Published in final edited form as:

Hist Fam. 2010 October 29; 15(4): 370–385. doi:10.1016/j.hisfam.2010.09.003.

Fertility control in historical China revisited: New Methods for an Old Debate

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Abstract

We revisit the debate over deliberate control of reproduction in historical China through a reanalysis of data from the Qing (1644–911) Imperial Lineage that accounts for physiological or other differences between couples that affected their chances of having children. Even though studies of contemporary and historical European fertility suggest that failing to control for such differences may obscure evidence of parity-specific control, previous studies of historical Chinese fertility have not accounted for them. We show that in the Lineage, failure to account for such differences leads the association between number of children already born and the chances of having another birth to appear to be positive, but that once they are accounted for properly, the relationship is inverted. Based on this, we conclude that lineage members adjusted their reproductive behavior based on the number of children. We also show that the sex composition and survival of previous births affected reproductive behavior. We conclude by suggesting that one way forward in the ongoing debate over fertility control in historical China is through application of such methods to other datasets and comparison of results. We also suggest that progress in the debate over fertility in historical China has been impeded by confusion over the definition of fertility control, so that some behaviors are recognized as fertility control by some parties in the debate but not others.

Keywords

fertility; reproduction; China; demography; Qing dynasty; family; lineage; genealogy

1. Introduction

Whether and how couples in China deliberately regulated their fertility before the late twentieth century remains the subject of intense debate (Engelen 2006). Some scholars argue that marital fertility in China was not only lower than in Europe, but that the number, sex

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composition, and spacing of births was subject to deliberate control (Campbell, Lee and Wang 2002; Han 2007; Lee et al. 2002; Lee and Wang 1999; Li, et al. 2004; Wang and Li 2002; Wang et al. 1995; Zhao 1997, 2002, 2006). Other scholars argue that even if levels of marital fertility in China were lower than in Europe, reproduction was not subject to deliberate control, and whatever difference existed was the unintended consequence of other factors such as malnutrition-induced subfecundity, amenorrhoea associated with extended breastfeeding, low coital frequency or else a spurious artifact of measurement issues related to differences in average age at first marriage (Brenner and Isett 2002; Cao and Chen 2002; Chuang et al. 2006; Huang 2002; Kok et al. 2006; Lavelly 2007; Wolf 2001; Wolf and Engelen 2006, 2008). The debate is now stalled because while there is general agreement about the levels and patterns of fertility in empirical results, disagreement continues as to whether these levels and patterns constitute evidence of deliberate control (Engelen 2006).

To advance this debate and suggest a way forward, we introduce a new approach and reexamine the vital records of the Qing Imperial Lineage for evidence of deliberate control over reproduction using methods that account for persistent but unobserved differences between couples in the chances of having birth. Specifically, we test for evidence of deliberate fertility behavior among couples in monogamous marriages according to the number, sex composition, and mortality of previous births by estimation of discrete-time event-history models that include random- and fixed-effects. These models account for the likelihood that couples differed systematically in their chances of having a birth for reasons related to physiology, the marital relationship, or other unobserved factors. Lee and Campbell (1997), Wang, Lee, and Campbell (1995), Kok, Yang and Hsieh (2006) and other studies of fertility behavior in historical China that applied event-history analysis to longitudinal, individual-level data, did not account for such unobserved variation.

Studies of fertility in historical Europe have confirmed the existence of such variation in past times and the importance of controlling for it (Van Bavel 2004ac; Van Bavel and Kok 2010). Failure to account for such heterogeneity in the study of fertility determinants may lead to biased estimates of effects of right-hand side variables (Heckman, Hotz, and Walker 1985). Most relevantly, if women or couples vary substantially in the chances of having a birth for physiological or other reasons, event-history analysis will suggest that couples who already have children are if anything more likely to have additional children, and conceal evidence of fertility limitation based on the number or composition of children.

We consider the possibility of deliberate fertility control according to the number, sex composition, and survival of previous births. We begin by investigating parity-specific behavior. We show that once unobserved differences between couples in the underlying likelihood of having births is accounted for, there is strong evidence of parity-specific fertility behavior. For any given woman, additional births substantially reduce the pace of subsequent childbearing. We also consider fertility according to the sex composition and mortality of previous births among couples in monogamous marriages. We demonstrate that both had powerful effects on the timing of subsequent births in the imperial lineage, and that the patterns of effects appear most consistent with deliberate control.

Our goal is to demonstrate that accounting for underlying physiological or other differences between couples that affect their reproduction will advance the debate over fertility control in historical China. The results here will not resolve the debate, since we apply them to a distinctive and unrepresentative population. By demonstrating through application of these methods to fertility data in the Qing Imperial Lineage that unobserved differences between couples in underlying fertility propensities are an important confounding factor to consider when studying the relationship between the number of children already born and the chances of having another, and that accounting for these unobserved differences yields patterns

suggestive of parity-specific control that are almost the opposite of the ones apparent from application of the methods used in previous studies, we hope to spur application of such methods to existing datasets covering other historical Chinese populations. Replication and comparison should clarify whether and how couples in historical China limited their fertility, and under what circumstances.

We divide the remainder of the paper into four parts. In part one, we provide background, identifying what we believe are key empirical and definitional that have impeded progress in the debate on fertility control in China. We outline different possible forms of fertility control and specify the patterns in the results of an analysis that would be consistent with each. We review the evidence in previous contributions to the debate to confirm that the approach used here could be applied to data for other historical Chinese populations. In part two, we introduce the data, the vital records of the Qing Imperial Lineage. Our discussion is brief, focusing primarily on issues relevant to analysis of fertility, since the data are described in detail elsewhere (Lee et al. 1993; Lee et al. 1994; Wang et al. 1995; Lee and Wang 1999). In part three, we introduce our approach, discrete-time event-history analysis by means of fixed- and random-effects logistic regression. In part four, we present results from the application of these methods. We show that once underlying and unobserved differences between couples in the propensity to bear children are properly accounted for, there is clear evidence of parity-specific control of reproduction in the Qing Imperial Lineage. We conclude with remarks about the implications of our findings for the debate on fertility control in historical China.

2. Background

2.1 Fertility control

We begin by specifying precisely what we mean when we refer to fertility control. Our definition is much broader than the classic one that emphasizes the difference between natural fertility and parity-specific control (Henry 1961), and encompasses any deliberate behavior consciously intended to influence the number, sex composition, and timing of births. Our consideration of control based on factors other than the number of children already born is hardly novel, and there is already a large literature on fertility in the historical West and contemporary developing world that suggests roles for deliberate spacing, response to economic shocks, and so forth. Examples include Anderton and Bean (1988) and Van Bavel (2004a) on spacing, and Bengtsson and Dribe (2006) on responses to economic shocks. As for historical China, as noted in the introduction we and others have suggested elsewhere that there was deliberate fertility behavior in China that was not parity-specific. For the discussion here, we follow up on this earlier work and identify three forms of control related to targets for family size, targets for the sex composition of births, and responses to short-term conditions. For each, we briefly assess the evidence for their importance in historical China. We then specify the patterns of fertility differentials consistent with each form of control, and the patterns that would be expected in the results.

Even when there is agreement about the empirical evidence for specific fertility-related behaviors, there is disagreement about whether they are a form of fertility control. Proponents of the view that there was no fertility control in historical generally focus on parity-specify control, that is deliberate limitation after achieving a targeted number of children. Proponents of the view that there was fertility control in historical China tend to take a much more expansive view of the forms that fertility control could take, and include efforts to influence the timing of births and achieve goals for the sex composition of children as forms of fertility control aimed at achieving targets for the sex composition of children. Setting aside the question of which if any definition of fertility control is somehow the

correct one, the lack of a common definition for fertility control has added confusion to the debate.

Accordingly, we begin by presenting our definition of fertility control because lack of clarity about what each side in the debate regards as fertility control has impeded progress. We will argue that the core empirical disagreement is really about a specific form of fertility control, parity-specific control. We will suggest that debate about parity-specific control remains unresolved because parties have relied on circumstantial or indirect evidence to make their cases, and have not yet carried out refined tests like the ones in this study that are specifically designed to detect parity-specific behavior in individual-level data. We will also suggest that there is consensus about the empirical evidence that couples accelerated or delayed births according to the sex composition of their children, but this is not recognized as an area of agreement because of disagreement about whether this constitutes a form of fertility control.

2.1.1 Family size—The first form of fertility control that we consider is parity-specific control, in which couples who have reached a targeted family size seek to avoid additional births (Henry 1953, 1961). The crux of the debate about fertility control in historical China really seems to be about the prevalence of parity-specific control. Here and later we will suggest that the debate has persisted because the evidence on parity-specific control brought to bear by parties on both sides has been indirect and circumstantial, and that no published study represents a decisive and direct test for the existence of parity-specific control.

Perhaps the best-known approach for detecting parity-specific control in aggregate data on fertility is the index m (Coale and Trussell 1984). m can be calculated from age-specific rates and varies systematically according to the prevalence of such behavior (Coale and Trussell 1974). Parity-specific control deforms patterns of age-specific fertility rates in a characteristic way, and m measures the extent of the deformation. Estimated values close to 0 are taken as evidence that fertility behavior is independent of parity, and higher values are taken as evidence of fertility subject to parity-specific control. Estimates of m based on the age-specific fertility rates of pre-transitional Chinese populations are generally inconsistent with the presence of parity-specific variations in fertility behavior (Lavelly 1986, Lavelly and Freedman 1990). There are other well-known approaches proposed for the detection of control in aggregate data on fertility (Van Bavel 2004b), but to our knowledge they have not been applied to historical Chinese data.

Parity-specific behavior may also be investigated in longitudinal, individual-level data on reproductive histories by construction and comparison of indices such as age-specific rates, or application of techniques for event-history analysis. The earliest applications of event-history analysis to the study of fertility examined contemporary populations (Heckman, Hotz, and Walker 1985), but more recent applications have included historical populations (Bengtsson and Dribe 2006; Gutmann and Alter 1993, Mroz and Weir 1990; Tsuya, Wang, Alter, Lee et al. 2010; Van Bavel 2004ac). A number of studies of fertility in historical China have analyzed longitudinal, individual-level data, but as noted earlier, disagreement continues over the interpretation of results.

Whether the methods applied in previous studies of historical Chinese fertility would even detect parity-specific fertility control is unclear. In principle, the practice of parity-specific control should lead event-history analysis to reveal an inverse association between the number of preceding births to a couple and their chances of having an additional birth. However, if there are substantial physiological or other differences between couples in the chances of having children that the analysis does not account for, the number of preceding births might appear to be positively associated with the chances of another birth because it is

also acting as a proxy for the couple's underlying and otherwise unobserved propensity to have children. Such differences between couples could arise for any number of reasons. Some couples might have persistently higher or lower frequency of intercourse. For physiological or other reasons, couples might also differ in the likelihood that intercourse would result in conception, or that conception would lead to a live birth.

This study differs from previous efforts to detect parity-specific control in historical China because it accounts for the possibility that there were persistent differences between couples in the underlying chances of having a birth. Our approach is inspired by the one in Van Bavel's (2004ac) original analysis of historical European populations, but differs because as the section on methods will explain, like Van Bavel and Kok (2010) we apply a discrete-time approach. We also include open birth intervals. We specify four scenarios corresponding to possible combinations of heterogeneity or homogeneity in fecundity with presence or absence of parity-specific behavior, and identify the patterns of results expected under each scenario. In *Scenario 1*, there is no unobserved heterogeneity between couples and there is no parity-specific effort at control, and the number of children already born should have no influence on the chances of having another child. Accounting for unobserved heterogeneity between couples should make no difference. In *Scenario 2*, there is no unobserved heterogeneity between couples but there is parity-specific control. The number of previous births should be inversely associated with the chances of another birth. Introduction of controls for unobserved heterogeneity should have no effect. In *Scenario 3*, there is unobserved heterogeneity but no parity-specific control. Analysis that does not account for heterogeneity should reveal that couples at higher parities have higher chances of an additional birth, because the number of preceding births will act as a proxy for a couple's underlying propensity to bear children. Once heterogeneity is accounted for, there should be no effect of parity. Finally, in *Scenario 4*, couples differ in terms of the underlying chances of having a birth and practice parity-specific control. Analysis that does not account for heterogeneity may indicate a positive, negative, or non-existent relationship between parity and the chances of a subsequent birth, depending on how much heterogeneity there is between couples, and how strictly couples limit their fertility upon reaching their goal. Analysis that accounts for heterogeneity should reveal that the chances of an additional birth declines as parity increases.

2.1.2 Sex composition of births—A second, related form of fertility control may have been stopping or spacing to achieve goals for sex composition of births. It is possible that net of whatever targets parents had for number of children, or even in the absence of such targets, parents may have had goals for the sex composition of their births. Possible behaviors include accelerated births on the part of parents with no sons, delayed childbearing on the part of parents who had already achieved a targeted number of sons, or more complex strategies aimed at achievement of a particular mix or sequence of children by sex. Lee and Campbell (1997), Wang, Campbell and Lee (2005), Wang, Lee and Campbell (1995), Kok, Yang, and Hsieh (2006), Wolf (2001, 146–147) and Zhao (1997) all report evidence of such behavior in studies using data from a variety of Chinese sources. Since there seems to be some consensus about the empirical evidence that fertility behavior was influenced by the sex of previous births, debate here appears to reflect disagreement about whether such behavior should be thought of as fertility control.

We identify three different scenarios for fertility control related to the sex composition of children, and specify expected patterns of outcomes corresponding to each. In *Scenario A*, parents took no measures to achieve a particular sex composition for their children. The sex composition of previous births should have no effect on the chances of an additional birth. In *Scenario B*, parents seek to have one or male births, but do not seek to replace males who died. A higher proportion of previous births who are female should be associated with

higher chances of an additional birth, and the prior death of a son should have the same effect as the prior death of a daughter, most likely no effect. In *Scenario C*, parents actively sought to replace sons who died, but not daughters. Prior deaths of sons should be associated with higher chances of an additional birth, but prior deaths of daughters should have no effect.

As we will show later, even though there seems to be broad agreement that couples accelerated or delayed births according to the sex composition of previous births, parties in the debate come to completely opposite conclusions about whether such behavior was evidence of fertility control. For example, Wolf (2001, 146–147) cites the higher fertility rates of parents who have not yet had a son as evidence against the existence of fertility control. Kok, Yang, and Hsieh (2006) also report an association between the sex composition of previous births and the timing of the next birth, but do not appear to consider such behavior to be a form of fertility control. By contrast, Campbell, Wang, and Lee (2002, 743) claim that fertility variations according to the sex of previous children are evidence of one form of fertility control. Indeed, the parties in the debate seem to be talking past each other because of fundamental differences in their definition of control.

2.1.3. Responses to Short-term Fluctuations—There may have been deliberate spacing behavior intended to accelerate or delay the arrival of a next birth in response to short-term fluctuations in conditions, even in the absence of targets for the overall number or sex composition of children. Such fertility control may have been a short-term response to current economic or other circumstances at the community, household or individual level (Tsuya et al. 2010). There is some evidence of such behavior in historical China. In eighteenth- and nineteenth-century Liaoning, for example, fertility was responsive to current economic conditions, as reflected in grain prices (Lee and Campbell 1997; Wang, Campbell and Lee 2010). Here we do not address this particular form of fertility control.

2.2. Evidence

Evidence on fertility in China before the middle of the twentieth century comes primarily from analysis of population registers, lineage genealogies and large surveys carried out in the twentieth century. Sources differ in the completeness of birth recording, the availability of additional details about family and community context, time depth, and geographic coverage. The populations they cover are all peculiar in one way or the other, and none is representative of China in a formal, statistical sense. As will be apparent below in detailed, each source has known limitations that require assumptions about the representativeness of the covered and the appropriate adjustments to make to estimates to compensate for omissions. Given the geographic and temporal diversity of the populations covered and the differences in the format, quality and known limitations of the sources, it is remarkable that there is as much agreement as there is that levels of marital fertility were lower than in the West, and that debate focuses on the reasons for low marital fertility.

At least until recently, the population registers used in most studies were from Taiwan in the southeast and Liaoning in the northeast. The Taiwanese registers were compiled by Japanese colonial authorities between 1905 and 1945. They have been the basis of numerous studies by Arthur Wolf and collaborators (Chuang, Engelen, and Wolf, eds. 2006; Wolf 1995; Wolf and Huang 1980). The most notable features of the Taiwanese registers are their complete or nearly complete recording of births and their detail on family context. The Liaoning registers record hereditary tenants on state-owned land in Liaoning on a triennial basis from 1749 and 1909. They have been used in studies of fertility by James Lee and his collaborators (Lee and Campbell 1997; Wang, Campbell, and Lee 2010). The Liaoning registers are distinguished by their time depth, volume, and level of detail about household

context. Their primary shortcoming as a source for the study of fertility is that they omit many sons who died in infancy and childhood, and most daughters. Fertility rates estimated from the registers are adjusted for missing daughters and some assumed proportion of sons who died in infancy or early childhood and were omitted. Event-history analysis of fertility assumes that the chance of a son being omitted is independent of the right-hand side variables. Recently, a new database has been constructed from population and land registers from a county in Heilongjiang province in the last half of the nineteenth century (Chen, Campbell, and Lee 2005). It appears to have more complete recording of daughters than the Liaoning registers, and has already been used to study fertility (Chen, Lee, and Campbell 2010).

Most of the lineage genealogies used in studies of fertility in historical China were from coastal provinces, especially in the southeast. These genealogies typically recorded members of a lineage defined by patrilineal descent from a founder. Unlike the Qing imperial lineage genealogy used here and in Wang, Lee, and Campbell (1995) and Lee and Wang (1999), they were compiled retrospectively, with the information added in each new edition gathered from living family members. The shortcomings of private family genealogies as sources for demographic analysis have been known for some time. Most only record sons who survived to adulthood, and omit all wives and daughters, along with sons who died in childhood (Harrell 1987). Almost all published fertility estimates from genealogies consist of rates calculated from observed numbers of surviving sons that have been multiplied by an inflation factor that accounts for omitted daughters and some assumed proportion of sons died before they reached adulthood and were omitted. Estimates are sensitive to the choice of assumptions about the proportion of sons were omitted (Lee and Wang 1999). Comparison between household registers and genealogies that covered the same families revealed that genealogies may have other shortcomings as sources because of their selectivity in terms of the lineages for which genealogies are available and the lineage members who were recorded (Campbell and Lee 2002b). Even though concern about genealogies has focused on the possibility for the omission of sons who died before reaching adulthood to bias fertility estimates, there was a countervailing tendency for the omission of men who reached adulthood and married but had few or no children to bias estimates upward. In this context, the appropriate adjustment to make to fertility estimates from genealogies is unclear.

Survey data used in studies of fertility in historical China have broader geographic coverage, but only refer to the twentieth century. One of the best-known sources is the data from the Buck survey that was carried out in rural China from 1929 to 1931. Fertility estimates from these data were originally presented in Notestein and Chiao (1937). The data were later reanalyzed using indirect techniques of demographic estimation, and the resulting estimates suggested a relatively low level of marital fertility by the standards of historical populations (Barclay et al. 1976). Subsequently there was controversy about the estimates, and dispute over their implications for the level of marital fertility in historical China (Coale 1984, Wolf 1984). Large retrospective fertility surveys carried out in China in the 1980s have also been used to produce estimates of fertility levels and patterns before fertility began to decline in the 1970s (Lavelly 1986). Results are not consistent. Based on an analysis of retrospective fertility data, Zhao (1997) suggested that there was deliberate limitation in China before fertility declined. However, Lavelly (2007) used such data to argue that low marital fertility in China primarily reflected extended breastfeeding and low coital frequency, not deliberate control.

From this review, reasons are apparent for why debate continues about whether and how couples in historical China controlled their fertility. In addition to the lack of consensus over definitions alluded to earlier, there are underlying limitations associated with each of the

sources that open the way for continuing disagreement. First, some of the most commonly used sources, family genealogies and northeast Chinese household registers, omit individuals, requiring assumptions about the appropriate adjustments to make to produce fertility estimates. Whether an estimate of marital fertility is the same as or lower than a historical European population may have more to do with assumptions made to adjust for infant and child mortality than the data itself (Lee and Wang 1999, 85). Second, none of the available population registers or genealogies from before the middle of the twentieth century are nationally representative. Each covers a specific population, and it is unclear whether and how results from each generalize to China as a whole. Third, nationally representative data from large surveys only covers the twentieth century, and it is unclear whether and how results reflect patterns and levels in China before the twentieth century.

Another impediment to resolution of the debate has been that most of the methods applied to these sources only yield indirect and circumstantial evidence on the fertility intentions of couples, and have not been adequate to test directly for deliberate behavior. Many contributions to the debate have sought to divine couples' intentions from aggregate indices of fertility behavior, including age-specific patterns of marital fertility, mean lengths of birth intervals, and average ages at starting and stopping. The limitation of such approaches is that almost any observed pattern in age-specific rates and other aggregate indices may be consistent with multiple interpretations. For example, low age-specific rates of marital fertility have been variously and plausibly interpreted as evidence of deliberate control (Lee and Wang 1999), poverty and malnutrition (Wolf 2001), and extended breastfeeding and low coital frequency (Lavelly 2007).

Applications of regression-based event-history approaches that take advantage of the individual-level and longitudinal nature of the from Liaoning, Taiwan, and the Qing imperial lineage all suggest that couples acted deliberately to achieve goals for the sex composition of their births. In particular, results from these settings are suggest that parents sought to have at least one son, and slowed their pace of childbearing once they achieved that goal. In Liaoning in the eighteenth- and nineteenth-centuries, couples with daughters but no sons had their next child at a faster pace than couples with daughter and sons, and that couples that had sons but no daughters had their next child at a slower pace (Wang, Campbell, and Lee 2010, 311). Wang, Lee, and Campbell (1995) included linear regressions of lengths of closed birth intervals on characteristics of the mother at the beginning of the interval, and showed that birth intervals were shorter for couples who had not yet borne a son. The analysis did not make use of information from open birth intervals, and did not include time-varying covariates. Event-history analyses of fertility in Taiwanese household registers compiled in the first half of the twentieth century during the Japanese occupation reveals that couples had their next child at a slower pace if at least one of their children was male, but at a faster pace if the most recent birth was female (Kok, Yang, and Hsieh 2006, 228).

The sole published event-history analysis of which we are aware that directly addresses parity-specific control in historical China by examining the relationship between parity and the chances of having another birth actually suggests a positive association. In Taiwan, every additional children already born increased the hazard ratio of having another birth by 8 percent (Kok, Yang, and Hsieh 2006, 228). The authors raise the possibility that this reflected deliberate behavior on the part of at least some families, suggesting that the pattern could be "accounted for by the dominance of fertility-maximizing families among the high parities." (p. 230). As suggested earlier, such an association would also be consistent with underlying but unobserved differences between couples in the likelihood of conceiving and delivering births, possibly related to persistent differences between couples in health, nutrition, frequency of sexual intercourse, or length of breastfeeding. The results are not

conclusive about the presence of parity-specific control because they are consistent with *Scenarios 3* and *4* outlined earlier, in which heterogeneity between couples generates a positive association between parity and the chances of having another birth. Previous studies using data from Liaoning and the Qing Imperial Lineage have not included the total number of children already born as an explanatory variable.

This review helps define the terms of debate and clarifies the potential of the methods applied in this study to advance the debate over fertility control in historical China. Most importantly, the continuing debate over whether there was fertility control really seems to be a debate about whether there was parity-specific control. We suggest that the debate about parity-specific control has continued because none of the tests have been decisive. Most prior contributions to the debate over fertility behavior in historical China relied heavily on examination of aggregate indices of fertility behavior such as age-specific or total marital fertility rates, average ages at stopping and starting, and mean birth intervals. Patterns in such indices are open to multiple interpretations, and definitions of fertility control varied, so that in some cases, the same quantitative evidence was cited by both sides in the debate as support for their account. Even though a variety of sources of longitudinal- and individual-level data exist in the form of datasets constructed from family genealogies and population registers, and almost all of them would allow for an analysis similar to the one in this study, only a few studies have applied event-history analysis or other regression-based techniques that take full advantage of such data. Only one study directly addressed the question of parity-specific control (Kok, Yang, and Hsieh 2006), and it did not account for the unobserved differences between couples that are the central focus of this study.

Results from these studies on the effects of the sex of previous births almost all suggest the presence of one form of fertility control: couples engaged in some kind of deliberate behavior to influence the sex composition of their children.

3. Data

Here we only review key features of the vital records of the Qing Imperial Lineage that relate to fertility, since these data have been described in detail elsewhere and their strengths and weaknesses discussed at length (Lee and Wang 1999, 2000; Lee, Campbell and Wang 1993; Lee, Wang, and Campbell 1994; Lee, Wang and Ruan 2001; Li and Guo 1994; Wang and Lee 1998; Wang, Lee, and Campbell 1995). The most important feature of these data relevant to this analysis is that they provide the most complete and detailed recording of fertility in any Chinese population before the twentieth century. In contrast with all other sources from before the twentieth century, almost all male and female births are recorded, even those that died in the first days of life. From the middle of the seventeenth century until just before the end of the nineteenth, the sex ratio of recorded births was 1.08. In almost all historical Chinese demographic sources, female births are more likely to be omitted than male births, thus if there is systematic under-recording of births, it tends to be immediately apparent in a skewed sex ratio. There are no historical Chinese sources of which we are aware that omit large numbers of births, but do so in equal proportions for boys and girls, leaving the observed sex ratio at birth unchanged. Thus based on the closeness of the observed sex ratio to the natural sex ratio at birth, we can be reasonable confident that results for the determinants of the numbers of recorded births really reflect differences in fertility, not differences in infant and child mortality or other factors that affected the likelihood of being recorded in other sources.

The data do have features that have implications for design of the analysis. First of all, the analysis only considers couples who had at least one child over the course of their lifetime. Even though the lineage genealogy recorded daughters more completely than in any other

source for China before the twentieth-century, it only recorded wives if they gave birth to at least one child. It is primarily in their role as mothers of lineage members that the wives of male lineage members were recorded in the genealogy.

Second, we proxy age of mother with duration since the couple's first birth since the data do not provide mother's age at marriage, age at birth, or age at death. This approach is reasonable because every analysis of female age at marriage in China before the middle of the twentieth century suggests that it was highly modal, and highly concentrated in the late teens or early twenties (Lee and Campbell 1997). Ninety percent of daughters born into the lineage were married by the time they were 25 (Wang, Lee and Campbell 1995, 386). For the 214 lineage wives for whom we can calculate ages at marriage from linked supplemental data, the average age at marriage was 20.2, and 90 percent married between the ages of 15 and 25. While another approach would have been to follow Wang, Lee and Campbell (1995) and proxy mother's age with father's age, mother's age at marriage was so much more concentrated than father's age at marriage that we believed that duration since first birth would be a closer approximation.

A third, related issue is that we cannot censor observations of couples upon the death of the wife because the data do not provide the dates of their deaths. Accordingly, the analysis treats all couples as at risk for thirty years from the time of their first birth. Censoring events include death of a husband, for which we have precise dates, and cessation of the registration system in 1921. As long as married female mortality risks are primarily a function of age, the major implication of the inability to censor mother's observations following their death should be that estimates of the coefficients for effects of duration will have a negative bias. The magnitude of such bias may be substantial. In the subset of imperial lineage daughters for whom complete recording of death was available, only 62.6 of women aged twenty survived to age 40, and only 54.3 percent would survive to age 50. Mortality risks may also be related to parity, but the magnitude of effects should have been relatively minor compared to the effects of age, and the expected direction of effects is ambiguous. While the childbirth process itself may increase a woman's risk of dying, analyses of Liaoning household registers have shown consistently that the presence of surviving sons decrease a woman's chances of dying (Campbell and Lee 1996; Campbell and Lee 2002a).

Because we have information on dates of death for a small subset of the mothers in the imperial lineage, we can assess empirically the implications of not having dates of death for most mothers. These auxiliary data come from applications for funeral expense subsidies filed by their children that were archived and which we have coded and linked. They allow us to construct a subset of mother person-month observations consisting of women who had their first birth by 1880 for whom we have a recorded date of death that excludes all observations from after their death. In our examination of parity-specific behavior, we re-estimate our models using this subset to confirm that results for effects of parity are not an artifact of an association between reproduction and mortality risks.

A fourth issue to be taken into account is that as a result of widower remarriage and polygyny, many of the men recorded in the vital records of the Qing imperial lineage had more than one wife. Thus while 49.1 of the 18,361 men in the lineage who survived to at least age 30 had only one wife, 22.3 percent had two, and 4.6 percent had three or more.¹ Men were most likely to have multiple wives in the early days of the dynasty when the

¹Based on authors' calculations. The remaining 16.6 percent either did not marry, or married but were childless, resulting in the omission of their wives from the records.

lineage was smaller and resources more abundant. Of the men born by 1740 who survived at least to age 30, 36.5 had one wife recorded, but 57.6 had two or more.

Because we do not have dates of marriage and death for the wives of most of these men, we cannot distinguish between polygyny and widower remarriage in accounting for the presence of multiple wives. Accordingly, we restrict analysis to monogamous men, that is men who only have one wife recorded in the vital records.

Finally, there is some deterioration in the quality of recording toward the end of the nineteenth century (Lee, Campbell, and Wang 1993; Lee, Wang, and Campbell 1994; Wang, Lee, and Campbell 1995). While the sex ratio of births before 1880 is 1.08, close to a natural sex ratio at birth, the sex ratio of births after 1880 is 1.67. After 1880, in other words, there seem to be substantial omissions of records of daughters. While recording of infant and child deaths appears complete until at least 1840, results from the previous studies listed above suggest that deaths after that year are undercounted. For each of our analyses, accordingly, we not only carried out estimates using the full data, we also carried out additional estimates on subsets ending in 1840 and 1880 to assess whether results apparent in the analysis of the full dataset are not artifacts of the problems that emerged in the last part of the nineteenth century. The results from this confirmatory analyses were nearly the same as the ones from the analysis of the complete dataset, thus here we only present results from the analysis of the complete data.

4. Methods

To test hypotheses about fertility control as a function of parity, sex composition, and mortality of previous births, we apply discrete-time event-history analysis. We estimate logistic regressions on a constructed dataset composed of person-month observations of couples. Our primary file includes person-months for all couples starting from the time of their first birth and continuing for 30 years, or 360 months. In this primary file, we censor reproductive histories by excluding observations for person-months after the death of the father, or after the last update of the genealogy in 1921. We also exclude observations for each couple in the nine months after their most recent birth on the grounds that it should not be physiologically possible to have a birth in that time. As noted earlier, we also construct a subset consisting of observations of mothers for whom we have dates of death, in which observations from months after her death are excluded.

As noted earlier, we proxy mother's age with duration since first birth. In historical China, female age at marriage was highly modal, heavily concentrated around age 20, and duration since first birth should accordingly capture the physiological effects of aging on the chances of having a child. We model duration with a set of categorical variables corresponding to 2–4 years since first birth, 5–9 years, and so on up to 25–29 years. The omitted category is 0–1 years.

To capture the possible effects of postpartum amenorrhea on fertility chances, whether as a result of extended and intensive breastfeeding or other factors, we also include measures of duration since most recent birth. The categories correspond to 2 years since most recent birth, 3 years, 4 years, and 5 or more years. To allow for the possibility of an early cessation of amenorrhea and elevated risk of conceiving as a result of the death of the most recent birth, we include an interaction term to identify observations in which less than 24 months had elapsed since the most recent birth and that child is now dead.

Our variables describing reproductive history are straightforward. Most are categorical. This accounts for the possibility that effects may be non-linear. When we estimate models that include information for couples at all parities, we include categorical variables for parity,

that is the total number of children born so far to the couple. Since the data restricts us to consider couples with one or more births, the omitted category is one birth. In analyses that use the primary dataset that includes all couples, parities eight and higher are collapsed together. In the analyses that use the subset of couples for which wife's date of death is available, parities six and above are collapsed together.

Our approach differs slightly from the one in Van Bavel and Kok (2010). What we refer to as parity is equivalent to the count of children ever born also included by Van Bavel and Kok (2010) in their estimate. They treat children ever born largely as an indicator of fecundity, and for evidence of deliberate behavior according to current family size, they focus on an interaction between marital duration and the number of surviving children. We also consider children ever born to be a proxy for fecundity, and take as evidence of control any observed shift in the direction of the effect of parity or children ever born in response to introduction of a control for unmeasured heterogeneity. However, we follow an alternative approach to assessing deliberate behavior according to current family size and sex composition, testing directly for replacement of children who have died, as we describe below.

To test for replacement effects, we include separate categorical variables for counts of previous male and female births that have already died. For both male and female deaths, zero is the omitted category. We expect that if apparent replacement effects were an artifact of an underlying physiological process, for example a tendency for some couples to have births at short intervals and thereby increase the risk of dying for the children already born, there should be no difference in the effects of previous male or female deaths on the chances of having a birth. If parents replaced sons who died, however, increases in the number of boys who died should increase the chances of having a child, while increases in the number of girls who died should have no effect. Differences by sex in the effects of a loss of child, in other words, should indicate deliberate replacement behavior.

To test for behavior that targets the sex composition of births, we include a continuous variable measuring the proportion of previous births that are female. If parents systematically sought sons, a higher proportion of previous births that were female should be associated with higher chances of having an additional birth. If parents were indifferent to the sex composition of their children, the proportion of previous births that were female should have no effect. Admittedly, this single variable does not capture the possibility of more elaborate preferences on the part of parents, for example, that they may have wanted a mix rather than a preponderance of males.

To account for heterogeneity among couples, we take a variety of approaches. To assess the extent of heterogeneity, we estimate a model with a random effect of couple, similar to the one in Van Bavel and Kok (2010) and other analyses. The distribution of couple-specific effects is assumed to be normal, and one of the parameters estimated in the model is the variance of the distribution of couple-specific effects. This estimated variance in turn yields an estimate of the 'within-couple' correlation in the chances of having another birth. The estimate does require an assumption about the distribution of couple-specific effects. While a normal distribution is certainly plausible, we do not have any strong priors about the shape of the distribution.

To assess parity-specific behavior while controlling for heterogeneity among couples without making any assumptions whatsoever about the distribution of couple-specific effects, we go on to estimate models with a fixed effect of couples. In such an approach, each couple is allowed to have its own underlying and unmeasured propensity to have births that remains constant over their entire reproductive career. In other words, each couple has

its own intercept, which is not estimated, and about which there are no distributional assumptions. Coefficients reflect comparisons among births to the same couple, and are net of effects of their underlying propensity to have births.

With this approach, coefficients for parity should uncover whatever systematic relationships existed among birth intervals at different parities, holding constant the underlying propensity to have births. If couples did not alter their behavior according to their parity, then coefficients for different parities should be zero, and variation in birth timing should be accounted for entirely by duration since first birth. If couples spaced births further apart or were more likely to cease childbearing altogether as they attained successively higher parities, that should be revealed in a pattern of increasingly negative coefficients as parity increased. We do give something up, however, when we estimate a fixed effect model: we are restricted to using data from couples who had at least one more birth after their first one. Furthermore, inclusion of a fixed-effect for couples precludes inclusion of explanatory variables such as measures of socioeconomic status that are constant across all the observations of a couple.

To investigate how the factors that affected fertility control may have varied by parity, we also estimate separate models by parity that include the length of the previous birth interval as an explanatory variable measuring the couple's propensity to have a birth. Our specific interest is to test whether selection effects based on heterogeneity play a more important role at higher parities than at lower parities. If there was pronounced heterogeneity among couples in the chances of having a birth, the higher parities should be dominated by couples whose fertility is less a product of deliberate control and more a product of physiology, or whatever other underlying factors accounted for persistently high probability of having births. Thus we expect that at higher parities, sex composition and mortality of previous births will matter less, and length of the previous birth interval will matter more.

5. Results

5.1 Parity-specific control

Heterogeneity between couples is suggested by the pattern of differentials in birth probabilities according to parity in a model that does not account for heterogeneity. Table 1 presents results from a basic logistic regression in which the chances of having a birth are related to duration since first birth, parity, and other characteristics of the couples. This model does not account for the possibility that couples differed in their underlying propensity to have births. According to these results, couples who have had births at a rapid pace in the past have an additional birth sooner than couples who have had births at a slower pace. The pattern is similar to the one reported for Taiwan by Kok, Yang, and Hsieh (2006). For example, comparing couple who are identical on all the explanatory variables except number of children already born, the odds that a couple that has already had three births will have another are 2.28 times those of a couple that has only had one birth. The pattern is consistent with *Scenarios 3 or 4* specified in the earlier discussion of implications of different combinations of heterogeneity and control, but does not resolve between them. The pattern persists when analysis is restricted to the subset of observations where the mother's date of death is available.

The source of the heterogeneity is unclear. There is likely to have been some physiological variation between couples in fecundity, so that holding coital frequency constant, some couples may have been more likely to conceive than others. Of course, there may have been other sources of heterogeneity. In particular, some couples may have had persistently higher coital frequency than others, whether because of variations in libido, opportunity, alternatives, or preferences for longer or shorter birth intervals. Such a pattern would even

be consistent with the coexistence of subpopulation stopping births after achieving a particular target with another subpopulation in which ‘natural’ fertility prevailed. In such a situation, selection effects would lead high parity couples to consist disproportionately of women who were not practicing stopping.

Results from estimation of a model with a random effect of couple confirm the existence of a within-couple correlation in the chances of having another birth. For the dataset consisting of all observations, the within-couple correlation (ρ) was 0.139, and statistically significant at the 0.001 level. For the subset for which dates of mother’s death were available, the within-couple correlation was smaller, 0.076, but nevertheless statistically significant at the 0.001 level. The smaller magnitude reflects the absence from the subset of women who are dead and therefore unable to conceive. In both cases, models excluded the categorical variables for parity and numbers of deaths of previous children, since they are likely to have been correlated with the random effect. Since the basic pattern of results for duration and other variables are essentially the same as in table 1, we do not present them here.

Controlling for heterogeneity among couples by introduction of a fixed effect of mother completely transforms the picture of parity-specific behavior. The results are most consistent with *Scenario 4*, in which there is heterogeneity between couples, and parity-specific control. According to the results in Table 2, the probability that a couple would have an additional birth declined dramatically as parity increased. For example, the odds that a couples at a given age who already had three children would give birth to another were 0.058 ($e^{-2.850}$) those of what they would be if they only had one child. This is the exact opposite of the pattern apparent when there is no accounting for heterogeneity. This reversal in the apparent effects of number of previous birth is exactly as suggested in *Scenario 4*. In the absence of an accounting for heterogeneity, the number of previous births is positively associated with the likelihood of an additional birth because it is acting as a proxy for the otherwise unobserved physiological or other propensity of the couple to have children. Once heterogeneity is accounted for, and comparisons are between births to the same couple, the number of previous births is inversely associated with the chances of having another one.

Such results suggest strongly that there was parity-specific fertility control in the Qing imperial lineage. Several different scenarios for control might account for such patterns, and from these results alone it is not possible to identify which. It may be that couples did not practice stopping based on targets for specific number of births, but deliberately spaced births further and further apart as the number of children they had increased. Alternatively, couples may have practiced stopping, but may have had different targets for their total number of children. Finally, couples may have practiced a mixture of strategies.

5.2 Sex composition of previous births

Review of results in Tables 1 and 2 confirms that parents exercised fertility control according to the sex composition of their previous births. The results are consistent with the ones for effects of sex composition reported in Wang, Campbell, and Lee (2010), Wang, Lee, and Campbell (1995), and Kok, Yang, and Hsieh (2006). For example, according to the results in Table 1 for the dataset that includes all observations, a couple whose prior births were all female was 1.18 ($e^{0.163}$) times more likely to have a birth than a woman whose previous births were all male. The effect is even stronger in the results from the fixed effects model in Table 2, at least in the estimates using all observations. A woman whose previous births were all female was 1.33 times more likely to have another birth than if her prior births were all male. In contrast with Wolf (2001, 146–147), and consistent with our broader definition of fertility control, we suggest that such differentials reflect deliberate behavior that may be thought of as a form of fertility control. Thus results do not address sex-

selective replacement fertility, thus we cannot yet distinguish between *Scenarios B* and *C* outlined in the earlier discussion of patterns consistent with different approaches to targeting sex composition of births.

As to why it is that the effect changes direction and becomes insignificant in the fixed effect model estimated on the subset of observations for which date of death were available, it is likely a selection effect. The applications for funeral expenses that were the source of mother's death dates were often filed by their sons. The women for whom we have death dates, in other words, are disproportionately likely to have had sons. For that reason, when we consider effects of sex composition and mortality of previous births, we restrict analysis to the results from the model that uses observations from all mothers.

5.3 Replacement fertility

There is unambiguous evidence in Tables 1 and 2 that parents sought to replace sons they had lost, but not daughters. In other words, parents' approach to targeting sex composition included replacement of sons who had died, as specified earlier in *Scenario C*. According to Table 1, the loss of one son increased the odds of having another child by 24.6 percent. The loss of two sons increased the odds of another child by 35.9 percent. By contrast, the loss of a single daughter increased the odds of another child by only 13.2 percent. The loss of two or three daughters actually had less effect than the loss of a single daughter, perhaps because in such cases, the deaths were more likely to be the result of infanticide, which was practiced in the imperial lineage (Lee, Wang, and Campbell 1993), and predictive of a desire by parents to limit their fertility. These effects are above and beyond whatever physiological effect there was of the death of a recent birth and early resumption of menses, since the model includes an indicator of whether or not the mother is within two years of a previous birth that has died.

5.4. Differences by parity

To assess how the importance of control evolved as a function of parity, we estimated separate models for each parity. Table 3 presents extracts from the results that summarize the effects of sex composition and mortality of previous births, and length of the previous birth interval. According to these results, control was most evidence at earlier parities. Effects of sex composition and mortality of previous births were generally significant, while effects of the length of the preceding birth interval were weak. At later parities, however, effects of sex composition and mortality declined, and associations with the length of the previous birth interval became stronger. One interpretation is that the population was divided between controllers and non-controllers. Controllers may have dominated the lower parities and because of a tendency to have fewer births overall, never reached the higher parities. The higher parities were accordingly made up largely of couples that had births regardless of circumstances, and for whom the best predictor of the chances of a future birth was simply their propensity to have births, as measured by the length of their preceding birth interval.

6. Conclusion

In this analysis we have revisited the issue of fertility control in the Qing imperial lineage, taking advantage of advances in statistical methodology to carry out a more refined analysis than was possible in Wang, Lee, and Campbell (1995). Inspired by Van Bavel (2004ab), we have estimated models that demonstrate that after heterogeneity between couples is accounted for, there is strong evidence of parity-specific spacing or stopping behavior. For any given couple, higher parities are associated with lower chances of an additional birth. To our knowledge, this is the most direct test for parity-specific control yet applied to data for a

historical Chinese population. Analysis by parity revealed that deliberate fertility behavior was most apparent at lower parities, while fecundity, as reflected in prior birth intervals, accounted for variation in chances of having a birth at higher parities.

Consistent with prior studies focused on the effects of sex composition on reproduction (Kok, Yang, and Hsieh 2006; Wang, Campbell, and Lee 2010; Wang, Lee, and Campbell 1995), there was also strong evidence of deliberate fertility behavior according to the sex composition and mortality of previous births. The results were consistent with a desire by parents to achieve a minimum number of sons, and replace sons they had lost. Since similar results have been reported previously, we do not claim that the ones here are novel.

Even though the Qing imperial lineage was an unusual population, we believe that these results have implications for our understanding of fertility behavior in historical China. The methods that lineage members used to limit their fertility, whether reductions in coital frequency or some other approach, are hardly likely to have been a secret known only by members of the lineage. Other segments of society may have been aware of such methods, and may have practiced them. Whether or not the parity-specific behaviors revealed here were prevalent or rare in other historical Chinese populations is an empirical question, and can only be resolved by additional studies for other locations and time periods.

We have also sought to highlight the role of differences in definitions of fertility control in the continuing debate over fertility in historical China. Specificity on the part of the participants in the debate about what fertility control means would help crystallize the discussion and clarify which disagreements are substantial and revolve around empirical findings, and which are ephemeral and turn on confusion over definitions. Broadly speaking, proponents of the view that there was no fertility control appear to emphasize the role of parity-specific control, while proponents of the view that there was fertility control have a much broader definition. We suggest that the most important unresolved empirical debate is the one over parity-specific control because most tests for it have not been definitive, and results have been open to multiple interpretations. There appears to be consensus that fertility behavior varied according to the sex of previous births, and reflected desire by couples to achieve goals for sex composition of their children, but disagreement about whether such behavior should be considered fertility control. Given the lack of a common definition of what forms of behavior constitute fertility control, and the likely difficulty of reaching a consensus on one, we suggest that parties in the debate all specify which more precisely the type of fertility control to which they refer when interpreting results.

Replication of this analysis in other historical Chinese populations and comparison of results might finally resolve the longstanding debate over whether couples controlled their fertility, and what forms fertility control took. Datasets exist for a variety of historical Chinese populations that would support analysis like the one here that accounted for heterogeneity between couples. Population registers from Liaoning and Shuangcheng would allow for discrete-time event-history analysis via random- or fixed-effects logistic regressions like the ones here. Data in the Taiwanese population registers are most compatible with continuous-time event-history approaches (Kok, Yang, and Hsieh 2006) could be analyzed by Cox proportional hazards models that account for a 'shared frailty' among births to the same mother. Existing datasets based on private family genealogies would also support application of methods like the ones used here, though some reorganization of the data to create reproductive histories might be required.

Acknowledgments

An earlier version of this paper was presented at the session "Fertility Control in History", International Union for the Scientific Study of Population XXV International Population Conference, Tours, France, July 2005. We are

grateful to the discussant and members of the audience for the comments and suggestions. While writing this paper, the authors received support from fellowships from the John Simon Guggenheim Memorial Foundation. The authors also acknowledge support for their research from NICHD 1R01HD045695-A2 (James Lee PI), "Demographic Responses to Community and Family Context."

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Table 1

Logistic Regression of Birth on Characteristics of Mother

Variable	All observations		Where mother's date of marriage is available	
	Coefficient	p	Coefficient	p
Years Since First Birth (Reference: < 2)				
2	-0.297	0.00	-0.193	0.25
3	-0.512	0.00	-0.411	0.02
4	-0.576	0.00	-0.198	0.27
5-9	-0.890	0.00	-0.616	0.00
10-14	-1.488	0.00	-0.953	0.00
15-19	-2.126	0.00	-1.508	0.00
20-24	-3.046	0.00	-2.150	0.00
25-29	-4.319	0.00	-4.431	0.00
Years Since Previous Birth (Reference: < 2)				
2	1.030	0.00	1.308	0.00
3	0.974	0.00	1.233	0.00
4	0.788	0.00	1.208	0.00
5	0.244	0.00	0.496	0.00
Parity (Reference: 1)				
2	0.516	0.00	0.346	0.00
3	0.828	0.00	0.608	0.00
4	1.077	0.00	0.607	0.00
5	1.305	0.00	0.842	0.00
6 (6+)	1.448	0.00	1.019	0.00
7	1.602	0.00		
8+	1.964	0.00		
Previous Deaths of Sons (Reference: 0)				
1	0.122	0.00	0.039	0.58
2 (2+)	0.204	0.00	0.106	0.33
3+	0.267	0.00		
Previous Deaths of Daughters (Reference: 0)				
1	0.068	0.00	-0.010	0.90
2 (2+)	-0.014	0.71	0.068	0.60
3+	0.014	0.82		
Prop. Of Previous Births Female	0.163	0.00	0.283	0.00
Previous Birth Dead and < 2 Years Elapsed	0.422	0.00	0.910	0.00
Constant	-4.478	0.00	-4.682	0.00
Person-months	1835367		101597	
Log-likelihood	-100022		-6952.27	
d.f.	27		23	
Pseudo R-squared	0.07		0.0629	

Table 2

Logistic Regression of Birth, With Fixed Effect of Mother

Variable	All observations		Where mother's date of marriage is available	
	Coef.	p	Coef.	p
Years Since First Birth (Reference: < 2)				
2	0.520	0.00	0.411	0.02
3	1.032	0.00	0.789	0.00
4	1.495	0.00	1.442	0.00
5–9	2.235	0.00	2.020	0.00
10–14	2.781	0.00	2.904	0.00
15–19	2.747	0.00	3.068	0.00
20–24	2.108	0.00	2.681	0.00
25–29	0.910	0.00	0.385	0.48
Years Since Previous Birth (Reference: < 2)				
2	0.918	0.00	1.282	0.00
3	0.839	0.00	1.209	0.00
4	0.679	0.00	1.259	0.00
5	0.083	0.03	0.471	0.00
Parity (Reference: 1)				
2	–1.859	0.00	–1.555	0.00
3	–2.850	0.00	–2.307	0.00
4	–3.527	0.00	–3.360	0.00
5	–4.031	0.00	–3.792	0.00
6 (6+)	–4.469	0.00	–4.619	0.00
7	–4.845	0.00		
8+	–5.246	0.00		
Previous Deaths of Sons (Reference: 0)				
1	0.221	0.00	–0.051	0.67
2 (2+)	0.307	0.00	0.024	0.87
3+	0.301	0.00		
Previous Deaths of Daughters (Reference: 0)				
1	0.125	0.00	0.090	0.49
2 (2+)	–0.007	0.91	–0.106	0.60
3+	–0.112	0.20		
Prop. Of Previous Births Female	0.284	0.00	–0.235	0.15
Previous Birth Dead and < 2 Years Elapsed	0.460	0.00	1.099	0.00
Person-months	1439818		90079	
Mothers	6285		405	
Log-likelihood	–80603		–5751	
d.f.	27		23	

Table 3

Results from Models Estimated for Each Parity

	Parity							
	1	2	3	4	5	6	7	8+
Previous Deaths of Sons (Reference: 0)								
1	0.279	0.152	0.123	0.150	-0.016	0.117	0.054	-0.140
2		0.427	0.227	0.224	0.179	0.035	0.082	0.191
3			0.120	0.324	0.297	-0.042	0.403	0.240
Previous Deaths of Daughters (Reference: 0)								
1	0.345	0.027	0.011	0.054	0.005	0.085	0.261	-0.086
2		-0.027	0.028	-0.095	-0.008	-0.095	-0.082	0.241
3			0.193	-0.279	0.217	-0.136	0.097	-0.057
Prop. Of Previous Births Female	0.140	0.223	0.123	0.399	0.197	0.300	0.119	0.186
	-0.12							
Previous Birth Dead and < 2 Years Elapsed	8	0.394	0.519	0.498	0.424	0.337	0.590	0.670
Length of Interval Before Previous Birth in Months		0.000	-0.002	-0.004	-0.006	-0.007	-0.010	-0.009
Boldface indicates statistically significant, $p < 0.05$								