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Of Grandmothers, Grandfathers and Wicked Step-Grandparents. Differential Impact of Paternal Grandparents on Grandoffspring Survival

Ariane Kemkes-Grottenthaler[*]

Abstract: Historically, kin served as the most essential source for economic assistance and security. However, from an evolutionary perspective, investments in next of kin should reflect the degree of confidence in genetic relatedness. Therefore, patrilineal relatives should be less willing to render support than matrilineal relatives, which might explain why the maternal grandmother is often found to be the most caring, followed by the maternal grandfather, the paternal grandmother, and lastly, the paternal grandfather. The purpose of the present study is to investigate grandparental investment strategies, when both sets of grandparents live close to their offspring. In this context, geographic proximity refers to living within the same village community. Demographic information was extracted from the German village genealogies of Dannstadt/Schauernheim (1480-1880) and Hochdorf/Assenheim (1412-1912). All empirical results are based on household-level data.

When grandparental roles in infant survival were considered, it became evident that maternal grandparents were of no consequence, while paternal grandparents seemed to impact differentially. The father's mother had a positive influence on offspring survival. However, after the infant's first birthday, the beneficial impact of the paternal grandmother seized to be of statistical significance. This timing implies grandmaternal solicitude directly bestowed on the daughter-in-law, rather than the grandchild itself. In contrast, the paternal grandfather exerted a negative effect on grandoffspring survival, which may be indicative of resource con-

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flicts. Overall, it is hypothesized that the unique outcome of the current study may have been fostered by geographic proximity and strong patriarchal ties invariably found in farm families. Rural communities are often characterized by patrilineal residence, work and inheritance patterns, tied in with a generation succession in farming, as agricultural subsistence ties individuals to specific resources.

Postreproductive Lifespan and Grandmaternal Solicitude—the Evolutionary Perspective

Human female life history, as opposed to non-human primates, is characterized by a pronounced post-generative life span. Not surprisingly, the adaptive significance of this phenomenon has captured the attention of evolutionary anthropology. The most compelling hypothesis predicts that selection will favor a prolonged post-reproductive lifespan if this enables individuals to increase their fitness through assisting their own offspring to reproduce successfully. Based on the initial ideas of Williams (1957), it may have become advantageous for females to stop dividing their energy between extant and potential future offspring and to focus remaining energy and resources entirely on previously born offspring. This has led to the formulation of a trade-off model between maternal mortality risks from late childbearing and potential survival benefits for dependent offspring (Gaulin 1980; Hamilton 1966; Hill and Hurtado 1991; Peccei 1995; Rogers 1993). Combined with the concepts of kin selection (Hamilton 1964) and parental investment (Trivers 1972), the model also suggests that postreproductive women contribute to their inclusive fitness by extending support to their grandchildren (Hawkes 2003). Hence, postmenopausal longevity has been selected for because grandmothers significantly improve grandoffspring survival probabilities, as aging females with declining fecundity could increase the reproductive output of their daughters by providing additional resources for weanlings (Hawkes et al. 1997; Sear et al. 2000). From this follows that providing financial and/or social support to grandchildren enhances grandoffspring survival chances, frees the mother for further reproduction and increases grandmaternal lifetime reproductive success (Bereszkei 1998; Nath et al. 2000). As a result, women with a prolonged post-reproductive lifespan have more grandchildren, and these differences are independent of economic disparities and diachronic increases in lifespan (Lahdenperä et al. 2004). The so-called "grandmother hypothesis" not only identifies the selection pressure for increased postmenopausal longevity, but also provides a parsimonious as well as an elegant explanation for various unique human life history features such as late maturity, small size at weaning, and high fertility (Alvarez 2000).

What about Grandpaternal Care?

Taking evolutionary concepts of an ontogenetically differentiated reproductive strategy into consideration, an ordered discriminative pattern of grandparental care giving can be predicted. According to the model, the maternal grandmother should be the most caring, followed by the maternal grandfather, the paternal grandmother and grandfather (Euler and Weitzel 1996). And indeed, there is culminating evidence of the prominent position of the mother's mother. A review of the literature quickly shows that the presence of the maternal grandmother is positively associated with increased parity progression ratios or decreased infant mortality risks (Voland and Beise 2002). This is in line with Sear and colleagues (2002), who studied the effects of kin on child mortality in a rural Gambian population and found that the maternal grandmother was the only family member who had a positive influence on a child's nutritional status and survival.

Similarly, empirical evidence overwhelmingly shows that grandpaternal care does not have the same standing as grandmaternal solicitude. The evolutionary perspective has high explanatory value when it comes to demystifying the phenomenon of differential grandparental investment. In species with internal fertilization, maternity is certain, whereas paternity can only be inferred (paternity certainty). Therefore, patrilineal relatives should be less willing to render support than matrilineal relatives, as all investments in children reflect the degree of confidence in genetic relatedness (Alexander 1974). While the maternal grandmother can be sure about her own relatedness with her daughter's offspring, the father's mother is only sure about her genetic relationship with her son but not about her biological ties to any children attributed to him. The same holds true for the grandfathers. Hence, from the evolutionary perspective, this imbalance in paternity confidence triggers differential grandparental solicitude—with maternal grandmothers generally displaying the highest levels of care and grandfathers only marginally involved (Euler and Weitzel 1996).

However, next to evolutionary aspects, cultural factors need to be considered. Since grandchildren's relationships with grandparents are of the second order, grandparent-grandchild interaction is mediated by the middle generation. There is consistent evidence that the relationship with the daughter or daughter-in-law is one of the main determinants of how often grandparents and grandchildren contact each other (Hagestad 1982; Johnson 1985, 1988; Cherlin and Furstenberg 1985). As women typically maintain the role of kin-keeper—in particular after the transition to motherhood (Fisher 1981)—children's relationships with their maternal grandparents are often warmer and more emotionally complex than those with their paternal grandparents (Hagestad and Neugarten 1985). Thus, the greater prevalence of matrilineal bias in parent-grandparent ties often leads to an overall matrilineal advantage in grandchild-grandparent relations (Chan and Elder 2002). This is particularly evident after marital break-up, as marriage dissolution often becomes a structural barrier between

the conjugal family and the extended kin group. A case in point is care patterns found after marital dissolution, where maternal grandparents, particularly grandfathers, get more involved with their grandchildren (Clingempeel et al. 1992). In this context it may be particularly important to keep in mind that a socially engendered favoritism of maternal relatives will produce a different pattern of grandparental caregiving, when compared to a predominantly patrilateral culture (Pashos 2000).

In general, the statement holds true that within modern industrial societies, only few grandfathers participate in activities with grandchildren independently from their wives (Johnson 1988). This is even more enhanced in communities with a highly gendered division of labor and polarized gender roles, as is typical for many historical contexts. Sociological studies document that several factors directly mitigate grandfather-grandchild interaction: residential proximity, sex, and age. Of these, residential proximity seems to be the prime determinant for both the frequency and quality of the intergenerational relationship (Adams 1968; Kivett and Atkinson 1984; Crimmins and Ingegneri 1990; Hodgson 1992; Strom et al. 1992). Similarly, there is evidence that the grandchild's sex may be a mitigating factor. Both Bengtson (1985) as well as Cherlin and Furstenberg (1986) found that although grandfathers were generally not as close to their grandchildren, grandfathers were closer to their grandsons than to their granddaughters. Lastly, age appears to play a role. Several studies were able to show that lower interaction levels were often characterized by an inverse age relationship, with higher age gaps automatically leading to greater emotional distance (Wood and Robertson 1976; Hodgson 1992).

Study Aim

Historically, kin served as the most essential source for economic assistance and security, even though familial support was voluntary (Hareven 1994). This has lead to the formulation of the "modified extended family system", i.e. a kinship network based on a system of nuclear families bound together by affectional ties, social activities and a mutual flow of assistance (Greven 1970). Given the evidence of social research on the importance of residential proximity, the purpose of the present study is to investigate grandparental investment strategies, when both sets of grandparents live close to their offspring. In this context, geographic proximity refers to living within the same village community[1]. This does not necessarily imply co-residence. Rather, it is assumed that adult children lived relatively close to their parents. This may have

[1] On average, no more than 100-200 families occupied the area at any given time in the 1700's and 1800's.

exerted a positive influence on reciprocal contact and intra-familial assistance. Since farm family life is generally characterized by a low female contribution to subsistence—which predicts patrilocal residence and promotes patrilineal bias (Korotayev 2003)—it is hypothesized that an environment of close residential proximity, tied in with a certain amount of patrilineal bias, might be conducive to greater patrilineal involvement.

In an independent investigation, the marital status of the grandparents is taken into consideration. It is widely known that the loss of a spouse entails drastic changes in the survivor's household arrangement. Historically, the life paths of men and women after having encountered spousal death were extremely gender-diverse: becoming a widower rarely altered a man's status, while the loss of a husband invariably changed a woman's life circumstances (Cavallo and Warner 1999). Modern sociological data indicates that widowhood often leads to co-residency with one of the children, which invariably increases intergenerational contact (Roan and Raley 1996). Even more importantly, historical evidence indicates that a widow was more likely to move to her married son's household than to the one of her married daughter (Kertzer and Karweit 1995). While widowerhood also entailed drastic life changes for the surviving husband, remarriage—rather than singlehood—was more often within the male's future (Kemkes-Grottenthaler 2003a). The latter could easily lead to conflicting resource interests. Hence, the female experience of spousal death might foster additional grandmaternal care, while the male experience might be characterized by intra-familial and economic conflict, combined with the interests of the new marriage partner.

Sample Composition

Demographic information was extracted from the German village genealogies of Dannstadt/Schauernheim (1480-1880) and Hochdorf/Assenheim (1412-1912) (Seelinger 1994, 1998). The data derive from a family reconstitution study based on regional population archives, village court transcripts, tax rolls, church records, as well as civil registers. Although a few of these sources date back to the 15th century, such entries are often sparse and sporadic. Hence, the majority of data can not be considered reliable until the 18th century, with the onset of church registers in the early part of the century and the beginning of civil registration ("Code civil") after annexation of the region by France in 1792.

All four villages belong to the district of Ludwigshafen, in the east of Rhineland-Palatinate, Germany. The district is located in the valley of the Rhine, both the actual river valley and the *Vorderpfaelzer Tiefland*, formed by the sediments of the rivers of the Palatinate hills. The climate is comparably warm, and together with the fertile loess soil, it makes the area favorable for growing

vegetables. For a historical and socio-cultural review of the area and its inhabitants, see Fouquet (1989).

Sample Preparation and Selection

All empirical results were based on household-level data. In total, 5,513 entries from family reconstitution were available. The majority of inhabitants were farmers (48.4%) or artisans (34.5%); 47.8% were Roman Catholic, 29.5% Lutheran, and 15.7% Reformed Calvinist. However, due to missing information (such as unknown death dates for grandchildren or grandparents), as well as various data restrictions (see below), only a fraction of the data was available for further study. Only first time marriages were chosen, as family building strategies in unions of higher marriage order follow different schemes contingent upon the number and ages of children by a previous union (Kemkes-Grottenthaler 2003b). Furthermore, the analysis relied exclusively on marriages in which the mother had survived to post-reproductive age (>45 years). Marital reproductive schedules largely conformed to the expected pattern found in pre-transitional Europe, which exhibit a certain measure of deliberate fertility control, even though this was often achieved in a non-parity-specific way. Overall, fertility constraints were not directed towards limiting final sibship size, but responded to the economic and social situation in different phases of the family life course (Kemkes-Grottenthaler 2003a; for a general review of this aspect, see Bengtsson and Dribe 2004).

Due to the fact that the study covers marriage cohorts that stretch over almost two centuries (1704 to 1899), cohort effects have to be accounted for. In order to control for both the uneven distribution of cases throughout the chosen time period, as well as for differences in mortality rates (approximately 74% of the selected couples predated the demographic transition), 50 year cohorts were included as covariates. The cohorts were entered as dummy variables in order to account for non-linear dependencies. In addition, maternal age was taken into consideration as pregnancy complications increase with age, and the risk of perinatal mortality, intrauterine fetal death or neonatal death shows a positive association with the mother's age (Jacobsson et al. 2004).

From an evolutionary ecological perspective, timing of weaning reflects a trade-off between benefits to offspring and costs to mother, which among humans may be influenced by patterns of family cooperation. Therefore, time of weaning is also a time where childcare responsibilities might be more easily shared. All analyses therefore focus on the first two years of life, as this time span roughly coincides with the period of weaning (for particulars on the weaning patterns in the study sample at hand, refer to Kemkes-Grottenthaler 2003a). This provides a particular interesting opportunity to explore how grandparents possibly provided familial support. On the one hand, support could have been

directed immediately to the daughter or daughter-in-law during her time of particular need, for example during pregnancy and shortly after birth (see Beise 2004). In this case, the influence of grandparental support should only be evident *until* the infant was weaned. On the other hand, grandparental assistance might have focused directly upon the grandchild's well-being. In the latter scenario, the beneficial effect of intergenerational help should only manifest itself *after* the child is no longer breastfed (Lahdenperä et al. 2004).

Methods

To examine the effect of a particular variable conditional to the effect of other variables requires multivariate analysis. In the study at hand, the binary logistic analysis was employed.

This procedure can be used to predict a dichotomous dependent variable (survival, non-survival) on the basis of various independents such as maternal age, cohort, and existence of grandparents (Kleinbaum 2002). All statistical analyses were performed with SPSS 11.1.0. The following table (table 1) summarizes the dependent and independent variables.

The descriptive statistics are presented in Table 2. As is to be expected, mean index child life span showed great variability. Both sexes were almost equally represented (male = 788; female = 802). Mean birth order was 4, and average family size 7 children. Premarital conceptions (for this subsample) were rare. Mean age at birth for women was 30 years, for men 33 years. When the grandparents are compared in terms of their age structure, the maternal grandmother is generally the youngest, while the paternal grandfather is the oldest of the four. While this is to be expected, the graded age distribution also leads to differentials in the post-birth life span. A grandchild can therefore expect to encounter the death of the paternal grandfather several years before the loss of a maternal grandmother. This difference is further dilated by sex-specific longevity differentials.

Table 1: Dependent and independent variables used in the binary logistic regression.

Variable	Variable Description
Surv	Survival of index child to given age (dead = 0, alive = 1); the variable is categorical and coded as follows: • birth • 6 months • 12 months • 18 months • 24 months
Cohort	Birth cohort of index child; the variable is categorical and coded as follows: • 1700-1749 • 1750-1799 • 1800-1849 • 1850-1899
Mat Age	Maternal age at birth of index child; the variable is categorical and coded as follows: • < 25 years • 25-30 years • 30-35 years • > 35 years
mGM	Maternal grandmother; survival status at given age of index child dead = 0, alive = 1
pGM	Paternal grandmother; survival status at given age of index child dead = 0, alive = 1
mGF	Maternal grandfather; survival status at given age of index child dead = 0, alive = 1
pGF	Paternal grandfather; survival status at given age of index child dead = 0, alive = 1

Table 2: Descriptive statistics of index child, parents and grandparents (N = 1,595).

	N	Minimum	Maximum	Mean	Std. Dev.
Life span of index child	1,317	0.0	97.8	35.3	33.4
Sex of index child	1,590	1.0	2.0	1.5	0.5
Birth order of index child	1,595	1.0	18.0	4.2	2.8
Family size of index child	1,595	1.0	18.0	7.4	3.3
Marital duration before birth of index child	1,559	-11.6	26.9	7.5	5.8
Mat age at birth of index child	1,573	16.3	54.7	30.4	6.3
Pat age at birth of index child	1,566	17.6	58.9	33.4	7.1
Age of mGM at birth of index child	860	34.4	80.9	56.4	7.9
Age of pGM at birth of index child	810	38.9	91.2	59.8	7.3
Age of mGF at birth of index child	841	40.2	82.3	59.5	7.9
Age of pGF at birth of index child	758	37.6	88.2	62.2	8.0
Number of years mGM survived birth of index child	872	0.03	54.5	14.9	10.4
Number of years pGM survived birth of index child	823	0.06	43.0	11.6	7.9
Number of years mGF survived birth of index child	850	0.05	40.2	13.5	8.7
Number of years pGF survived birth of index child	758	0.04	38.1	11.4	8.3

Table 3: Marital status of grandparents at the beginning of observation.

Grandparent	married		widowed		remarried	
	N	**%**	**N**	**%**	**N**	**%**
mGM	1204	60.9	620	31.3	154	7.8
mGF	1209	65.2	487	26.3	158	4.6
pGM	1034	56.9	686	37.8	97	5.3
pGF	1034	63.6	540	33.2	51	3.1

Note: mGM = maternal grandmother; mGF = maternal grandfather; pGM = paternal grandmother; pGF = paternal grandfather.

Table 3 documents the marital status of the four grandparents at the birth of the index child. In terms of original marriages, more grandfathers (on both sides) were still married than grandmothers. By the same token, more maternal than paternal grandfathers were still married. This is to be expected and reflects naturally occur-

ring age gaps between the four grandparents. Overall, it can be seen that grandmothers incurred a greater risk of widowhood. In terms of remarriage incidence, more maternal grandmothers eventually remarried, while their paternal counterparts more often remained a widow. In contrast, grandfathers were seemingly less likely to remarry after bereavement. However, this is primarily a function of differential age patterns, rather than a true reflection of remarriage patterns, as men were generally more able and willing to enter into a second union after bereavement (van Poppel 1995, Kemkes-Grottenthaler 2003b).

Results

Table 4 documents the results of the binary logistic regression for the dependent variable "index child survival to given age". Additional factors used in the modelling were maternal age and birth cohort (values not shown).

Table 4: Logistic Regression Analyses: Probability of infant survival at different ages given grandparental survival and marital status (controlling for maternal age and birth cohort—not shown).

Survival at given age	Grandparental	Sig.	Exp(B)
At birth	mGM_{alive}	.852	1.034
	mGF_{alive}	.573	1.105
	pGM_{alive}	.025	1.489
	pGF_{alive}	.011	0.631
6 months	mGM_{alive}	.567	1.084
	mGF_{alive}	.753	0.957
	pGM_{alive}	.014	1.406
	pGF_{alive}	.003	0.653
12 months	mGM_{alive}	.809	0.969
	mGF_{alive}	.309	1.140
	pGM_{alive}	.029	1.328
	pGF_{alive}	.004	0.684
18 months	mGM_{alive}	.820	1.029
	mGF_{alive}	.648	1.058
	pGM_{alive}	.117	1.214
	pGF_{alive}	.017	0.741
24 months	mGM_{alive}	.428	0.907
	mGF_{alive}	.362	1.116
	pGM_{alive}	.235	1.156
	pGF_{alive}	.043	0.777

When grandparental survival is considered, it is evident that maternal grandparents are of no consequence to infant survival (see table 4), while paternal grandparents seem to impact on grandchild survival odds differentially. The father's mother had a positive influence on offspring survival, with survival odds during the first year of life steadily declining from 49% to 33%. After the infant's first birthday, the beneficial impact of the paternal grandmother seized to be of statistical significance. In contrast, the paternal grandfather exerted a negative effect on grandoffspring survival, which lasted throughout the duration of the observation span. The existence of the father's father increased mortality risks at birth by 37%, with a slow decrease to 26% until the child's second birthday.

Table 5: Survival of index child [%] and grandparental marital status.

		Mortality [%] of index child			
Age of index child	Marital status	mGM	mGF	pGM	pGF
At birth	married	7.8	7.7[1]	8.2	8.2
	widowed	8.7	8.1	10.4	7.2
	remarried	12.5	13.2	9.3	10.5
At 6 months	married	15.2	15.1[2]	16.5	16.5
	widowed	16.2	16.6	18.3	12.9
	remarried	21.7	22.0	18.7	19.3
At 12 months	married	19.5	19.4	20.6	20.6
	widowed	19.4	21.1	22.2	16.6
	remarried	27.3	25.8	21.5	28.1
At 18 months	married	22.5	22.5[3]	23.4	23.4
	widowed	23.2	24.8	26.5	20.6
	remarried	29.0	29.1	22.4	31.6
At 24 months	married	24.0	24.0[4]	24.2	24.2
	widowed	24.4	27.6	28.5	23.0
	remarried	29.1	31.3	22.4	33.3

Notes 1, 2, 3, 4: differences in marital status achieved statistical significance ($p < 0.05$).

In order to establish whether the differential patterns of grandparental solicitude might be mitigated by grandparental marital status, the mortality rates at

given ages where compared. Table 5 documents that marital status and mortality rate seem to be co-dependent, although these differences did not achieve statistical significance (with the exception of the maternal grandfather). For maternal grandparents—and also to a large extent for the paternal grandfather—mortality was lowest when the grandparent was still married to their first spouse. In contrast, the prevalence of index child death was highest, when the grandparent remarried. Interestingly, the paternal grandmother deviated from that pattern. In her case, widowhood was associated with heightened grandoffspring mortality. Overall, individuals still married to their longtime spouse boasted the lowest child mortality rates.

Discussion

After controlling for maternal age and offspring birth cohort, the binary logistic regression identified two independent risk factors for survival: paternal grandmother and paternal grandfather. The results indicate that the survival odds of infants were greatly improved by the existence of a paternal grandmother, while the paternal grandfather had a negative impact. Interestingly, maternal grandparents appeared to be of no consequence. These intriguing results call for an analysis of historical facts and socio-cultural circumstances surrounding the sample population. A wider explanatory framework has to incorporate household structure, residential patterns and familial cooperation among in-laws. From this follows that evolutionary aspects, sociocultural background as well as normative expectations concerning intergenerational support have to be considered.

The Beneficial Mother-in-law

When it comes to the role of the paternal grandmother within familial support systems, evidence is often ambiguous (Sear et al. 2000), including even allegations of negative effects (Sear et al. 2002; Jamison et al. 2002). The "evil mother-in-law" has been particularly well documented for German historical data (Beise and Voland 2002; Voland and Beise 2002). It is Voland's and Beise's contention that the effect of the paternal grandmother on infant mortality is the result of a tense relationship between female in-laws. From a sociological perspective, both the mother-daughter and the mother-in-law/daughter-in-law relationship can be characterized as an inter-generational, asymmetrical female-female bond defined by kinship networks. The central difference between the two is the diverging orientation of maternal versus paternal kin. In the latter, kinship is initiated by marriage and the relationship is solely based on the fact that both have intimate bonds with the son/husband. Interestingly, the existence of grandchildren often decreases strain and creates convergence

within the mother-daughter-bond, while an increase in relational tension and greater divergence within the daughter-in-law/mother-in-law relationship is observed. It therefore seems plausible to assume that the greatest source of stress between in-laws is issues involving the rearing of grandchildren. This potential source of conflict seems to be responsible for high stress levels—particularly in daughters-in-law (Fischer 1983). However, there is also evidence that differences in childrearing practices between in-laws need not necessarily lead to intergenerational conflict. Marotz-Baden and Cowan (1987) found that the relationship between mothers-in-law and daughters-in-law living in two-generation farm houses were not as problematic as expected. Neither close proximity nor the existence of grandchildren affected stress levels or marital satisfaction of the daughter-in-law. One of the main conclusions of the study was that—despite some relational strains—the adherence to shared values leads to a common bond between the two females, effectively counteracting any tensions.

At first sight, it may be paradoxical to find that the maternal mother had no statistically significant impact on infant survival, and even more puzzling to provide evidence of a beneficial mother-in-law effect. It is hypothesized that the unique outcome of the current study may have been fostered by geographic proximity and stronger patriarchal ties invariably found in farm families. Rural communities are often characterized by patrilineal residence, work and inheritance patterns, tied in with a generation succession in farming, as agricultural subsistence ties individuals to specific resources. Due to the interdependent nature of farm family life—tied with the generation succession in farming—young farmers often live closer to their parents than their in-laws (King and Elder 1995). In addition, the regionally prevailing inheritance system of partible inheritance may have maintained a profound link between the sons and the family land (Platteau and Baland 2000).

A second persuasive factor presents itself from the comparison of the marital status between the two grandmothers. Interestingly, more paternal than maternal grandmothers were widowed, but more maternal grandmothers would eventually remarry. Both phenomena are directly tied to age, particularly age at bereavement, which is the principal component in remarriage trends (van Poppel 1995). While differences in marital status did not attain statistical significance, it seems that spousal death not only differentially affected the lives of these women, but also had a bearing on index child mortality. Offspring mortality was highest in maternal grandmothers (who eventually remarried) and paternal grandmothers (who remained a widow). The first phenomenon could be tied to responsibilities associated with the establishment of a new household. In addition, a shift in residency after the new betrothal may have been a decisive factor. From a historical perspective, it is important to note that remarriage was not exclusively thought of as securing additional heirs. Oftentimes the new union was looked upon as a partnership of convenience, based on labor and

land ownership. Hence, a quick remarriage would guarantee the normal working routine typical of a strict division of labor within an agricultural setting (Mitterauer 1992). The fact that widowed paternal grandmothers were more often associated with higher grandoffspring mortality could likewise indicate unavailability of grandmaternal care. A decline in living standards is a common experience for widows—many of who actually fall into poverty at widowhood, a happenstance that can still be observed today (Hungerford 2001). Due to the fact that inheritance laws placed an imperative priority on the rights of children to inherit before all others (including the surviving spouse), a widow not only had to share her late husband's estate with her children, but a widow's property rights, ownership and income might be greatly reduced as a result (Wunder 1992). It is therefore plausible that these women may have been predominantly engaged in sustaining their own livelihood, which would have rendered them unable to care for their son's offspring.

Next to differential grandparental solicitude patterns, it is also important to elucidate the time pattern behind the caregiving, as this can highlight possible motives. Historical data from Finland (Lahdenperä et al. 2004) disclosed a grandmaternal effect only after the child had reached weaning age. This is in line with several other studies that likewise document that grandmaternal care peaked after mothers had begun to reduce their investment in their lastborn offspring and had turned their attention to a future pregnancy (Brown 1935; Sear et al. 2000). Such timing implies grandmaternal solicitude directly bestowed on their grandchildren. This contrasts with the observations of the current study, where grandmaternal benefits were visible from birth to probable weaning age[2]. This is in line with evidence from historical Quebec (Beise 2004), where the paternal grandmother's assistance was predominantly geared at the daughter-in-law. Beise therefore, quite aptly, refers to the maternal grandmother as a true "helper" who supported her daughter and her grandchildren in times of increased need, while the paternal grandmother was primarily interested in her daughter-in-law's well-being and may have assisted her with subsistence and domestic duties. While the intentions and interests of both sets of grandmothers cannot be retrospectively verified, the timing of support lends great credence to the assumption that the mother-in-law focused her attentions immediately on her daughter-in-law. This too, is a highly effective reproductive strategy, as breastfeeding entails high maternal energetic costs (Valeggia and Ellison 2001) and is associated with substantial opportunity costs (Quinlan et al. 2003), as nursing can interfere with a women's time allocation to household chores or potentially constrains direct maternal care for older offspring. An accommodating mother-in-law would therefore increase her daughter-in-law's

[2] The average interbirth interval in the sample was between 27-30 months, which indicates that weaning must have taken place during the first year, depending on the sex of the child (boys were breastfed slightly longer than girls) (Kemkes-Grottenthaler 2003c).

health status, which might ultimately lead to a new pregnancy and hence higher reproductive success for both women.

The Harmful Grandfather

Many anthropological studies on kin-helper effects have found that males, including fathers, only have marginal effects on the nutritional status and/or survival prospects of their offspring (Gurven and Hill 1997; Hawkes et al. 1998; Sear et al. 2000; Voland and Beise 2002; Beise and Voland 2002). This is not to say that (grand) paternal investment is of no consequence. Hill and Hurtado (1996) document a positive, albeit insignificant association between the presence of both grandfathers and grandchild survival in a modern hunter-gatherer population. Similarly, studies within industrial countries indicate that the grandparents' socio-economic characteristics have a direct bearing on grandchild well-being (Hernadez-Iglezias and Riboud 1988). In this context, the grandfather's past economic level can be used to identify poverty-induced effects, which are known to have a considerable impact on grandchild health (Najman et al. 2004).

While it may be surprising to find that males apparently have little impact on offspring survival, studies that attest to a negative effect on survival probability are even more perplexing. Jamison and colleagues (2002), employing historical data from Japan, found that the presence of grandfathers unduly inflated the risk of infant death. Unfortunately, the authors do not elaborate on the behavioral pathways that may have triggered this reduction of survivability. While paternity certainty quite plausibly explains differential solicitude patterns, it seems over-simplistic to attribute increasing mortality risks merely to issues of confidence in genetic relatedness. For the sample at hand, it is suggested that "estate thinking" (*Hofdenken*) may have been the driving force, i.e. the concept of the farm taking primacy over the individual lives of succeeding generations of family members. In order to better understand the pathways economy and fertility may have interacted through in the current sample, the "wealth-flows theory" provides high explanatory value (Caldwell 1982). The model posits that fertility behavior is economically rational, and particularly so in societies where wealth flows from the younger to the older generation. High fertility will prevail as long as the net flow of wealth follows this direction. However, when the system of wealth flow is reversed, family limitation will be practiced. In systems of partible inheritance, a couple's wealth typically peaked after the childbearing years, mainly because inheritance shares arrived little by little. Equal sharing of resources determined a variety of aspects of family life, such as social and domestic reproduction, intermarriage as well as postmarital residency (Pingaud 1995). Hence, in anticipation of future inheritance, marriages were regulated to adjust to the availability of land and other resources and family limitation strategies were implemented. While the threat of land

fragmentation certainly added a powerful incentive for limiting the number of offspring (Benz 1999), this does not necessarily mean that regions that practiced equal division were characterized by low fertility. On the contrary, empirical evidence demonstrates that regions that practised equal division had higher birth rates than those that were based on a system of impartible inheritance. As a matter of fact, partible inheritance results in rapid population growth through multiplication of local nuclear households and a high nuptiality rate (Platteau and Baland 2000).

In order to fully understand the possible interaction between economic situation and child mortality, it is important to remember that family transfers are of two kinds: between living family members and as bequests. For the question at hand, the former is of particular interest. Within the modern context it is known that the transfer process is concentrated in the family lineage, and goes downward from the older to the younger generations, targeted to the latter's economic needs. Among the transfers, almost 70% are given to adult children, while only 7% go to grandchildren. The remainder is delegated to other relatives (15%), non-kin (10%) and in-laws (8%) (Kohli 1999). In farm families, the generational succession is linked to the transmission of productive capital, and interestingly, their family dynamics and conflicts are particularly evident (Bohler and Hildenbrand 1997). In line with this, the records of the local village court of Dannstadt aptly document that inheritance disputes were often the basis for family feuds between close relatives (Fouquet 1989). It is therefore hypothesized that the grandfather's negative influence on grandoffspring survival may be indicative of resource conflicts. For one thing, substantial transfers to the next generation may not have been possible during the grandfather's lifetime. This may have caused economic hardship within the following generation. Social scientists and demographers have long been interested in the intergenerational transmission of inequality, particularly economic standing. As such, poverty is known to drive much of the observed differences in health and mortality (see Finch 2003). In addition, when the marital status of the grandfather is taken into consideration, it becomes apparent that mortality was highest after remarriage. While this may simply reflect heightened risks associated with a non-surviving grandmother, the observed phenomenon could also indicate conflicting resource interests on the part of the grandfather who has financial and social obligations to both his new wife, as well as his children from the previous marriage. In this context it is important to note that the new wife could play a prominent role, possibly focused on her own financial and reproductive interests. While admittedly, nothing is known about the role of stepgrandparents, "cruel stepparents" are no longer reduced to staple characters recognized in folklore and fairy-tales, but universally, stepchildren constitute an enormously higher proportion of child abuse victims than their numbers in the population-at-large would warrant. Furthermore, empirical studies show that excess risk to stepchildren is not an artefact of poverty or any other suggested

correlate of the step-relationship (see Daly and Wilson 1996). The data at hand does not give evidence of any mistreatment of children on the part of the step-grandmother, which may have elevated grandoffspring mortality. Rather, it is suggested that women take over the role of kin-keeper. However, within a step-grandparent relationship all female parties involved may show a reduced interest in sustaining and/or perpetuating kin-ties. Hence, intra-familial assistance geared towards the step-daughter or step-daughter-in-law or participation in childcare chores may not have been a viable option for both the step-grandmother as well as the second-generation families in question.

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