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MARRY IN HASTE, AND REPENT AT LEISURE? EARLY VERSUS LATE AGE AT MARRIAGE AND REPRODUCTIVE SUCCESS: IMPLICATIONS FOR MOTHER AND OFFSPRING

ABSTRACT: Age at first marriage has a direct bearing on fertility behaviour. Based on 2,211 family-related entries from family reconstitution, four marriage cohorts could be differentiated. Mean marital age was 24.2 years (s=4.4). Group 1 (n=337) included all early marriages before the age of 20 years. The majority of cases fell into Group 2 (n=1,564) which was made up of women between the ages of 20–28.5 years (mean marital age ± 1s). Group 3 (n=218) consisted of individuals aged 28.6–33 years of age (mean marital age + 2s). Group 4 (n=92) included all females with marital ages past 33 years.

*The ages of husband and wife showed a moderate but significant correlation (r=.386**). In 75.8% of the analysed couples, the male spouse was older. Age differences between the spouses displayed a distinct divergence in both the younger and the older marriage cohort. Thus, younger women married men who were on average several years older [age hypergamy], while older females married men who were some years younger [age hypogamy].*

The study at hand could show that early age at marriage was significantly linked to higher sibship size, reduced child and maternal mortality as well as higher absolute reproductive success. While socio-economic factors may have led to an additional compositional effect, the analysis was able to demonstrate that any restriction of the marital fertility span has a serious negative impact on the survival chances of subsequent offspring. In order to maximise their reproductive output, mother and offspring incurred great risks. The deliberate attempt to limit birth spacing via a reduction of breastfeeding not only resulted in suboptimal intergenetic intervals, but seriously compromised the child's survival chances.

KEYWORDS: Female age at marriage – Homogamy – Reproductive success – Child mortality – Historical demography

INTRODUCTION

Marriage is one of the most popular and enduring universal human institutions and constitutes a quintessential part of preindustrial population organization and dynamics. Historically marriage can be traced to a few thousand years in the past, yet it is only after the 16th century that information on family formation rules becomes available at the micro level (Segalen 1991). However, many social scientists agree that in one form or another marriage has always existed. And indeed, from an evolutionary perspective, pair bonding is found in species with highly dependent young. Therefore, marriage may be viewed as a reproductive social arrangement which traditionally involved the extended family (Weisfeld, Weisfeld 2002).

The most popular theoretical perspective on mate selection is that of homogamy or "assortative mating" (Burgess, Wallin 1943, Kalmijn 1998). Homogamy refers to the idea that a normative structure operates through cultural conditioning to direct people to select a mate with characteristics similar to their own. Overall, it has become apparent that the age gap between marital partners is not simply a by-product of a random matching of a separately determined distribution of male and female ages at marriage (Casterline *et al.* 1989). Mate selection results from both social homogamy (similar environment) as well as active phenotypic assortment (desired attributes). This phenomenon has been documented for various traits, including age. An underlying assumption of age homogamy is that greater differences between spouses will lead to higher marital instability (Vera *et al.* 1985). Interestingly, the norms for age homogamy are subject to change across the life span (Winston, Klepfer 2000). Furthermore, marriage patterns may vary within and across regions (Casterline *et al.* 1986) or display a diachronic component (Vossen 1998). Hajnal (1965), in his classical study on European marriage patterns, discovered a transition around the sixteenth century from a norm of early and universal marriage towards a norm of late marriage with significant celibacy. Another major diachronic change becomes visible during the period of industrialization, where several mechanisms – such as increasing involvement in marketplace situations, exposure to primary education, growing economic independence and reduction of parental control – changed the principles of partner selection (Shorter 1971, 1973). Similarly, age at first marriage has increased significantly over the past few decades due to the expansion of educational attainment, urbanization, and working opportunities in the modern sectors. This demonstrates that age at marriage is a cultural variable which may be influenced by a host of socio-economic factors.

It is a well-known fact that age at first marriage has a direct bearing on fertility behaviour (Davis, Blake 1956, Coale 1971). Thus, female age at marriage is an important variable in the human reproductive process, especially in historical societies where almost all births occur within the marital context. Within a historical setting, three potential mechanisms for the observed trends in age at marriage can be identified: the age preferences of the potential spouses, the prevailing social norms, and the structure of the interaction opportunities (Knodel 1988, van Poppel *et al.* 1997). Until the end of the nineteenth century, access to marriage was restricted to individuals having a certain amount of assets. This regulation was introduced to avoid the pauperization of broad segments of the population. Laws passed in the 1820s and 1830s allotted the freedom to marry only to those who were able to support a family. Hence, in some German states and provinces up to 6% of all marriage applications were refused on socio-economic grounds. The strata which were most obviously affected were day labourers, apprentices and farmer's sons of higher birth order (Matz 1980, van Dülmen 1988).

The aim of this paper is to examine the age patterns of women at marriage and their subsequent reproductive history. Based on the statistical analysis of entry into marriage and the speed of the transition into the process of reproduction, this study contrasts four sets of marriage cohorts and investigates whether differences in the pace of marriage formation influence subsequent reproductive outcome. Specifically, the question whether differences in first age at marriage lead to differential reproductive scheduling and behaviour, and possibly, reproductive success is addressed. The latter is measured in terms of reproductive output and child survival.

MATERIAL AND METHODS

Information was derived from the village genealogies of two neighbouring parishes: Dannstadt/Schauernheim [1480-1880] (Seelinger 1994) and Hochdorf/Assenheim [1412–1912] (Seelinger 1998). All four villages belong to the county of Ludwigshafen/Rhine – strategically situated between the towns of Ludwigshafen, Speyer, Neustadt/Weinstraße and Bad Dürkheim – and were part of the German state of Rhineland-Palatinate. No claim can be made that the data at hand are representative of the life-circumstances of German villages, as the social and economic lives of any given population are foremost locally circumscribed.

In total, 5,513 family-related entries were available. Of these, 2,211 data sets were used for this investigation. Data selection was guided by the inclusion of information about female marital age (first marriages only) and subsequent birth history.

While total sample size would have suggested the use of parametric tests, certain assumptions, such as normal distribution, were questionable. Therefore, non-parametric tests were chosen, as they are often more powerful in detecting population differences under these circumstances. Comparisons between independent groups of sampled data were based on Mann-Whitney (two independent samples) and Kruskal-Wallis tests (several independent samples). In addition, evidence from Correlation Analysis was incorporated. All statistical analyses were performed with SPSS 8.0.

RESULTS

The data set of 2,211 family-related entries was grouped into four marriage cohorts according to female marital age at first marriage. Mean marital age was 24.2 years (s =4.4). Group 1 (n=337) included all early marriages before the age of 20 years. The majority of cases fell into Group 2 (n=1,564) which was made up of women between the ages of 20–28.5 years (mean marital age ± 1s). Group 3 (n=218) consisted of individuals aged 28.6–33 years of age (mean marital age + 2s). Group 4 (n=92) included all females with marital ages past 33 years.

Overall, the ages of husband and wife showed a moderate but significant correlation (r=.386**). In 75.8% of the analyzed couples, the male spouse was older than the female. Age differences between the spouses displayed a distinct divergence in both the younger and the older

TABLE 1. Median age of husband and median age difference between the spouses by marriage cohort (p<0.01).

Marriage cohort	n	%	Age of husband	n (husbands)	Age difference
Group 1	337	15.2	24.5	305	6.3
Group 2	1564	70.7	26.4	1463	2.7
Group 3	218	9.9	28.5	202	–1.4
Group 4	92	4.2	32.3	84	–4.0

TABLE 2. Differences in occupational status and religious denomination by marriage cohort [I=landlords and academics; II=farmers, vintagers, shepherds; III=skilled artisans, merchants, innkeepers; IV=day-laborers, farm-hands; V=civil servants; VI=industrial workers] (** p<0.01).

Marriage cohort	Occupational status** (%)						Religious denomination** (%)		
	I (85)	II (943)	III (684)	IV (175)	V (53)	VI (41)	Catholic (1066)	Lutheran (780)	Reformed (329)
Group 1	9.3	56.0	27.5	4.0	1.0	2.3	12.8	14.4	26.1
Group 2	3.4	47.7	34.8	8.9	3.1	2.1	70.8	74.4	61.1
Group 3	3.8	36.4	40.8	14.1	3.3	1.6	11.8	7.4	9.1
Group 4	2.6	40.3	41.6	14.3	–	1.3	4.6	3.8	3.6

TABLE 3. Comparison of protogenetic interval, bridal-pregnancy index, intergenetic interval, age of mother at last birth, total sibship size by marriage cohort, and proportion of suboptimal births. Numbers in parentheses denote sample-specific n (** p<0.01).

Marriage cohort	Median protogenetic interval** [months]	Bridal-Pegnancy-Index** [%]	Median inter-genetic interval [months]	Age of mother at last birth** [years]	Sibship size**	Proportion of sub-optimal births**
Group 1	12.8 (325)	16.4	28.3 (308)	32.1 (333)	6.0 (337)	21.4
Group 2	10.2 (1523)	29.8	27.6 (1359)	34.5 (1551)	5.0 (1564)	25.5
Group 3	10.3 (211)	33.8	27.7 (179)	38.2 (216)	4.0 (218)	30.3
Group 4	9.8 (88)	36.8	23.6 (63)	40.5 (90)	2.0 (92)	38.5

TABLE 4. Comparison of the number of surviving children, the survival index, absolute and relative reproductive success and the exogenous maternal mortality rate by marriage cohort (* p<0.05; ** p<0.01).

Marriage cohort	n (children)	Median number of surviving children**	Survival index**	ARS**	RRS	Ratio of slopes	Exogenous maternal mortality*	n (mothers)
Group 1	320	3.0	54.2	3.5	59.1	0.79	10.3	272
Group 2	1439	3.0	55.5	3.0	61.0	0.84	6.8	1244
Group 3	200	2.0	53.1	2.4	62.3	0.86	3.5	170
Group 4	69	1.0	42.9	1.7	60.7	0.59	4.3	69

TABLE 5. Differential child mortality by marriage cohort (%); (p<0.01).

Marriage cohort	During 1st year of life	Infans I	Infans II	Juveniles	Adulthood	Total offspring (n)
Group 1	25.2	11.7	3.9	2.9	56.4	1295
Group 2	26.7	12.3	3.2	2.4	55.5	5395
Group 3	32.2	11.5	3.9	2.1	50.3	668
Group 4	35.8	17.7	3.3	2.1	41.2	243

marriage cohort (see *Table 1*). Thus, younger women married men who were on average several years older [age hypergamy], while older females married men who were some years younger [age hypogamy].

Socio-demographic background

In terms of occupational status, six categories could be distinguished: (I) landlords and academics; (II) farmers, vintagers, shepherds; (III) skilled artisans, merchants, innkeepers; (IV) day-labourers, farm-hands; (V) civil servants and (VI) industrial workers. The classification followed Adler (1991) and Knodel (1988). It has to be stressed that this distinction is solely based on occupational information, which may not convey actual economic status (financial earnings, extent of land ownership). *Table 2* documents that women who married farmers did so at an earlier age than those who married skilled artisans, merchants or innkeepers. The results also attest that individuals of higher economic standing, i.e. the daughters of landlords and academics, married earlier than any of the other occupational groups.

Similarly, religious denomination influenced marital age. *Table 2* shows that the members of the Reformed Church married earliest, while Lutherans took an intermediate position. Roman Catholics married last.

Female reproductive history

Table 3 gives an overview of both protogenetic and intergenetic interval, age of the mother at last birth as well as sibship size (all recorded births). It can be seen that the protogenetic interval varied considerably with maternal age. The younger the mother, the longer the period to birth. This trend became particularly evident when pre- and postnuptial conceptions were contrasted, as older females had a higher number of children conceived out of wedlock which attests to a higher incidence of "bridal pregnancy".

In terms of median intergenetic interval, the differences where not significant when all four groups were taken into consideration. However, when early and late marriage cohorts were compared it became apparent that the median intergenetic interval of the oldest cohort was significantly shorter than that of the youngest.

Late age at marriage leads to a shortened marital reproductive span and consequently to smaller sibship size. Subsequently, as can be deduced from *Table 2*, the oldest marriage cohort is characterized by protracted childbearing. *Table 3* documents that this attempt at maximizing reproductive output is also visible in the differential attitudes towards child spacing. Hence, the proportion of suboptimal births, i.e. those children born after an extremely short birth interval (< 6 months), shows a linear relationship with age at marriage.

Maternal and child mortality

In terms of exogenous maternal mortality (mortality within six weeks of giving birth), *table 4* shows that the risks were highest within the youngest marriage cohort. Successive marriage cohorts showed a marked decrease in mortality risk, with a slight increase visible in the oldest brides. In contrast, no significant differences could be discerned within the endogenous mortality rate (mortality within 6 days of giving birth).

Table 4 also documents that offspring of women with a high marital age ran the greatest mortality risk. This is also reflected in the family-dependent survival index which drops from 55% to 42%. The latter is apparently not a function of the number of stillbirths, as no significant differences within the number of stillborn infants could be discerned.

The analysis also included a comparison of absolute reproductive success [ARS] (the absolute number of offspring surviving to maturity) and relative reproductive success [RRS] (the proportion of live born surviving to maturity). *Table 4* demonstrates that the four marriage cohorts vary significantly in terms of ARS. However, the differences in the value of RRS did not attain significance.

Bourgeois-Pichat (1952) provides a simple method to separate infant deaths attributable to causes preceding or associated with birth from deaths attributable to postnatal environment (endogenous vs. exogenous child mortality). The model is based on a linear relationship between age and the cumulative infant death rate after the first month of life. The results are expressed in a "ratio of slopes" (see *Table 2*; calculation after Gehrmann 1984). In families with prolonged breastfeeding, mortality was found to rise more rapidly in the later months of life. In families where breastfeeding was uncommon or short, the reverse pattern prevailed. The marriage cohort-specific ratio of slopes documents a much longer breastfeeding period for Groups 2 and 3 than for Groups 1 and 4. Group 4 is characterized by the smallest ratio of slopes which indicates a marked tendency towards early weaning (compare *Table 4*).

When the offspring mortality pattern was further analyzed in terms of its age distribution, it became apparent that the various marriage cohorts seemed to exert different strains on the survival chances. Overall, *Table 5* documents that the risk of dying displays a positive relationship with age at marriage. Mortality risks within the subadult age groups Infans II and juveniles were lowest, while infancy was found to be associated with the highest risks.

DISCUSSION

Female age at first marriage and mate selection

Age of husband at marriage and age differentials between spouses

In line with other studies, the current data showed a marked age hypergamy for the youngest brides. Evidence from comparative studies on the mean ages of mate choice points in the direction that males are on average older than their partners. This is assumed to reflect a male mating preference for fecund females, while older males are more likely to offer material advantages (Buss 1989). However, Davis (1998) was able to demonstrate that actual sex-linked mate selection is to some extent inconsistent with the outlined scenario. For women, access to potential grooms is highest in the 20s and decreases with advancing age (Veevers 1988). Yet, most women in the youngest age category do not favour those mates most likely to be associated with secure attainment of wealth and prestige. Rather, their preferences are for men who are on average five years older than themselves. This is also in agreement with the current sample and other studies on historical populations (Knodel 1988).

Older brides, on the other hand, showed a reversal of the commonly found marital age gap, as husbands of women of higher marriage age were predominantly younger. This phenomenon may be best explained by the "marriage squeeze" (Elder, Rockwell 1976). As people move beyond the typical age for marriage, the pool of eligible spouses is significantly reduced. This can create a bottleneck which decreases the value of women on the marriage market. Consequentially, as the supply of men declines and the demand for them increases, women have little choice but to broaden their age range of acceptable partners (Spanier, Glick 1980, Vera *et al.* 1985, Wheeler, Gunter 1987, Berardo *et al*. 1993). This marriage squeeze, however, is not a short-lived phenomenon. If a woman is born into a cohort with a relative "female abundance", she will remain in this squeeze for the rest of her reproductive life (James 2000). As a result, a person may marry someone whose age differs greatly from their own because they do not expect to do better (Adams 1979, Becker 1981).

Socio-economic differentials

Marriage markets are differentiated not only by the ages of the participants but by their skills and economic standing. Within the theoretical model of the marriage market, the income of males will be positively associated with age at first marriage (Bergstrom, Schoeni 1996). This relationship between economic background variables and nuptiality does not only manifest itself on the individual level, but can also account for diachronic trends in marriage patterns. Thus, better economic conditions fostered by higher mortality (leading to more remarriages, and enabling first marriages through inheritance) are characterized by higher nuptiality rates (Larsen 1988). Historically speaking, marriages were regulated to adjust to the availability of land and other resources. Thus, mate selection often oriented itself on three basic criteria: dowry, work capacity, and health – all three of which are positively linked to age (Rosenbaum 1985).

Voland and Dunbar (1997) could show that a female's age at marriage is predominantly influenced by her natal economic status. Next to sociobiological considerations, early marriage also has a more practical component when it comes to the tradition of dowry. Results from historical Tuscany indicate a positive correlation between a bride's dowry size and her age (Botticini 1999). On the other hand, a dowry can also be viewed as a reproductive tactic to attract the wealthiest bridegrooms (Gaulin, Boster 1990). By the same token, female entry into marriage may also depend on the social status of her husband-to-be. As such, the wives of day-labourers, a group characterized by greater financial instability, were on average older than their contemporaries who married farmers or skilled artisans, while the wives of farmers often entered into marriage earlier than those of artisans. The latter may be linked to the greater occupational homogamy often observed in farmers (van Leeuwen, Maas 2002) and seems to be directly related to the role that women and children play within an agricultural and household production. Thus, early entry into marriage was crucial in guaranteeing the normal working routine typical of a strict division of labour in an agricultural setting (Knodel 1988, Mitterauer 1992).

The observed patterns may also be indicative of the socially imposed prerequisite of proving one's economic ability before being allowed to establish an independent household (Knodel 1988). Therefore, the differences in marital age are also a by-product of socio-economic constraints. This is further exemplified by the fact that individuals of higher economic rank married significantly earlier. In agreement with the results of the current study, high-income households were often characterized by an earlier female age at marriage of the wife (Schlumbohm 1992, Weir 1995) as well as a broader age gap between the spouses (Schraut 1992). Overall, the younger age at marriage of women of the elites was probably the consequence of parental control strategies (Widmer 1993) as well as preferential mate selection (Voland 1992). In contrast, marriage postponement in the less well-to-do groups (day-labourers, apprentices and farmer's sons of higher birth order) may have been implemented as a strategy to curb fertility (Jeggle 1977, Matz 1980, van Dülmen 1988, Kemkes-Grottenthaler 2003) as late age at first marriage decreases the marital reproductive span and thus sibship size. In some cases, socio-economic hardship may have even led to the deliberate decision to forgo parenthood (Kemkes-Grottenthaler 2002/submitted).

Religious denomination

The Age of Reformation created a confessional landscape which formed new collective identities. Subsequently, integration and demarcation began to set in, not just along the lines of the Roman Catholic and Protestant denomination, but also within the major Protestant (Lutheran, Reformed) branches (Schilling 1991). Religion embodies cultural values and can be treated as a proxy for life style and social support. Religious beliefs therefore play an independent and important role in determining nuptiality and fertility (Kemkes-Grottenthaler 2003). The current study showed that median age at marriage varied within the three major religious denominations. Reformed married first, followed by Lutherans, while Roman Catholics married latest. These findings are confirmed by Zschunke (1984) and Janssens (1998). Differences can also be observed in terms of family limitation practices (Hörning 1998, Kemkes-Grottenthaler 2003). While the Roman Catholic church explicitly opposed any form of family limitation (Janssens 1998) – as did the Reformed Calvinist denomination – Protestants viewed marriage as a source of companionship rather than a union to create progeny (Ozment 1983).

However, next to religious beliefs, socio-economic aspects have to be taken into consideration. In this particular case it is of great interest that confessional as well as occupational status are both familial characteristics. Most of the skilled artisans (50.4%) were Roman Catholic (compared to 20.6% Lutheran, and 28.9% Reformed), while the farming community consisted mainly of Reformed Calvinists and Lutherans (62.9%). These differences were highly significant ($p<0.01$). In a more extended study on the denominational correlates of nuptiality, fertility and mortality it could be demonstrated that the observed differences in marital age are not primarily a consequence of religious belief systems but are part of a more intricate socio-economic pattern and may be regarded as a byproduct of resource constraints (Kemkes-Grottenthaler 2003).

Female age at marriage and subsequent reproductive history

The results document that age at marriage has a direct bearing on subsequent reproductive behaviour. This is reflected in significant differences in terms of protogenetic interval, age at last birth, as well as sibship size.

Protogenetic interval

The current study could show that the protogenetic interval displayed a linear relationship with maternal age. This is in distinct contrast to evidence from reproductive biology which documents that the age of the mother is inversely related to the period to conception (Dunson *et al.* 2002). And not surprisingly, several studies attest to this reduced rate in prenuptial conceptions by maternal marriage age (Knodel 1970, Smith, Hindus 1975). Thus, the mechanism which may best explain these differentials in the rate of "bridal pregnancy" has to be linked to socio-cultural factors rather than fecundity and may be indicative of either entering into a sexual relationship after a promise (engagement) or the enforcement of marriage (after a pregnancy has been established) (Larson 1988, Gleixner 1994). In some areas, especially in Central Europe and Scandinavia, sexual intercourse between engaged couples was an expected and legitimated part of courtship in order to "test" the prospective wife's fecundity. Thus, women who were less attractive on the marriage market may have had to incur greater risks during courtship in order to procure a husband (Alter 1988).

Completion of childbirth

The effect of timing of first birth is known to bear a negative relationship to completed fertility. In light of a greatly reduced marital reproductive span, the latest marriage cohort was characterized by protracted childbearing. The data documents that the reproductive behaviour of Group 1 displays signs of early stopping and deliberate birth spacing, while Group 4 attempts to maximize its reproductive output before menopause. Hence the time span between last birth and the onset of menopause shows an inverse relationship with marriage cohort. This pattern has also been noted elsewhere (Knodel 1978).

In addition, the median ages of last birth suggest that some sort of fertility limitation must have taken place when compared with natural fertility populations (Mineau *et al.* 1979). This, of course, would entail a crude knowledge of pregnancy prevention measures (for a review compare McLaren 1978, Wunder 1992). Stopping behaviour is deemed instrumental in the fertility transition in rural Germany (Knodel 1987) and usually commences once a preferred family size has been established (Janssens 1998). It has been suggested that the number of surviving children (or live births) is the maximum predictive power on contraceptive use, while child mortality is the main inhibiting factor (Varea *et al.* 1996). The data at hand therefore suggest that younger marriage cohorts were at leisure to resort to family limitation while older brides were forced to protract childbearing.

Sibship size

Due to the compositional effect of a greatly reduced marital reproductive period teamed with a higher reproductive age, older brides had significantly fewer children. Age at first marriage thus showed a distinct inverse relationship with fertility (see also Gehrmann 1984). When discussing reproductive patterns, three demographic index values have to be distinguished: fertility, fecundity and fecundability. However, when relying on census or genealogical data, the assessment of these variables is limited. While the reproductive output of an individual (fertility) can be determined with some certainty – despite problems regarding underregistration of data – the physiological ability to have children (fecundity) cannot be fully ascertained, as the observed trend may be the result of a conscious decision to forgo offspring. This also holds true for the probability of pregnancy during a menstrual cycle (fecundability), as both behaviour and physiology determine fecundability (Bongaarts 1975).

Recent studies have shown that nearly all pregnancies occur within a six day fertile window. While there is no evidence of a reduction of the fertile window in older individuals, the day-specific probabilities of pregnancy decline with age (Dunson *et al.* 2002). Reproductive capacity in women thus decreases dramatically beyond the fourth decade of life and oocyte quality seems to be the primary determinant of reproductive potential (Klein, Sauer 2001). It has also been shown that older-aged husbands depress marital fecundity (Mineau, Trussell 1982). However, as the age differences between the spouses displayed an inverse relationship between younger and older brides, this effect was deemed negligible.

Female age at marriage, child mortality and reproductive success

Age at marriage differentials not only bear an important effect on fertility but also on child mortality. Several factors are directly responsible for this phenomenon: spacing behaviour, differential breastfeeding patterns and maternal age. The current results reflect that children of women who marry late are exposed to greater mortality risks. While 55% of all infants born to women from marriage cohort 1 survived into adulthood, the survival chances of offspring of older brides were dramatically decreased (42%). Reproductive success was evaluated in terms of absolute (ARS) and relative reproductive success (RRS) (Crognier 1998). The analysis could show that the four marriage cohorts varied significantly in terms of their ARS. However, the differences in the value of RRS did not attain significance. Thus, short interpregnancy intervals in older brides may have lead to a comparable reproductive output (given the reduced marital duration), however, as off spring mortality risks were greatly enhanced, the absolute reproductive success of females with late age at marriage was merely half of that of the younger marriage cohort.

The empirically derived conclusion for the observed phenomenon is a joint effect of paternal and maternal age, birth spacing behaviour and differential breastfeeding. While this is a very likely and plausible scenario, an additional compositional effect has to be taken into consideration: the socio-economic background of the family in question. It has already been alluded to that late age at marriage may also be a sign of financial hardship. Thus, poverty may have been an equally determinative factor in familial child mortality.

Intergenetic interval

Groups 1 and 4 displayed distinctly different reproductive patterns in terms of birth spacing behaviour. The median intergenetic interval of the late brides (Group 4) is five months shorter than that of those who entered into matrimony at a much earlier age. This may be viewed as a catching-up effect in light of a shorter marital reproductive span. As can be deduced from *Table 3*, the older the mother, the greater the proportion of suboptimal births. This again, is due to a deliberate attempt to circumvent birth spacing in order to maximize reproductive output.

However, the time allowed between successive births has an elementary effect on child survival. Therefore, adequate child-spacing is considered a positive factor in the health parameters of both mother and offspring. Interpregnancy intervals below 6 months and greater than 59 months are associated with increased maternal morbidity and mortality (Conde-Agudelo, Belizan 2000) as well as adverse pregnancy outcome (Fuentes-Afflick, Hessol 2000). The latter is apparently linked to nutritional depletion as well as postpartum stress (Zhu *et al*. 1999, St. George *et al*. 2000). Offspring of women who become pregnant before foliate restoration is complete therefore run a higher risk of neural tube defects, intrauterine growth retardation, and pre-term birth (Smits, Essed 2001). Moreover, this negative effect of short interpregnancy intervals continues beyond the first year of life into early childhood (Lindstrom, Berhanu 2000).

Differential breastfeeding patterns

Shorter birth intervals can be achieved by suppression of lactation amenorrhea. Breastfeeding associated with lactation amenorrhea has been clinically proven to provide a good method of postpartum fertility control (Vekemans 1997, Tommaselli *et al*. 2000). The biometric analysis of infant mortality (Bourgeois-Pichat 1952) documented that the observed differentials are attributable to postnatal environment, particularly a trend towards reduced breastfeeding and early weaning with the oldest marriage cohort. Epidemiological research emphasizes the benefits of breastfeeding to the infant against a wide range of illnesses and infections due to specific nutritional components which provide immunologic protection and beneficial effects on intestinal flora. Thus, breast milk enhances the immature immune system of the neonate and strengthens host defense mechanisms against infective and other foreign agents (Oddy 2001). Specifically, infants who are exclusively breastfed for six months experience less morbidity from gastrointestinal infection than those who are mixed breastfed as of three or four months. Similarly, no deficits have been demonstrated in growth among infants from either developing or developed countries who are exclusively breastfed for six months or longer (Kramer, Kakuma 2002). Thus, exclusive breastfeeding for four to six months – followed by continued partial breastfeeding into the second year of life – promotes infant and child health (Filteau 2000).

The early commencement of weaning combined with shortened interpregnancy intervals and maternal depletion could be regarded as prime factors in the observed child mortality differentials between marriage cohorts. This combined effect of early weaning and subsequent reduced birth interval is particularly evident when the offspring mortality risks are analyzed by age group, as highest mortality risks are incurred in infancy, particularly during the first year of life, where the transition from breast milk to solid foods greatly increases the risk of nutritional deficiencies. For a historical review of alternative infant feeding practices see Alt (2002).

Maternal age

Historical studies often document that childbearing at older ages can have a negative impact on offspring survival (Imhof 1977, Knodel 1988). This is in partial agreement with evidence from modern obstetrics which documents that women 35 years or older are significantly more likely to have specific antepartum and intrapartum complications (Berkowitz *et al.,* 1990, O'Reilly-Green, Cohen 1993). A comparative analysis of more than 60 studies found that, globally, maternal age is the central variable affecting pregnancy outcome, followed by socioeconomic factors and the level of health care (N.N. 1975). Advanced maternal age increases maternal morbidity and the risk for preterm delivery, low birth weight, asymptomatic hypoglycemia, wet lung syndrome and the risk for chromosomopathies (Romero-Maldonado *et al.* 2002). In particular, nulliparous women 35 years and older run an increased risk of antepartum, intrapartum, and neonatal complications. While these risks are manageable within the context of present-day obstetrics (Ziadeh 2002), these advances were not available to the majority of females in the current study, as the beginning of modern obstetric care has to be conservatively placed into the urban centers of the 18th century (Graves 2001).

Age at marriage and maternal mortality

Adequate perinatal care for mother and child substantially reduces a variety of morbidity and mortality risks associated with both low and high maternal ages. Therefore, the increased incidence of negative birth outcomes in the current sample reflects the poor state of obstetric care available. At the beginning of the 17th century, the risks involved in childbirth were to a large extent governed by the socio-economic situation of the mother and the cultural context of her social environment. And although measurable progress had been made during the 18th century, life-saving discoveries in the realm of asepty and antisepty would have to wait until the 19th century (Graves 2001). Likewise, the cesarean section – although already known and practiced in the 5th century A.D. – was primarily, if not exclusively, applied to women who had died in childbirth. The year 1610 marked the first incident where the cesarean section was successfully implemented. However, it was not until the latter part of the 19th century that this procedure was actually able to safe lives (28% maternal mortality, 8% infant mortality) (Metz-Becker 2000).

The WHO International Classification of Diseases (ICD-9-2002) defines maternal mortality as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes". The death notification process therefore requires that all female deaths which occur in pregnancy or within 42 days of being pregnant are reported. These deaths are then further classified as direct, indirect and fortuitous. "Direct deaths" include those resulting from obstetric complications of the pregnant state (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above. "Indirect" refers to deaths resulting from a previous existing disease or disease which developed during pregnancy and which was not due to direct obstetric causes, but was aggravated by physiologic effects of pregnancy. Lastly, "fortuitous deaths" denote those due to unrelated causes which happen to occur in pregnancy or the puerperium. The distinction between these causes, however, is rarely possible within the historical context (Hogberg, Brostrom 1985). From an epidemiological point of view, the main causes of maternal mortality are preeclampsia, hemorrhage, obstructed labour, and infection (Christian 2002). In developing countries, these childbirth complications still constitute a leading cause of death for women of reproductive age. Historical population statistics also attest to this sad phenomenon. Indirect obstetrical deaths such as pneumonia, tuberculosis, dysentery and heart diseases accounted for 30.8% of the specified death causes (Hogberg, Brostrom 1985).

Next to the above-mentioned complications, maternal age constitutes an important factor in the determination of obstetric outcome. Pregnancy in adolescence constitutes a high-risk obstetric situation and is a serious public health problem, particularly in developing countries with limited obstetric facilities. The average excess mortality risk for children born to mothers aged under 18 years is approximately 51%, while a 14% average excess is associated with the mother being an older teenager (Hobcraft 1992). Adolescent motherhood adversely affects child survival and maternal life due to fetal wastage. However, the increased risk of maternal complications from pregnancy and delivery among teenagers seems to be associated with socioeconomic factors rather than with gynaecological immaturity (Makinson 1985, Mahfouz *et al.* 1995), as there is evidence that adolescent women who receive adequate prenatal care are at no greater risk than adult women of a similar socio-demographic background (Bukulmez, Deren 2000, Kirchengast 2002). The most frequently observed medical consequences of teenage pregnancy include anemia, pregnancy-induced hypertension, obstructed and preterm labour (Cunnington 2001, Treffers *et al.* 2001). In terms of anemia, the relative risk of mortality associated with the moderate kind is 1.35 and 3.51 for severe anemia (Brabin *et al.* 2001). Disease prevalence is determined by both maternal and environmental factors. These include poor pregnancy care, illness during pregnancy, socioeconomic background variables as well as household sanitation (Ondimu 2000). Gestational hypertension during the third trimester reflects an exaggerated maternal inflammatory response to pregnancy and is defined as hypertension arising in pregnancy after 20 weeks gestation without any other feature of the multisystem disorder preeclampsia and which resolves within 3 months postpartum. It constitutes a severe pathology leading to important maternal and neonatal effects and represents one of the most important causes of maternal morbidity. Hypertensive syndromes occur in approximately 10% to 15% of all pregnancies and are the cause of 30% of maternal deaths and 20% of fetal and neonatal deaths (Mounier-Vehier *et al.* 1999). Obstructed labour is one of the most common preventable causes of maternal and perinatal morbidity and mortality. Among the prevailing causes are cephalopelvic disproportion, malpresentation, and malposition (Konje, Ladipo 2000). The main etiological factor is unrecognised positional disproportion. Associated complications are ruptured uterus, genital and wound sepsis (Konje *et al.* 1992).

Just as younger mothers run a higher risk, older women are also more prone to suffer from adverse pregnancy outcome. From an epidemiological point of view, mothers aged >35 years are considered to be of advanced maternal age. Advanced maternal age increases maternal morbidity and the risk for preterm delivery, low birth weight, asymptomatic hypoglycemia, wet lung syndrome and risk for chromosomopathies. Childbearing in older women therefore runs significantly higher rates in terms of preterm delivery (16.0 vs. 8.0% in younger mothers), cesarean delivery (31.3 vs. 13.5%), and the occurrence of one or more antepartum complications (29.5 vs. 16.6%) (Seoud *et al*. 2002). However, most of these complications are caused by age-related confounding variables. Today, healthy older pregnant women who receive appropriate pre-pregnancy counseling and perinatal care achieve results comparable to younger mothers (Newcomb *et al.* 1991).

SUMMARY

While the proverb *Marry in haste, and repent at leisure* heeds warning to carefully chose among potential mates before getting married, this adage can also be applied to differential ages at marriage and reproductive success. The study at hand could show that early age at marriage and hence early childbearing is significantly linked to higher sibship size, reduced child and maternal mortality as well as absolute reproductive success. While socio-economic factors may have led to an additional compositional effect, the analysis was able to demonstrate that the incurred restriction of the marital reproductive span had a negative impact on the overall survival chances of subsequent offspring. The deliberate attempt to circumvent birth spacing via a reduction of breastfeeding thus resulted in suboptimal intergenetic intervals which in turn seriously compromised the child's survival chances.

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