S. demographic transition, beginning between generations G0 and G1 and continuing to generations G2 and G3. A positive impact on reproduction in G2 is the assumed combined result of increased fertility and reduced child mortality associated with greater kin availability, relative to generation G1. A negative impact on reproduction in G2 is the assumed combined impact of decreased fertility and increased child mortality associated with lower kin availability relative to generation G1.

of choice. Qualitative evidence from the twentieth century suggests that as couples become more aware of the costs of childrearing, they make more planned choices about their fertility and who will provide support for raising children (Hilevych 2018, 2020; Hilevych and Rusterholz 2018; Rusterholz 2015). If G1 and G2 couples were making rational decisions about migration and where they would live in relation to each other, it is likely that G2 childbearing couples became increasingly cognizant of the potential role of kin in caring for young G3 children. Nonetheless, the data are consistent with a long-term trend toward reduced kin proximity and contact. Although interstate migration fell between the late nineteenth century and early twentieth century, intrastate migration, particularly from rural to urban areas, reduced the proximity of parents from their childbearing children (Hall and Ruggles 2004; Nelson 2018).

Increased migration can also contribute to lower levels of kin priming. The act of migration by G2 couples may itself be a conscious break with the influence of G1

parents. Even if migration decisions that separated G1 and G2 were mutual, the limitations of the era's transportation technology meant that generations separated by 500 or more miles were at least a day's journey apart, even if they had access to railroads. Over shorter distances outside the railroad network, travel by horse and stagecoach was limited to an effective speed of less than six miles per hour (Perez-Cervantes 2014). As a result, families living in different counties, and certainly those in different states, had limited direct contact with each other (Boyd and Walton 1971). When couples have limited contact with their parents, the social and cultural pressure to start a family or have more children may be reduced. Migrants are also likely to have better access to information, increasing the chances they will know about contraceptives, and be embedded in different social networks (Klüsener et al. 2019). Distance may have made the heart grow fonder, but it made familial connections, influence, and assistance harder.

Both the historical and contemporary literature make it clear that some kin are more important than others. Much research has focused on the role of older women. The "grandmother hypothesis" posits grandmothers' contributions to the support, sustenance, and survival of their grandchildren as a possible explanation for the puzzlingly long postmenopausal life span of human females relative to other primates. According to this evolutionary perspective, a postmenopausal woman—although beyond her own childbearing years—could increase the quantity and quality of her surviving grandchildren, and thus her reproductive fitness, by providing support and childcare assistance to her daughter or daughter-in-law. Several studies have suggested that paternal grandmothers have a stronger pronatal effect on couples' fertility than maternal grandmothers, who may be more likely to balance the desire for grandchildren with concerns about the costs and risks of childbearing to their daughters (Hawkes et al. 1998; Voland et al. 2005). In a review by Sear and Coall (2011) of 39 articles on the effects of parents and parents-in-law on fertility, the presence of a childbearing woman's parents was more likely to reduce her fertility than increase it, while the presence of her parents-in-law almost invariably increased her fertility.

Relatively few historical studies have investigated the impact of kin on fertility or child mortality. Data and measurement issues largely explain this gap in the literature. Censuses and registration systems do a good job of identifying the relationships of people who live in households, but do not typically inquire about social or genetic relationships beyond the household unit. Although researchers can study the impact of coresident kin on couples' reproduction—such as the Rotering and Bras (2015) study of the impact of siblings, other coresident kin, and nonkin on birth intervals in the Netherlands—the large majority of kin in Western societies lived outside the household. The historical demographic literature on extended kin and fertility has focused on China and Japan, where complex family systems present more opportunities to measure kin in the household and their impact on demographic behavior. For example, researchers associated with the Eurasia Project (Bengtsson et al. 2004; Tsuya et al. 2010) found that the presence of mothers and mothers-in-law was positively correlated with reproduction in eighteenth- and nineteenth-century populations in northeastern Japan and northeastern China, but only in certain contexts. The results varied by gender and birth order, and suggest that older women may have helped their daughters and daughters-in-law avoid female infanticide among higher order female births (Tsuya and Kurosu 2010; Wang et al. 2010). In a recent comparative study of

male child mortality in three East Asian populations, Dong et al. (2017) found that the impact of coresident grandparents, uncles, and aunts was either negligible or inconsistent across populations.

Historical research on the impact of kin outside the household requires an extensive genealogical reconstruction, the existence of direct survey questions on kin proximity, or indirect estimates based on shared surnames and is therefore less common than research on coresidential kin. Genealogies typically are better at identifying the number and type of kin still living than their physical proximity. In a study of the villages of Liaoning, China, Campbell and Lee (2008) found that the number of proximate male kin in the same generation outside the household was an important factor in men's chances of marriage. Using genealogical data in the Utah Historical Database, Jennings et al. (2012) found that women's childbearing birth intervals were shorter if their mother or mother-in-law was alive. In a recent paper, Dillon et al. (forthcoming) compared the impact of grandparents' vital status and residential proximity on fertility in four mostly pretransition populations in Sweden, Utah, and Quebec. The results indicate that paternal grandmothers had the most consistent fertility-enhancing effects on couples' fertility across the study populations.

The influence of grandmothers on infant survival has been studied in a variety of contexts, including pre–demographic-transition Europe (Ragsdale 2004; Voland and Beise 2002), nineteenth-century Utah (Heath 2003), eighteenth- and nineteenth-century China and Japan (Wang et al. 2010), and eighteenth-century Québec (Engelhardt et al. 2019). For example, Beise (2004) reported that between 1680 and 1750, children under the age of two in Quebec had a 20% to 30% lower chance of mortality if their maternal grandmother was still living, but found no effects of having a living maternal grandfather, paternal grandmother, or paternal grandfather.

Although intergenerational help from grandparents to parents and children appears to be a universal behavior in humans, environmental, societal, and economic contexts likely moderate kin behavior and its impact on reproduction (Sear 2017; Willführ et al. 2021). Most historical studies of the impact of kin on demographic outcomes focus on the pre–demographic-transition era, when couples asserted relatively little conscious control over their fertility. The role of kin during the demographic transition—especially kin outside the household—has received less attention. In two recent papers examining cross-sectional correlates of fertility in the 1850, 1880, 1910, and 1930 U.S. censuses, Hacker and Roberts (2017, 2019) reported a positive correlation between the number of women's own children younger than five in the household and the presence of a potential mother-in-law (i.e., someone whose surname, age, marital status, and birthplace suggested that she was the woman's mother-in-law) living in a household enumerated within five households in the census from the focal couple. However, the presence of a mother or mother-in-law within the childbearing woman's household was negatively associated with the number of living children. The authors speculated that the negative association between reproduction and coresidence could have been the result of unobserved selection mechanisms. For example, if the presence of a mother or mother-in-law in a household was related to financial hardship or physical frailty, her coresidence would have represented an additional burden to the childbearing couple rather than the availability of more assistance. Coresidence also could have led to increased crowding, reduced privacy, and reduced coital frequency.

Showing causality rather than correlation remains a challenge in the historical literature. Correlations between couples' past reproductive behavior and their parents' current coresidence are unsuitable for determining the direction of causality. A recent paper by Willführ et al. (2021), which relied on a panel of individuals linked between the 1880, 1890, 1900, and 1910 full-count Swedish censuses, minimized potential selection biases by correlating the coresidence or proximity of a couple's parents in each census with the couple's subsequent reproduction, measured at the next census. The results indicate that while coresidence with maternal parents lowered a couple's subsequent fertility, possibly out of parental concern for their daughter's health, coresidence with paternal parents increased it. The authors noted, however, that some selection bias is impossible to avoid. As in other countries dominated by the nuclear family system, a very small proportion of households in Sweden contained grandparents and therefore experienced "strong selection in terms of both health and socioeconomic conditions into this specific household arrangement." More importantly, the analysis also demonstrated a negative correlation between fertility and the distance paternal parents outside the household lived from their children, providing support for the positive role of nearby kin in couples' reproductive success.

To our knowledge, the first social surveys in the United States to directly inquire about the proximity of kin, and affective ties with nonresident family, were studies by sociologist Ernest Burgess and colleagues of engaged and married couples in the 1930s (Burgess and Cottrell 1939; Burgess and Wallin 1953). Little use of these measures, however, was made in the main publications resulting from these studies. Major surveys of family relationships around the world now ask about the proximity of kin (Sear and Coall 2011). The widely used Health and Retirement Survey in the United States, for example, now includes questions on kin proximity. Among other things, kin proximity exerts an important influence on adults' residential mobility decisions. Kin who live close by restrain moves, and many moves are motivated by the need for middle-aged adult children to be closer to elderly parents (Spring et al. 2017). But many of these data are recent (after the peak of the baby boom) or pertain to families in modern lower income societies. We know little about the effects of kin proximity in North America and Western Europe during the early stages of the demographic transition, and to know more we have to work with indirect measures of kin proximity.

## Data and Methods

### Data

Our analysis is based on newly released data from the IPUMS Multigenerational Longitudinal Panel (MLP) (Helgertz, Ruggles et al. 2020), which contains identifiers linking records of men and women in the full-count IPUMS data sets of the 1900–1940 censuses (Ruggles et al. 2019). We selected the 1900 to 1910 period as these censuses possess substantial advantages for the purposes of this study. Specifically, both censuses asked ever-married females to indicate the number of children they had borne and the number of those children who were still alive, which allowed us to measure couples' reproductive success along three deminsions: fertility, child

mortality, and net reproduction. In contrast, most historical studies (e.g., Dribe and Eriksson 2019; Hacker and Roberts 2017) have been limited to measures of net reproduction based on the number of coresident children. Both censuses also included demographic and socioeconomic variables identified in prior studies as important correlates of reproduction and child mortality, such as women's age-group, race, nativity, literacy, urban–rural residence, age difference from spouse, and spouses' race, nativity, literacy, and occupational group.

The links were generated through a two-step probabilistic linking algorithm, first identifying high-confidence links in the data through the use of an elaborate set of linking variables. The subsequent step exploits already declared confident matches to identify less certain links among other household members. The linking algorithm not only links a higher share of males compared to other methods used within the social sciences, but also is characterized by higher precision (Helgertz, Price et al. 2020). Of the 72.5 million individuals enumerated in the 1900 census, the IPUMS MLP confidently linked 41% to a record in the 1910 census.[2]

Our target study population was married women aged 15–44 in the 1900 census with at least one surviving child and who remained married to the same spouse in the 1910 census. Once linked, all couples therefore included one or more children at risk of death in the subsequent 10 years. For our analysis of fertility and reproduction, we further limited the study population to women aged 15–34 in 1900. If we assume that menopause began after age 45, women in the study population were recently fecund and at risk to have additional children without interruption by widowhood, separation, divorce, or significant age-related sterility. Of the 5.35 million married women aged 15–44 in 1900 who met the selection criteria, 3.17 million (59%) were successfully linked along with their spouse.

Although the representativeness of our linked sample to the potential target population is not essential to our results, which are based on *changes* in reproduction in the decade between 1900 and 1910, couples in the final linked data set are broadly representative of couples who had been married for 10 or more years in 1910 and had had at least one child born prior to 1900. Compared with their counterparts in the potential baseline population, women in the linked data set had about the same number of children on average in 1910 (4.97 vs. 5.02); were more likely to be White (94.3% vs. 90.5%), married to a farmer (36.3% vs. 35.4%), and literate (93.5% vs. 91.6%); and were less likely to be foreign-born (15.9% vs. 18.0%). Among individuals born in the United States, those in the linked data set were more likely than their counterparts in the potential baseline population to have been born in a Midwestern state (40.4% vs. 35.8%), roughly as likely to have been born in a Northeastern state (24.3% vs. 22.7%) or a Western state (2.6% each), and less likely to have been born in a Southern state (32.7% vs. 38.9%). These differences reflect characteristics that affect the likelihood of accurate enumeration (literacy, region of residence) and the chance of being linked (state-specific birth cohort size). Women in the linked population were slightly more likely than those in the potential baseline population to have had a mother and father in the household in 1900 (3.5% vs. 3.3% for mothers, and 1.6% vs. 1.5% for fathers). These modest differences are likely the result of our linking procedures, which were

[2] This is a low estimate of the true linkage rate, as a nontrivial number of individuals enumerated in the 1900 census *de facto* are unlinkable to the 1910 census owing to death or emigration.

biased toward well-enumerated households in both census years and toward more consistently spelled names.

## Methods and Variables

The complete-count data sets allowed us to construct several mutually exclusive estimates of the availability of kin both within and outside the household. The measurement of kin inside the household was straightforward and direct. Both censuses recorded individuals' relationship to the household head, allowing us to identify the presence of coresiding mothers, fathers, mothers-in-law, and fathers-in-law of childbearing women (Ruggles and Brower 2003). For consistency, all relationships cited in the following are to the childbearing women in the linked data set. We refer to kin who shared a surname with the childbearing woman and her spouse as paternal kin. We also identified the presence of female servants, who could have contributed childcare or other types of household assistance to mothers (Jennings 2019). Our estimation of kin outside the household was indirect, and necessarily limited to paternal kin who had the same surname as childbearing couples. We created two estimates: (1) a conservative estimate identifying the presence of potential mothers-in-law within five households on either side of the household of couples in the data set, and (2) a less restrictive proxy of paternal kin availability based on the density of nonrandom shared surnames in couples' census enumeration districts.

Our indirect measures of paternal kin outside the household were possible because of the way the 1900 and 1910 censuses were enumerated and the availability of restricted versions of the complete-count 1900 and 1910 IPUMS data sets with names included. In both censuses, the formative administrative unit was the enumeration district, which were constructed by local officials. The typical enumeration district in 1900 included between 1,000 and 2,000 inhabitants. Where the borders of enumeration districts are known, they run down major roads and along barriers to travel such as rivers or railroads and conform to recognized neighborhoods (Logan and Parman 2017). Within districts, single enumerators were instructed to canvas households sequentially, literally walking from house to house taking the census and numbering households in their order of visitation. Researchers who have matched property data to census records have shown that households sequential in the census generally were adjacent or very close to each other (Grigoryeva and Ruef 2015; Kenzer 1987; Owsley 1949). Kenzer, for example, charted the physical path of enumerators in Orange County, North Carolina, in the 1850 and 1860 censuses. Although their routes across the county were circuitous, the enumerators clearly followed country roads, paths, rivers, and creeks, with households enumerated in order. Grigoryeva and Ruef's (2015) precise mapping of a Washington, D.C., enumeration district in 1880 confirmed that more than 95% of households were on a direct walking path of the enumerator. While the distance between households varied between urban and rural areas, the order provides a ranking of the closest neighbors. The sequential household order is maintained in the IPUMS complete-count data sets through the variable *serial* that identifies unique households and their order within the enumeration district (Hacker and Roberts 2017; Logan and Parman 2017).

To identify potential mothers-in-law in nearby households, we examined all individuals in the five households enumerated immediately before and after each married couple's household. If there was an ever-married woman residing in one of the 10 households who shared the husband's last name, had the same birthplace as his mother's birthplace, and who was 15–50 years his senior, we assumed the woman was the mother-in-law of the childbearing woman, provided that the childbearing woman did not have a mother-in-law or father-in-law coresiding in her household.[3] It is possible, of course, that some of the identified "potential mothers-in-law" were aunts-in-law, significantly older sisters-in-law, or other paternal kin, and thus some focal women had more than one potential mother-in-law. Although a higher number of potential mothers-in-law had meaning, we decided to treat the measure as a dichotomous indicator. We excluded from our construction of neighboring houses any group quarters, such as prisons, hospitals, or poor farms, and limited our search to the nearest 10 regular households. Hacker and Roberts (2017) include more detail on the construction of the variable.

Our less restrictive estimate of kin availability outside the household relied on the density of adults sharing the same surname and residing in the same enumeration district as focal couples. Some surnames, of course, were more common than others and had the potential to occur more often randomly. To distinguish between surname popularity and kin availability, we used the distance between surname matches measured in number of households in the data set and the distribution of surnames at the state level to estimate the number of *nonrandom* surname matches.

Equation (1) details the calculation of couples' surname kin density (SKD) among adults in the enumeration district:

$$\mathrm{SKD} = \left( \frac{\Sigma_{i=1}^{n} P(K_i)}{A_e} \right), \text{ where } P(K_i) = A_i * \left( 1 - \frac{F_{rs} - 1}{T_{rs} - 1} \right)^{2D_i}. \quad (1)$$

When individuals in different households ($i$) share the same surname ($F$) and race ($r$) as a couple in the data set (excluding women previously identified as a nearby potential mother-in-law), the probability-adjusted (nonrandom) number of adults in the household with a matching surname ($P(K_i)$) is determined by (1) the number of adults with the same surname in matching households ($A_i$); (2) the number of households between the two matches ($D_i$); (3) the number of adults with the same surname and race in the state ($F_{rs}$); and (4) the number of adults of the same race living in the

[3] In previous publications, Hacker and Roberts (2017, 2019) discussed the impact of smaller and larger search windows around each focal couple. The likelihood of identifying an additional potential mother-in-law declined rapidly after the first household. Expansion of the search window from plus or minus one to plus or minus three households yielded few additional potential mothers-in-law, and further expansion to plus or minus five households yielded even fewer, with a negligible impact on the model results. Ultimately, the analysis suggested that limiting our search to the 10 "closest" households struck an appropriate balance between finding a few more potential mothers-in-law and significantly increasing the chances of misidentification or overtaxing our computing resources. A search window of five households in either direction also had the virtue of being consistent with prior work on kin propinquity in the United States (Smith 1989). We will nonetheless miss a few mothers-in-law who were in the same enumeration district or were in a different enumeration district but were physically close. The effect of these omissions will be to bias coefficients modestly downward.

state ($T_{rs}$). We summed the results for all households in the enumeration district with matching surnames to determine the total number of probability-adjusted adult surname kin. Because the number of surname kin depends on enumeration district size, we divided the number by the number of adults in the enumeration district ($A_e$) to obtain an estimate of adult surname kin density.[4] Nelson (2018, 2020) contains more details and discussion of the construction of surname kin density measures.

The most significant limitation of our surname kin density and nearby potential mother-in-law measures is their limitation to paternal kin. Given that prior scholarship has shown that the role played by maternal and paternal kin in reproductive success is not the same, this limitation is important, as we omitted a theoretically relevant variable. If the presence of maternal and paternal kin outside the household were correlated, omitted variable bias may have been significant. Although we have no way of testing the presence or size of this correlation or its potential to bias our results directly, ordinary least-squares regression indicated a modest negative correlation between the coresidence of a childbearing woman's mother or father and surname kin density in the enumeration district, suggesting the risk of significant omitted variable bias is low.

## Descriptive Results

Table 2 summarizes the characteristics of the analytic sample of 2,047,694 linked couples with women aged 15–34 in 1900 (for our mortality analysis, we extend the analytic sample to women aged 15–44 in 1900, which increases the number of linked couples to 3,173,297). During the 10-year interval from 1900 to 1910, these couples, on average, gave birth to 2.15 additional children and experienced the death of 0.46 children.

Unsurprisingly, given the dominance of the nuclear family system and high rates of fertility and mortality in the late nineteenth century, only a small percentage of the married women in the data set had coresident parents or coresident parents-in-law. Among those who did so in 1900, a higher percentage lived with their mother-in-law (4.4%) and father-in-law (3.4%) than with their own mother (4.0%) and father (2.3%), respectively. The pattern was reversed in 1910, however, when women in the data set were more likely to live with their mother (3.5%) and father (1.6%) than with their mother-in-law (2.4%) and father-in-law (1.0%), respectively. These changes are consistent with typical age differences between spouses (women in the linked data set were on average 4.8 years younger than their spouses), corresponding age differences between parents and parents-in-law, and corresponding shifts in the number of surviving maternal and paternal parents at risk of coresidence across time.

Surname kin density in couples' enumeration districts averaged 3.36 adults per 1,000 in 1900. More than half of all couples in the data set (55.1%) lived in an enumeration district with no surname kin. The average surname density declined by 10.1%, to 3.02 adults per 1,000, between 1900 and 1910, in line with the national trend of declining kin propinquity observed by Nelson (2020). Our more conservative

[4] Where convenient for illustration and discussion (e.g., Tables 2 and 3), we express adult surname kin density per 1,000 adults in the enumeration district.

**Table 2** Characteristics of currently married women in the 1900–1910 linked data set

| | Census Year | |
|---|---|---|
| Measure | 1900 | 1910 |
| No. of Children Ever Born | 2.815 | 4.965 |
| No. of Children Surviving | 2.480 | 4.170 |
| Age-group | | |
| 15–19 | 0.031 | |
| 20–24 | 0.238 | |
| 25–29 | 0.378 | 0.040 |
| 30–34 | 0.354 | 0.228 |
| 35–39 | | 0.383 |
| 40–44 | | 0.348 |
| Age Difference From Spouse | –4.753 | –4.835 |
| Residence Type and Population | | |
| Rural, <2,500 | 0.647 | 0.607 |
| Urban, 2,500–9,999 | 0.073 | 0.081 |
| Urban, 10,000–99,999 | 0.114 | 0.132 |
| Urban, 100,000–499,999 | 0.073 | 0.081 |
| Urban, ≥500,000 | 0.095 | 0.099 |
| Woman's Literacy | 0.935 | 0.952 |
| Spouse's Literacy | 0.929 | 0.949 |
| Race and Nativity | | |
| Black | 0.056 | 0.057 |
| Native-born of native-born parents | 0.642 | 0.640 |
| Second generation (native-born of foreign parent(s)) | 0.201 | 0.201 |
| Foreign-born | 0.158 | 0.159 |
| Spouse native-born of native parents | 0.629 | 0.629 |
| Spouse second generation | 0.185 | 0.185 |
| Spouse foreign-born | 0.186 | 0.186 |
| Enumerated With a Paid Labor Force Occupation | 0.021 | 0.065 |
| Spouse's Occupation Group | | |
| Professional | 0.030 | 0.025 |
| Farmer | 0.355 | 0.363 |
| Manager/official/proprietor | 0.054 | 0.081 |
| Clerical/sales | 0.047 | 0.052 |
| Craftsman | 0.131 | 0.141 |
| Operative/apprentice | 0.099 | 0.071 |
| Service worker | 0.019 | 0.021 |
| Farm laborer | 0.046 | 0.027 |
| Laborer | 0.185 | 0.210 |
| Nonoccupational response | 0.035 | 0.010 |
| Woman Interstate Migrant | 0.194 | 0.235 |
| Spouse Interstate Migrant (native-born residing outside state of birth) | 0.215 | 0.248 |
| Coresidence of Parents and Parents-in-Law | | |
| Mother coresident | 0.040 | 0.035 |
| Father coresident | 0.023 | 0.016 |
| Mother-in-law coresident | 0.044 | 0.024 |
| Father-in-law coresident | 0.034 | 0.010 |
| Coresidence of Female Servants | 0.047 | 0.045 |
| Estimated Measures of Spouse's Kin Outside the Household | | |
| Adult surname kin density (per 1,000) | 3.360 | 3.020 |
| Mother-in-law residing within five households | 0.084 | 0.040 |
| No. of cases | 2,047,694 | 2,047,694 |

*Source:* Ruggles et al. (2020).

measure of nearby paternal kin—the proportion of couples in which the woman had a nearby potential mother-in-law—declined as well, from 8.4% in 1900 to just 4.0% in 1910, reflecting the combined effect of mortality and migration in the intervening decade.

Table 3 illustrates how our measures of nearby kin differed by couples' residence locations and socioeconomic and demographic characteristics. Compared with older women, younger women in the data set had higher percentages of coresident parents, coresident parents-in-law, and nearby mothers-in-law. The age pattern is consistent with the increasing cumulative risk of mortality among parents and in-laws with age, and with the increasing cumulative risk of migration from one's community of birth, where denser kin networks prevailed, to a new location with less dense kin networks (Nelson 2020). Women in rural areas were more likely than others to live within five households of a potential mother-in-law and lived in enumeration districts with the highest surname kin densities, while women living in large urban areas were less likely than others to live near a mother-in-law and lived in enumeration districts with the lowest kin densities. Black women rarely coresided with their father or father-in-law, consistent with high mortality rates among Black men (Preston and Haines 1991).

Adult surname kin densities and the percentages of couples with nearby mothers-in-law were much higher in rural areas, suggesting the importance of nearby kin in the farm economy (Billingsley 2004; Gjerde 1997; Nelson 2019). Because of these stark urban–rural differences, we examine the relationship between kin and couples' reproduction separately for urban and rural couples later in the analysis. The inclusion of state of birth and state of residence in our data allowed us to examine the impact of interstate migration status on kin availability (unfortunately, our data do not allow us to examine rural-to-urban migrants). The results indicate a significant difference between nonmigrants and migrants in the percentage who lived within five households of a potential mother-in-law and in the density of surname kin in their residence areas. These differences suggest either that interstate migrants were willing to give up stronger kin networks in exchange for the economic opportunities offered by new areas or that couples with less dense kin networks were more willing to migrate.

Spatial patterns of kin availability are evident in Figure 2, which maps the average adult kin density by county in 1900. The map indicates dramatic differences in kin density within and across regions, with high levels of surname kin density in the Appalachian Mountain counties of West Virginia, Virginia, Kentucky, and Tennessee; in counties in Idaho and Utah predominantly settled by Mormon pioneers; and in coastal counties of North and South Carolina. Low kin densities were more common in the more recently settled western parts of the nation.

## Empirical Models

We constructed separate Poisson models for couples' fertility, child mortality, and net reproduction, and estimated coefficients using maximum likelihood.[5] In specifying

[5] We relied on Stata package *ppmlhdfe*, which implements Poisson pseudo-maximum likelihood regressions with multiway fixed effects (Correia et al. 2020).

**Table 3** Kin availability by group among currently married women in linked data set, 1900 census

| Measure | Percentage Coresident Mother | Percentage Coresident Father | Percentage Coresident Mother-in-Law | Percentage Coresident Father-in-Law | Percentage Nearby Potential Mother-in-Law | Adult Kin Density in Enumeration District (per 1,000) |
|---|---|---|---|---|---|---|
| Overall Average | 3.96 | 2.27 | 4.35 | 2.90 | 8.42 | 0.336 |
| Age-group | | | | | | |
| 15–19 | 5.27 | 3.66 | 6.94 | 5.30 | 15.73 | 0.500 |
| 20–24 | 3.99 | 2.58 | 5.19 | 3.70 | 11.60 | 0.395 |
| 25–29 | 3.82 | 2.19 | 4.23 | 2.80 | 8.26 | 0.329 |
| 30–34 | 3.96 | 2.03 | 3.69 | 2.25 | 5.81 | 0.290 |
| Residence Type and Population | | | | | | |
| Rural, <2,500 | 3.10 | 1.91 | 4.73 | 3.29 | 11.35 | 0.466 |
| Urban, 2,500–9,999 | 4.86 | 2.62 | 3.66 | 2.26 | 4.23 | 0.129 |
| Urban, 10,000–99,999 | 5.55 | 2.97 | 3.89 | 2.35 | 3.34 | 0.111 |
| Urban, 100,000–499,999 | 5.88 | 3.05 | 3.62 | 2.04 | 2.80 | 0.081 |
| Urban, ≥500,000 | 5.71 | 3.00 | 3.39 | 2.01 | 1.98 | 0.073 |
| Race and Nativity | | | | | | |
| Black | 3.43 | 1.33 | 4.08 | 1.59 | 11.05 | 0.392 |
| White, native-born of native-born parents | 3.97 | 2.30 | 4.73 | 3.03 | 10.33 | 0.416 |
| White, foreign-born | 3.08 | 1.62 | 3.05 | 2.15 | 3.60 | 0.162 |
| White, second generation (native-born of foreign parent(s)) | 4.61 | 2.70 | 4.15 | 3.06 | 6.09 | 0.217 |
| Enumerated With a Paid Labor Force Occupation | 5.87 | 3.12 | 5.23 | 2.87 | 9.19 | 0.363 |
| Not Enumerated With a Paid Labor Force Occupation | 3.91 | 2.25 | 4.33 | 2.90 | 8.40 | 0.336 |
| Spouse's Occupation Group | | | | | | |
| Professional | 6.13 | 3.20 | 4.80 | 2.73 | 3.56 | 0.148 |
| Farmer | 2.43 | 1.33 | 4.99 | 3.21 | 13.76 | 0.557 |
| Manager/official/proprietor | 5.16 | 2.68 | 3.97 | 2.37 | 4.60 | 0.199 |
| Clerical/sales | 7.19 | 3.91 | 4.89 | 2.90 | 3.83 | 0.132 |
| Craftsman | 4.49 | 2.53 | 3.36 | 2.19 | 4.50 | 0.164 |
| Operative/apprentice | 4.09 | 2.44 | 3.04 | 2.08 | 4.93 | 0.190 |
| Service worker | 5.16 | 2.67 | 3.61 | 2.09 | 3.11 | 0.126 |
| Farm laborer | 4.53 | 3.78 | 8.18 | 7.63 | 11.92 | 0.454 |

**Table 3** (continued)

| Measure | Percentage Coresident Mother | Percentage Coresident Father | Percentage Coresident Mother-in-Law | Percentage Coresident Father-in-Law | Percentage Nearby Potential Mother-in-Law | Adult Kin Density in Enumeration District (per 1,000) |
|---|---|---|---|---|---|---|
| Laborer | 4.53 | 2.59 | 3.38 | 2.15 | 5.50 | 0.224 |
| Nonoccupational response | 4.54 | 2.84 | 5.26 | 3.80 | 8.69 | 0.355 |
| Migration Status (native-born population) | | | | | | |
| Residence in state of birth | 4.03 | 2.34 | 4.43 | 2.92 | 9.02 | 0.364 |
| Interstate migrant | 3.66 | 1.99 | 4.04 | 2.78 | 5.90 | 0.219 |
| Spouse resident in state of birth | 3.92 | 2.25 | 4.56 | 3.02 | 9.38 | 0.379 |
| Spouse interstate migrant | 4.09 | 2.33 | 3.59 | 2.43 | 4.87 | 0.178 |

*Source:* Ruggles et al. (2020).

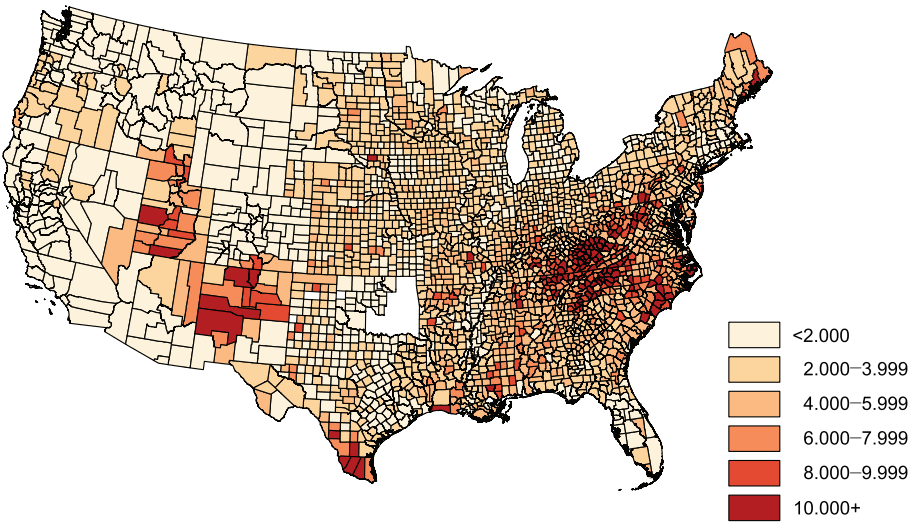


**Fig. 2** Average surname kin density per 1,000 adults by county, 1900 census

our models, our primary concern was the potential impact of unobserved heterogeneity in families' fecundity and demographic behavior. Prior research has demonstrated a positive correlation between parents' and their children's fertility, even after adjustment for socioeconomic status. Whatever the causes of the association, couples originating from high-fertility families with more surviving children are likely to have higher density kin networks and lower proportions of coresiding parents and parents-in-law. It is also possible that the presence of kin is correlated with other unobserved factors. To control for this potential source of endogeneity, we constructed conditional change models with the lagged value of the dependent variable included on the right-hand side of the equation. Equation (2) shows the general form of the regression using the fertility model as an example, with $Y_{it}$ representing the number of children ever born reported by couple $i$ at time $t$ (the 1910 census) and $Y_{it-10}$ representing the number of children ever born reported by the same couple at time $t-10$ (the 1900 census):

$$E(Y_{it} - Y_{it-10}) = \exp(\beta * X_{it-10} + \mu * Z_{ct-10} + \gamma * Y_{it-10}). \quad (2)$$

As shown, the model estimates the changes in a couple's fertility between 1900 and 1910 as a response to characteristics at the couple level, $i$, measured 10 years earlier ($t-10$) captured by the $\beta$ parameters. Additionally, we included a vector of explanatory characteristics at the county level, $c$, also measured 10 years earlier and captured by the $\mu$ parameters. The coefficient for the lagged endogenous variable, $\gamma$ (sometimes referred to as the "stability coefficient" in the statistical literature because of its use to control for prior, unmeasured influences on $Y$), controls for the fecundity of a couple's family of origin and other, unmeasured familial influences on the couples' subsequent fertility (Finkel 1995, 2008; Menard 2008). In addition to coresident parents, parents-in-law, nearby mothers-in-law, and surname kin density, we included independent variables identified in prior studies as important correlates of

reproduction and child mortality in the early twentieth-century United States. These control variables included women's age-group, race, nativity (native-born of native-born parents, native-born of foreign-born parents, and foreign-born), literacy, residence (rural, small urban, medium urban, and large urban), age difference from spouse, and spouses' race, nativity, literacy, and occupational group.

The models for mortality and net reproduction varied slightly. Our model of child mortality, which examined the number of children dying in the interval 1900–1910, included the number of children at risk of death as an independent variable (the number of children surviving in 1900 plus the number of children born in the interval) and the proportion of each couple's children dying before 1900 as the conditional control variable. Our model of net reproduction examined the number of surviving children added in the interval (the number of births between 1900 and 1910 minus the number of children's deaths over the same interval), with the number of children surviving in 1900 included as the conditional control variable. We report coefficients relative to selected reference groups and emphasize the direction and substantive effect of variables on the dependent variables in our discussion. All models employed county-level fixed effects, in addition to robust standard errors clustered at the enumeration-district level. We report conventional statistical significance levels for coefficients in the models.

Despite our use of conditional change models, some selection biases are unavoidable. Given the relatively rare coresidence of parents and parents-in-law at the turn of the century, we suspect that unobserved factors—such as the financial and health considerations of both childbearing couples and their parents—may have led to the atypical decision to form a multigenerational household. Parents who were unable to care for themselves, for example, may have had an adult child return to their household to live with them or moved into a child's household (Hareven 1994). These parents were unlikely to contribute much help to caring for their grandchildren and may have been a hindrance. If coresidence of parents and parents-in-law was adversely selected, results will not be generalizable to parents and parents-in-law residing outside the household. Rather than representing a general test of the grandmother and kin influence hypotheses, in other words, our results for coresident parents and parents-in-law likely apply only to the subpopulation of couples with coresiding parents. Additionally, because no linking method yields samples free of any selection bias, our results apply only to couples in the data set and the processes at work on those couples, not necessarily to all couples in the wider population (Frick 1998).

Table 4 shows the main results from Poisson regression models. To ease interpretation, we present incidence rate ratios, which show the relative change in the number of children for a one-unit change in the explanatory variable, if all other variables are held constant. Models 1, 2, and 3 show the changes in couples' fertility, child mortality, and net reproduction between 1900 and 1910, respectively. We limit the display of model coefficients to variables associated with kin and servant availability, and focus our discussion on their potential influence on couples' reproduction. Briefly, however, the incidence rate ratios for independent variables not shown in Table 3 are consistent with results from prior studies of reproduction and child mortality in the early twentieth-century United States (Dribe et al. 2014, 2020; Hacker and Roberts 2019; Morgan et al. 1994; Preston et al. 1994; Preston and Haines 1991). Women married to farmers, for example, experienced a higher rate of births, lower rate of child deaths,

and higher net gain in the rate of living children than women whose spouses worked in other occupations. Urbanization and population size of urban areas were negatively correlated with fertility and positively correlated with child mortality. Literate women married to literate men had a lower rate of births than illiterate women, but their children were less likely to die between the two censuses.

Nativity had a substantive association with fertility, as foreign-born women gave birth to 18% more children in the interval than did native-born women, all else being equal, but only a modest association with child mortality. Although evolutionary theory helps direct researchers' attention toward "ultimate" explanations of why reproductive behavior evolved in a way to contribute to enhanced evolutionary fitness (Stulp and Sear 2019), we should not lose sight of proximate explanations that may have greater substantive influence on couples' reproduction. Full-model results are shown in Table A-1 in the online appendix.

Turning first to the analysis of kin and proximity in model 1, we find that women with coresident mothers-in-law had a 3.0% higher rate of births, all else being equal. In contrast, for married women with coresident mothers in 1900, the results suggest a 4.9% lower birth rate in the subsequent 10 years. Coresidence of fathers and fathers-in-law in 1900 was not associated with higher or lower birth rates. These results are consistent with several other studies of historical populations, and suggest that while both paternal kin and maternal kin may have wanted more grandchildren, maternal kin (particularly childbearing women's mothers) were more concerned about the negative health consequences (maternal depletion) and increased risk of maternal mortality from high rates of childbearing for their daughters (Dribe and Eriksson 2019; Sear and Coall 2011).

Results for surname kin density and nearby potential mothers-in-law were also consistent with expectations. Couples residing in enumeration districts with higher densities of paternal surname kin in 1900 had a higher rate of births in the subsequent decade than couples residing in districts with lower densities. The association was modest, relative to both other measures of kin proximity and other correlates of fertility (e.g., race, nativity, urban–rural residence, occupation, and literacy), but still statistically significant. For example, the results imply that couples residing in an area with a surname kin density of 20.0 per 1,000 (the mean surname kin density of couples in the top decile of the data set) had a 0.5% higher rate of birth between 1900 and 1910 than couples living in an area with no surname kin.[6] Couples living within five households of a potential mother-in-law had a 1.6% higher rate of childbearing than couples without a nearby potential mother-in-law. The result for female servants, however, was contrary to expectations, as having one or more coresident female servants was associated with a 9.9% lower rate of births in the following decade. Because the presence of servants was rare in the United States relative to England and was largely confined to wealthier households, we speculate that the finding may reflect a negative relationship between wealth and fertility not controlled for

[6] Predicted birth, mortality, and reproduction rates at selected adult kin density levels were made with the Stata *margins* command at the mean values for variables in the model (not shown). Because our measures of kin are mutually exclusive, it is possible to interpret the results simultaneously. As a check, we also constructed models with each measure included separately. These models yielded quantitatively and qualitatively similar results (not shown, but available on request).

**Table 4** Incidence rate ratios from Poisson regressions assessing relationships of demographic characteristics with fertility, child mortality, and net reproduction among currently married women in the 1900–1910 linked data set

| Measure | Fertility (1) | Child Mortality (2) | Net Reproduction (3) |
|---|---|---|---|
| Coresidence of Parents and Parents-in-Law | | | |
| None (ref.) | — | — | — |
| Mother coresident, 1900 | 0.951*** | 1.024*** | 0.949*** |
| Father coresident, 1900 | 0.993 | 1.048*** | 0.993 |
| Mother-in-law coresident, 1900 | 1.030*** | 1.020*** | 1.036*** |
| Father-in-law coresident, 1900 | 0.999 | 1.018* | 1.001 |
| Adult Surname Kin Density | 1.283*** | 0.160*** | 1.636*** |
| Nearby Potential Mother-in-Law | | | |
| None (ref.) | — | — | — |
| Nearby mother-in-law, 1900 | 1.016*** | 1.011 | 1.020*** |
| Coresident Female Servants | | | |
| None (ref.) | — | — | — |
| Coresident female servants, 1900 | 0.901*** | 0.994 | 0.910*** |
| No. of Children Ever Born, 1900 | 1.127*** | | |
| No. of Children at Risk to Die, 1900–1910 | | 1.360*** | |
| Proportion of Children Dying Prior to 1900 | | 2.393*** | |
| No. of Children Surviving, 1900 | | | 1.123*** |
| No. of Cases | 2,047,694 | 3,173,297 | 2,047,694 |
| Pseudo-$R^2$ | 0.084 | 0.207 | 0.075 |

*Notes:* Dependent variables include number of children born 1900–1910 (fertility model), number of children dying 1900–1910 (child mortality model), and net change in number of living children 1900–1910 (reproduction model). Other variables in the models include woman's age-group, literacy, nativity (native-born of native-born parents, second generation, foreign-born), labor force participation, and age difference from spouse; spouse's literacy, nativity, and occupation group; and residence type and population (rural, <2,500; urban, 2,500–9,999; urban, 10,000–99,999; urban, 100,000–499,999; urban, ≥500,000). Coresidence of parents, parents-in-law, and servants was measured in 1900. All models include county fixed effects and standard errors clustered at the enumeration district level. Incidence rate ratios are the exponentiated parameter estimates.

*Source:* Ruggles et al. (2020).

*$p < .05$; ***$p < .001$

in the model by spouses' occupation. The results may also reflect the effect of crowding or the possibility that women in the data set with coresident female servants were in poorer health than women without servants.

Most studies of natural fertility populations have found that the presence of a kin member in addition to the mother improves survival rates for children, with the childbearing woman's mother most consistently identified as beneficial to children's survival (Sear and Mace 2008). Unexpectedly, the results in model 2 show that coresidence of childbearing women's mothers, fathers, mothers-in-law, and fathers-in-law was associated with increased children's mortality (i.e., the coresidence of grandparents was associated with their grandchildren's mortality), supporting our suspicion that the small proportion of multigenerational families in the data set tended to be the result of negative selection factors. If coresident parents were burdens to childbearing

couples rather than sources of financial and physical assistance, their presence in the household would have had negative consequences for their grandchildren. Even if grandparents were able to provide some assistance, the beneficial results of their help could have been offset by their contribution to greater crowding in the household (potentially facilitating the spread of infectious diseases) and increased competition for household resources. Outside of the household, the expected positive association between kin proximity and child survival held. Although the nearby presence of a potential mother-in-law had no significant impact, children had lower mortality when their parents resided in an enumeration district with higher surname kin densities. All else being equal, a couple residing in a district with a surname kin density of 20.0 per 1,000 experienced a 3.6% lower rate of children's death than couples residing in a district with no adult surname kin.

The results for couples' net reproduction shown in column 3 closely parallel the results for the fertility model, as the presence of coresident mothers was associated with lower rates of net surviving children in the interval between the two censuses, and that of coresident mothers-in-law was associated with higher incidence rates. The results for the presence of nearby potential mothers-in-law and higher adult kin densities were also positive, closely following the results for the fertility model. Compared with couples with a zero surname kin density, couples residing in an enumeration district in the top decile of surname kin densities had a 1.0% higher rate of net reproduction.[7]

In Table 5, we use alternate model specifications and different selections of childbearing couples to highlight the potential differential influence of kin on reproduction between couples with coresiding older or younger parents, couples with low and high parity levels, and rural/farm and urban/nonfarm couples. Model 1 reproduces the results for model 3 in Table 4 for easier comparison. Model 2 examines whether net reproduction differs according to the age of coresident parents and parents-in-law. We define younger parents and parents-in-law as those younger than 65 in 1900 and older parents and parents-in-law as those aged 65 or older.[8] Our working hypothesis was that younger parents and parents-in-law would be more positively associated with reproduction than older parents and parents-in-law because of their presumed ability to provide more physical assistance to childbearing couples, while at the same time requiring less care for themselves. This hypothesis is consistent with findings that in preindustrial Finland, older mothers were less beneficial than younger mothers to their grandchildren's survival (Chapman et al. 2019). Our results do not support such

[7] In an attempt to shed light on possible selection factors, we constructed an alternate configuration for each model by replacing the measurement of parents, parents-in-law, female servants, and nearby mothers-in-law in 1900 with their measurements in 1910. In the fertility and reproduction models, the coefficients associated with coresidence in 1910 were significantly lower than the corresponding coefficients for coresidence in 1900 ($F$ tests for difference were significant at the .001 level). In the mortality model, the coefficients for coresidence of parents, parents-in-law, and servants in 1910 were in most cases significantly higher than the corresponding coefficients for coresidence in 1900. The impact of a nearby mother-in-law, however, remained approximately the same in all models. These results provide additional support for the hypothesis that the coresidence of married women with their parents and parents-in-law tended to be negatively selected.

[8] Using this definition, 32% of coresident mothers were "older," as were 47% of coresident fathers, 51% of coresident mothers-in-law, and 67% of coresident fathers-in-law.

**Table 5** Incidence rate ratios from Poisson regressions assessing relationships of demographic characteristics with net reproduction among currently married women in the 1900–1910 linked data set, by rural–urban residence and parity

| Measure | All Couples (1) | All Couples (2) | Rural/Farm Couples (3) | Urban/Nonfarm Couples (4) | Couples With Parity <3 in 1900 (5) | Couples With Parity ≥3 in 1900 (6) |
|---|---|---|---|---|---|---|
| Coresidence of Parents and Parents-in-Law | | | | | | |
| None (ref.) | — | — | — | — | — | — |
| Mother coresident | 0.949*** | | 0.967*** | 0.943*** | 0.939*** | 0.968*** |
| Father coresident | 0.993 | | 0.975 | 1.005 | 0.992 | 1.003 |
| Mother-in-law coresident | 1.036*** | | 1.042*** | 1.033*** | 1.043*** | 1.029*** |
| Father-in-law coresident | 1.001 | | 0.998 | 1.003 | 0.994 | 1.007 |
| Younger mother coresident | | 0.942*** | | | | |
| Older mother coresident | | 0.966*** | | | | |
| Younger father coresident | | 0.999 | | | | |
| Older father coresident | | 0.989 | | | | |
| Younger mother-in-law coresident | | 1.026*** | | | | |
| Older mother-in-law coresident | | 1.054*** | | | | |
| Younger father-in-law coresident | | 1.000 | | | | |
| Older father-in-law coresident | | 1.007 | | | | |
| Adult Surname Kin Density | 1.636*** | 1.620*** | 0.988 | 159.352*** | 1.548*** | 1.658*** |
| Nearby Potential Mother-in-Law | | | | | | |
| None (ref.) | — | — | — | — | — | — |
| Nearby mother-in-law | 1.020*** | 1.021*** | 1.015*** | 1.032*** | 1.021*** | 1.018*** |
| Coresident Female Servants | | | | | | |
| None (ref.) | — | — | — | — | — | — |
| Coresident female servants | 0.910*** | 0.916*** | 0.991 | 0.858*** | 0.929*** | 0.903*** |
| No. of Cases | 2,047,694 | 2,047,694 | 718,879 | 713,709 | 1,073,342 | 974,339 |
| Pseudo-$R^2$ | 0.075 | 0.076 | 0.061 | 0.060 | 0.093 | 0.055 |

*Note:* See Table 4.

*Source:* Ruggles et al. (2020).

***$p < .001$

a conclusion, as women with older coresident mothers-in-law had higher reproduction rates than women with younger coresident mothers-in-law ($F$ test for difference significant at the .001 level), and women with older coresident mothers had higher reproduction rates than women with younger coresident mothers ($F$ test for difference significant at the .01 level). We speculate that this unanticipated result could be related to the norms and desired family sizes of older parents, who were born earlier in the fertility transition than younger parents (see Anderton et al. (1987) for discussion of intergenerational cohort influences on fertility during the U.S. fertility transition). Alternatively, older mothers and mothers-in-law may have anticipated dying sooner than younger mothers and mothers-in-law and may have put more pressure on their children to produce grandchildren.

Models 3 and 4 show separate results for the rural/farm and urban/nonfarm populations. Although Table 3 indicated that married women in rural areas were more likely to coreside with their parents-in-law than with their parents, while married women in urban areas showed the opposite pattern, we found that the effect on reproduction of having coresident parents or parents-in-law, or having nearby mothers-in-law, did not differ between rural/farm couples and urban/nonfarm couples. In both populations, coresidence with mothers was negatively correlated with reproduction rates, while coresidence with mothers-in-law was positively correlated. One difference stands out, however: net reproduction was not associated with surname kin density among the rural/farm population, while the incidence rate for the urban/nonfarm population was positive and large, indicating that the influence of nearby kin on reproduction was confined largely to urban areas. Given higher population densities in urban areas and reduced travel times between households, we suspect that couples living in an urban location had more frequent kin interactions than couples in rural locations with similar surname kin densities.

Finally, we tested whether the impact of proximate kin and servants varied by parity. We hypothesized that couples with higher parities in 1900 were more likely to have met or exceeded their target family size, while couples at lower parities had not yet done so, all else being equal. In addition, we hypothesized that parents and parents-in-law with more grandchildren were less encouraging of subsequent births than parents and parents-in-law with fewer grandchildren. We therefore expected that the effect of kin would be more pronatal at lower parities. Stratifying the sample by parity, however, has the potential to separate couples who were intentional and successful family planners from couples who did not intend to limit their reproduction. The results, shown in models 5 and 6, were mixed. Among couples with two or fewer children in 1900, coresidence with a mother was associated with lower net reproduction rates over the decade relative to couples with three or more children. Coresidence with a mother-in-law, however, was associated with higher subsequent reproduction rates among couples with fewer children relative to women with three or more. Overall, the results indicate modest differences between low-parity and high-parity couples.

## Discussion and Conclusion

Researchers have demonstrated that kin play an important role in couples' reproductive success in a wide variety of contexts. Modern qualitative accounts show that kin

support a couple's reproduction by providing financial aid, physical assistance, and pronatal encouragement, and that couples articulate the importance of family support in their fertility decisions. When nearby kin are available for assistance, mothers are able to combine childbearing with work and reduce intervals between births while promoting child health and survival (Mace and Sear 2005; Sear and Coall 2011).

Despite its potential importance, the role of kin in demographic behavior is an understudied topic in historical demography, especially in Western contexts where the dominant nuclear family system meant that the vast majority of kin lived in different households, rendering them invisible in traditional data sources. Although there are a few exceptions (Dribe and Eriksson 2019; Hacker and Roberts 2017; Jennings et al. 2012; Rotering and Bras 2015), research on kin and reproduction in Europe and North America has focused on the period prior to the demographic transition (circa 1870–1930). This is unfortunate, because the long-term decline in kin proximity accompanying economic modernization likely played an important role in the fertility transition (Jaadla et al. 2020; Nelson 2020; Newson et al. 2005).

We relied on a linked data set of more than 3.1 million couples enumerated by the 1900 and 1910 U.S. censuses to examine the impact of kin on couples' reproduction. Unique information available in both censuses—the number of children ever born to each woman and the number of those children still surviving at the time of each census—allowed us to examine couples' fertility, child mortality, and net reproduction separately. Complete-count data sets for both census years also allowed us to construct new measures of paternal kin proximity outside the household. The results provide strong support for the kin influence hypothesis. Couples residing in areas with higher density surname kin networks in 1900 subsequently had more children, fewer child deaths, and higher net reproduction than couples residing in areas with lower density surname kin networks or no surname kin. We also found support for the grandmother hypothesis. Women who resided within five households of a potential mother-in-law in 1900 subsequently gave birth to more children and had more surviving children than women not residing near a potential mother-in-law.

Our results for coresiding parents and parents-in-law were less consistent and less conclusive, likely because coresidence of couples with their parents was rare and tended to be negatively selected. In most models, coresidence of a childbearing woman in 1900 with her mother, father, mother-in-law, or father-in-law was associated with higher mortality among her children in the subsequent decade. Coresidence with mothers in 1900 was also associated with lower subsequent fertility. Coresidence of a childbearing woman with her mother-in-law, however, was associated with higher subsequent fertility and net reproduction, consistent with expectations. These results are consistent with those of previous studies that stress the emergence of different strategies among maternal and paternal kin. Maternal kin are believed to have been more worried than paternal kin about the physical costs of high fertility borne by mothers (Sear and Coall 2011).

A shortcoming of this study, of course, is the lack of data on maternal kin outside of the household, which limits our investigation of the impact of kin outside the household to paternal kin and increases the potential for omitted variable bias. Another shortcoming is our inability to link approximately 40% of married couples across both censuses, which may impart some bias to the results. Nonetheless, our results, which are based on *changes* in the reproduction of linked couples between

the two censuses, confirm that kin were an important factor in couples' reproductive success and suggest that the long-term decline of kin availability likely played a contributing role in the transition to smaller families. ■

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