Jan Kok, Mattijs Vandezande and Kees Mandemakers

HOUSEHOLD STRUCTURE, RESOURCE ALLOCATION AND CHILD WELL-BEING

A comparison across family systems

Abstract

Using a unique database containing detailed household information of more than 30,000 Dutch children (1850-1909), we compare infant and child mortality in the 'stem family' region of Eastern Netherlands to mortality in the 'nuclear family' northwestern part of the country. We elaborate on the relation between household structure and mortality by adapting the model proposed by Mosley and Chen. We study the impact of different types of co-resident kin (grandparents, siblings, uncles and aunts) in 'normal' situations (both parents alive) and 'crisis' situations (one or both parents absent). Our findings confirm that intact three-generation families – which were found mainly in the stem region – were beneficial for young children, provided there were not too many young children. In the nuclear area, co-residence with grandparents was an efficient way to counteract family crises. In the stem family region, this 'safety valve' function of households was less conspicuous. Overall, however, kin functioned in the same way in both regions, with some kin (especially grandparents) playing an altruistic role, having a positive effect on child survival, and other kin competing for resources and diminishing the survival chances of infants and children.

A crucial function of households is the protection and rearing of the most vulnerable members of society: infants and young children. The central role in this respect is played by the mother. The loss of the mother was always devastating for infants in the period before artificial feeding was reliable enough to replace mother's milk. But also for older, weaned children, the loss of the mother increased their mortality, at least in the first months after her death.[1] The question we would like to address here is: who else, besides the mother, plays a role in ensuring the survival of young children? Do fathers, grandparents, siblings, uncles and aunts lend a helping hand? Or do they

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1.   Frans van Poppel, 'Children in one-parent families: Survival as an indicator of the role of the parents', *Journal of Family History* 25 (2002) 269-290.

actually increase the mortality risks of children by competing for household resources? The presence of these family members – at least in the household – is not only a matter of demographic chance but is closely associated with 'family systems' or broad regional norms regarding family processes, such as inheritance, co-residence and division of tasks within households.[2] These norms have a great impact on the relative 'value' of family members and on intra-familial relationships. Our question is then: can we associate levels of infant and child mortality with regional family systems, that is, with the presence, the value, the position and the roles of different household members as normatively 'prescribed' in family systems? Below, we summarize the literature on family systems, households and mortality in northwestern Europe, China and Japan. In the Eurasian regions that we examined, three major family systems are of importance: the nuclear or simple family system, the stem family system and the joint family system.[3] The nuclear family system is characterized by residential independence of the couple at marriage and is found in large parts of northwestern Europe, north-western and southern Italy, central and southern Spain, central Portugal, Greece, Romania and Poland. The stem family system is defined by co-residence of married couples in two generations and by impartible inheritance. In principle, this implies that the older generation co-resides only with the heir and his/her spouse and children. It is found in northern Spain and northern Portugal, southwestern France, much of Germany and central Europe, southern Sweden, Korea and Japan. Finally, the joint family system combines partible inheritance with co-residence of more than two married couples in two generations or more. Generally, joint families are patrilineal, with all brothers sharing in the property and with a strong gender bias to the detriment of girls, who leave the household and often the village as well (Balkans, central Italy, Finland, Hungary, Bulgaria, Russia, China and North India). Thus, every family system is characterized by different sets of family members. Moreover, these family members stand in different (power) relations to one another, as they have different claims on the parental property. What are the potential implications for infant and child survival?

A well-known description of the implications of the dominance of nuclear families in northwestern Europe and its colonial offshoots is Peter Laslett's

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2.   Karen O. Mason, 'Gender and family systems in the fertility transition', *Population and Development Review* 27 (2001) Supplement: Global Fertility Transition, 160-176.

3.   Michel Oris and Emiko Ochiai, 'Family crisis in the context of different family systems', in: Renzo Derosas and Michel Oris (eds.), *When dad died. Individuals and families coping with distress in past societies* (Bern 2002) 17-79; Emmanuel Todd, *The explanation of ideology. Family structures and social system* (Oxford 1985).

'nuclear hardship hypothesis'.[4] Laslett suggested that in these areas fami-
lies perform fewer welfare functions than families in regions with a larger
share of extended family households. Thus, children who were missing one
or both of their parents were less likely to receive help from relatives than
children elsewhere and were likely to suffer higher mortality. The hypothesis
also states that, perhaps as a consequence of the nuclear family deficit in this
respect, community welfare facilities were more developed in the nuclear
family regions. Testing this assumption proved difficult from the start. Las-
lett already admitted that interpreting household composition data could be
problematic: '... it could still be true that the exceptional households of com-
plex structure in areas where simple households are dominant, existed and
exist for welfare reasons, to provide against nuclear hardship'.[5] Richard Wall
seemed to confirm this when he concluded from his comparison of the wel-
fare role of rural households in England, Corsica and Hungary:

> '(...) the nuclear family regime of England ... actually had a wider range of
> kin-types within its households than were to be found in selected commu-
> nities from other parts of Europe where more complex household regimes
> predominated. In England one can see the household functioning as a welfare
> agency, taking in a wide variety of persons who would find it difficult to live
> on their own, whereas in the other two populations the kin group was much
> less diverse and primarily associated with the process of the transfer of the
> headship of the household'.[6]

Recent research has confirmed the flexibility of the nuclear family system.
Often, one child would remain unmarried to take care of the elderly parents in
old age. If any, these spinsters and bachelors could be considered true victims
of nuclear hardship.[7] Also, kin outside the household proved more helpful
and efficient than Laslett had imagined. Studies on the relationship between
household composition and mortality in nuclear family societies generally
focus on the effect of parental loss.[8] In many cases, the death of the father

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4. Peter Laslett, 'Family, kinship and collectivity as systems of support in pre-industrial
Europe: A consideration of the "nuclear-hardship" hypothesis', *Continuity and Change* 3
(1988) 153-157.
5. Laslett, 'Family, kinship and collectivity, 155.
6. Richard Wall, 'Characteristics of European family and household systems', *Historical
Social Research* 23 (1998) 44-66, 62.
7. Oris and Ochiai, 'Family crisis in the context of different family systems', 42-44; Renzo
Derosas, 'Fatherless families in 19th century Venice', 421-452 in: Renzo Derosas and
Michel Oris (eds.), *When dad died. Individuals and families coping with distress in past societies*
(Bern 2002) 421-452, 427.
8. Van Poppel, 'Children in one-parent families'; Frans van Poppel and Ruben van Gaalen,
'The presence of parents and childhood survival: the passage of social time and differences

plunged families in great misery. However, Beekink et al. have shown that in the Netherlands, widows could recruit outside help, either from relatives or charity, more efficiently than widowers. Indeed, after the first month, fatherless children in the nineteenth-century town of Woerden had even lower mortality than children whose father was alive![9] One of the rare studies on the impact of extended kin impact on infant and child mortality in an urban population is by Derosas on Venice.[10] Derosas found only a few unambiguous effects. In Venice, younger siblings increased the hazard of dying, especially for fatherless infants and children. After the father passed away, his mother played a positive role in lowering the mortality of his children (and her grandchildren).

In stem families, the focus is on preserving the family estate, or house, and to limit the potential claims on the estate as far as possible. Das Gupta has named this a 'lifeboat ethic'. In her view, life chances (including mortality) of heirs and non-heirs differ strongly, which is probably most apparent at later ages. Other research emphasizes the tensions inherent in stem families. The pressure on the heir and his spouse to care for both the elderly generation and their own children was enormous: 'The economic charge and the domestic conflicts could transform the situation into a small hell.'[11] These tensions could also influence infant mortality. In their village reconstruction of Krummhörn, northern Germany (1720-1874), Beise and Voland discovered that the paternal grandmother had a negative effect on infant survival, especially in the period immediately after birth. They attributed this to the conflicts between women and their mothers-in-law prevalent in three-generation stem families, resulting in miscarriages and neonatal mortality.[12] They also found that a living maternal grandmother had a positive effect, especially after the first six months in the infant's life. This suggests that her help is important during and after the weaning of children.[13] For grandfathers, they found no significant effects. In the stem family society of Japan, the goals of families seem to have been a gender-balanced and well-spaced offspring set.

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by social class', in: Tommy Bengtsson and Geraldine P. Mineau (eds.), *Kinship and demographic behavior in the past* (New York 2008) 105-134.

9.   Erik Beekink, Frans van Poppel and Aart C. Liefbroer, 'Parental death and the death of the child' in: Renzo Derosas and Michel Oris (eds.), *When dad died. Individuals and families coping with distress in past societies* (Bern 2002) 233-260.

10. Derosas, 'Fatherless families'.

11. Oris and Ochiai, 'Family crisis in the context of different family systems', 48.

12. Jan Beise and Eckart Voland, 'A multilevel event history analysis of the effects of grandmothers on child mortality in a historical German population (Krummhörn, Ostfriesland, 1720-1874)', *Demographic Research* 7 (2002) 469-498.

13. A similar effect was found in several African populations, in which infants were even sent to live with their grandmother when the time to wean had come, Rebecca Sear and David Coall, 'How much does family matter? Cooperative breeding and the demographic transition', *Population and Development Review* 37 (2011) Supplement 81-112.

The first child should be a daughter, followed after about four or five years by a son, to be followed by a daughter, etc. Infanticide, abortion and other methods were employed to ensure this result.

In joint families, the main goal is to preserve the family line. In contrast to stem families, all family members retain claims to the corporate property. According to Das Gupta, the 'corporate ethic' of joint families ensures that resources are pooled, that members are disciplined to fulfill common goals, and that all family members are sustained and protected.[14] However, to restrict access to the group of family members claiming a share of the resources, such families tend to limit reproduction, which often takes the form of infanticide (of girls). Thus, in the case of joint families, one should make a sharp distinction between infant mortality and mortality at later ages. Patrilineal joint families are generally bent on maximizing male offspring. The 'value' of daughters depends on the number of brothers and her rank number among the girls (the fewer older brothers and sisters, the better). Families could always use a limited number of girls. To begin with, girls are needed to assist with household chores. Moreover, their marriages might help to cement network alliances. In regions with bride prices, their marriage could provide the money with which, in turn, a daughter-in-law could be brought in.[15] Finally, girls without brothers could play an important role by bringing in a son-in-law to carry on the family line.[16] For all this, however, one needs only a few girls, which results in female infanticide, which was seen as a lamentable necessity.[17] It is important to realize that the decision whether a particular newborn child would be allowed to survive often did not rest with the parents. The senior couple, the parents-in-law of the mother, held authority in these matters. However, recent research discloses that women who were older than their husband – thus possessing relatively much 'conjugal power' – had more surviving daughters than other women, all other factors being equal.[18]

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14. Monica Das Gupta, 'Lifeboat versus corporate ethic: Social and demographic implications of stem and joint families', in: Antoinette Fauve-Chamoux and Emiko Ochiai (eds.), *House and stem family in Eurasian perspective* (Kyoto 1998) 444-466.

15. In regions with dowries, this worked against girls, as has been observed in hypergamous upper-caste families of India, Katherine A. Lynch, 'Why weren't (many) European women "missing"?', *History of the Family* 16:3 (2011) 250-266.

16. Sping Wang, Jan Kok and Ying-chang Chuang, 'Who married how? Modeling marital decisions in early-twentieth century Taiwan', *Journal of Family History* 33 (2008) 430-451.

17. Lynch, 'Why weren't (many) European women "missing"?'

18. Feng Wang, Cameron Campbell and James Z. Lee, 'Agency, hierarchies, reproduction in Northeastern China, 1789 to 1840', in: Noriko O. Tsuya, Feng Wang, George Alter and James Z. Lee (eds.), *Prudence and pressure. Reproduction and human agency in Europe and Asia, 1700-1900* (Cambridge Mass 2010) 287-316, 310.

New insights in these issues are offered in the first two volumes of the Eurasian Project on the History of Population and Family Structure.[19] In this project, household data from villages in Japan, China, Italy, Belgium and Sweden were analysed and compared using the same analytical categories and statistical techniques. These books studied mortality and reproduction in families in the East and West, specifically by looking at demographic reactions during crisis situations. By and large, the authors conclude that household size and household complexity were not major variables in mortality and fertility. In other words, protection and support were no more guaranteed in 'collectivist' than in other settings.[20] Neither the elderly nor vulnerable children such as orphans were better off in complex family societies than in nuclear family societies. The authors confirm the hypotheses of Das Gupta and Skinner that what really mattered were the specific positions which individual persons occupied within household hierarchies. These positions – and the power and claims to resources that came with them – depended on gender, age, rank order, and closeness to the 'stem line' of the family. For women, their 'conjugal power' was important as well, measured through the age difference with the husband. Women who were older than their husbands were able to have more daughters registered (interpreted as saving more daughters from infanticide), whereas it was the other way round for women who were much younger than their husbands.[21] These hierarchies were different in each local setting, and more or less reflected the broad regional family systems.[22] Thus, one part of the story is power and competition for resources. However, the authors emphasize that *altruism* should be considered as well: 'The household...is not just a locus of resource competition but an organization that thrives on the devotion of its members to each other's welfare'.[23] The questions then become: who is available to provide care, who is willing to do so, and who is more likely to receive care than others. This is affected by demography, by individual psychology, but also by cultural norms dictating who should help whom and how. The Eurasia Project group found that in the conjugal societies of Western Europe, older siblings turned out to have a positive role in lowering child mortality. Apparently, local rules determined how this worked; for instance, in Italian villages having older brothers was positive

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19. Tommy Bengtsson, Cameron Campbell, and James Lee (eds.), *Life under pressure: Mortality and living standards in Europe and Asia, 1700-1900* (Cambridge Mass. 2004); Tsuya et al., *Prudence and pressure.*

20. James Z. Lee, Cameron Campbell and Feng Wang, 'Society and mortality, in: Tommy Bengtsson, Cameron Campbell, and James Lee (eds.), *Life under pressure* 107-132, 115, 129.

21. Wang, Campbell and Lee, 'Agency, hierarchies, reproduction', 310.

22. Wang Feng, James Z. Lee, Noriko O. Tsuya and Satomi Kurosu, 'Household organization, co-resident kin, and reproduction', in: Tsuya et al., *Prudence and pressure* 67-95, 81.

23. Wang et al., 'Household organization', 68.

for girls but not for boys. In southern Sweden, having older sisters was negative for girls.[24] The presence of elderly persons (defined as persons older than 55 years) in the household laid more stress on the 'generation in the middle', but in several places it was beneficial for infants and children. In the volume on reproduction, the elderly were studied in more detail. The authors showed that the presence of grandmothers (especially widows) stimulated the arrival of more (female) children. In Japan, families with a grandmother continued longer with child-bearing, which in many cases implied that infanticide was reduced.[25] In China the presence of a grandmother was associated with registering more girls, which suggests that killing girls was limited.[26]

Summarizing the literature, we can conclude that family types as such (nuclear, stem or joint) do not predict infant and child survival. A more important aspect is the positions of individuals within household hierarchies, which are determined by family norms. One of the direct results of these norms are gender biases in infant survival. The position of infant girls in patrilineal joint systems is much worse than in nuclear or stem family systems because of the rules of inheritance and the subjugated position of the girl's mothers.[27]A summary of both historical and ethnographic studies has recently been made by Sear and Coall.[28] They conclude that the role of the maternal grandmother is most consistently positive across these studies. Much more ambiguous is the effect of the paternal grandmother, the fathers and the grandfathers. In general, older siblings have a positive effect – although this is rarely studied. By and large, we still know little about how and why specific configurations of kin affected the well-being and survival of children.

Despite the impressive effort of Sear and Coall to bring together all evidence, the different studies can hardly be compared directly. For instance, some of them work with genealogies (thus studying the effect of the survival of kin), whereas others use household records (thus studying the effect of co-residence of kin). As we are particularly interested in mechanisms at the household level, we adopted the second approach. All studies differ in the type of kin they include in the models. And all of them adopt different methods to control for the other factors that are known to affect mortality. In the next section, we aim to address the possible connections between the family system, household composition, and infant and child mortality in a more

24. Lee et al., 'Society and mortality', 120.
25. Also in G. William Skinner, 'Family systems and demographic processes', in: David I. Kertzer and Tom Fricke (eds.), *Anthropological demography: Toward a new synthesis* (Chicago 1997) 53-95, 74.
26. Wang et al., 'Household organization', 88.
27. Lynch, 'Why weren't (many) European women "missing"?'
28. Sear and Coall, 'How much does family matter?'; also Rebecca Sear and Ruth Mace, 'Who keeps children alive? A review of the effects of kin on child survival', *Evolution and Human Behavior* 29 (2008) 1-18.

systematic way. Then, we will briefly introduce our dataset, which is based on the Historical Sample of the Netherlands. In the subsequent section, we will contrast the parts of the Netherlands with a clear 'nuclear family system' to the parts where extended family were more common. Our central question is: what is the role of kin (mothers, fathers, siblings, grandparents, others) in ensuring the physical well-being of infants and children, and do we find a differences in the role of specific kin between regions in which neolocality was the rule and regions in which three-generation households were more common?

A model for the relation between family systems and child mortality

In designing our analytical model, we built on the well-known framework proposed by Mosley and Chen.[29] They specified five 'proximate determinants' that immediately affect the health of infants and children. These are maternal factors, environmental contamination, nutrient deficiency, injury and personal illness control. Under *maternal factors* we put the mortality risks accumulated already during gestation. Risks of dying are generally higher for infants born shortly after the previous child was born, and also higher when the previous child has died. If a child dies, then a mother tends to have a shorter birth interval until the next child (whether due to the cessation of breastfeeding or to the deliberate planning of a replacement child). However, this 'scars' the mother in that it gives her less time to recover from her previous pregnancy, resulting in a lowered birth weight and therefore an increased risk of dying for the next child.[30] Thus, we include both short birth intervals (the child was born less than 400 days after the previous one) and the death of the previous child. We also look at the mother's age, as pregnancies are known to have more complications among both young and old women. We use dummies for mothers younger than 20 and older than 35. Next, we include the gender of the child, as it is well-known that male infants have higher risks of dying than female ones. Similarly, the risks are higher for twins (who are often born prematurely). *Environmental contamination* is a very important factor to take into account. Already in the first minutes of life, when the umbilical cord is cut, a child can be infected and perish shortly thereafter of tetanus

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29. W. Henry Mosley and Lincoln C. Chen, 'An analytical framework for the study of child survival in developing countries', *Population and Development Review* 10 (1984) Supplement 25-45.

30. Wiji Arulampalam and Sonia Bhalotra, 'Sibling death clustering in India: State dependence "versus" unobserved heterogeneity', *Journal of the Royal Statistical Society Series A,* 169 (2006) 829-848.

when contaminated water is used for cleaning.[31] The use of water (contaminated) and cow milk to replace mother's milk is another factor contributing to premature deaths, especially during the summer months.[32] Finally, brackish water, which was common in the western regions in the Netherlands during the nineteenth century, forms a breeding ground for mosquitos carrying malaria.[33] Environmental factors also include infectious diseases, which are either air- or waterborne and can affect several family members simultaneously. The factor *nutrient deficiency* refers to the nutrients available to the child (or to the mother if she is breastfeeding). Clearly, until proper artificial feeding was introduced, breastfeeding offered the best nutrients as well as protection against waterborne diseases. *Injury* can range from neglect to the outright killing of infants. In the societies of Japan and China, infanticide was a more or less accepted form of 'postnatal birth control', in contrast to Europe.[34] However, the surmortality of European illegitimate children can also be attributed, at least in part, to infanticide.[35] Finally, Mosley and Chen mention *personal illness control* or preventive and curative treatments available.

In the model in figure 1, we place these proximate determinants in the box on the right. In the box on the left, we put the socio-economic and cultural variables working via the proximate determinants. Regional factors include a broad range of variables. We can think of population density affecting the risk of infectious diseases, the availability of uncontaminated water, the proximity of medical care, etc. In our research, we can only control for these factors to a limited extent, by including a dummy variable that states whether the child was living in a city or not.[36] In various studies, an association between religion and child survival has been noted, although the precise mechanisms are

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31. Olof Gardarsdottir, 'Public health measures against neonatal tetanus on the island of Vestmannaeyjar (Iceland) during the 19th century', *History of the Family* 14 (2009) 266-279.

32. Evelien C. Walhout, 'Is breast best? Evaluating breastfeeding patterns and causes of infant death in a Dutch province in the period 1875-1900', *History of the Family* 15 (2010) 76-90.

33. Frans van Poppel, Marianne Jonker and Kees Mandemakers, 'Differential infant and child mortality in three Dutch regions, 1812-1909', *Economic History Review* LVIII (2005) 272-309.

34. Renzo Derosas en Noriko Tsuya, 'Child control as a reproductive strategy', in Tsuya et al., *Prudence and pressure* 129-155; Lynch, 'Why weren't (many) European women "missing"?'

35. Frans van Poppel, Jan Kok and Ellen Kruse, 'Mortality among illegitimate children in mid-nineteenth-century The Hague,' in: Carlo A. Corsini en Pier Paolo Viazzo (eds.), *The decline of infant and child mortality. The European experience: 1750-1990* (Den Haag 1997) 193-211; Cliona Rattigan, 'Done to death by father or relatives': Irish families and infanticide cases, 1922-1950, *History of the Family* 13:4 (2008) 370-383.

36. We followed the distinction proposed by Kooij between urban and rural municipalities: 'urban' here stands for a town with over 10,000 inhabitants and with less than two and a half per cent of the population employed in the agricultural sector, Pim Kooij, 'Stad en

still unclear. It has been suggested that Roman Catholics had relatively high rates of infant mortality because of an 'anti-modern' attitude stimulated by priests during the period of Catholic emancipation in the second half of the nineteenth century. This apparently made Catholics wary of hygienic advice coming from government agencies and health officials. Thus, Catholicism can be an an indicator for low values on 'personal illness control'. Presumably, Catholics also began to reject public breastfeeding, precisely in a period when their women were becoming more active in paid, outdoor labor.[37] In contrast, nineteenth-century Jews were noted for their observance of hygienic rituals, their propensity to breastfeed and their responsiveness to medical advice, all combining to improve the survival chances of Jewish infants.[38] In our analysis, we include the religion of the head of the household.

Figure 1 *Explanatory model for the relation between family systems and infant and child mortality*

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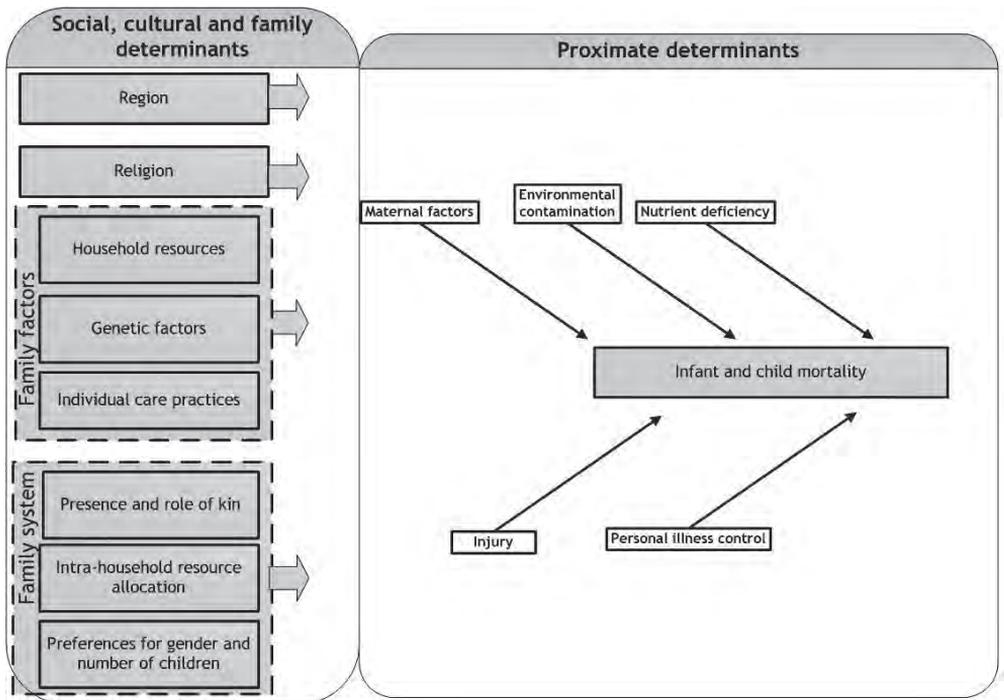
platteland', in: Frits L. van Holthoon (ed.), *De Nederlandse samenleving sinds 1815. Wording en samenhang* (Assen 1985) 93-115.

37. Frans van Poppel, 'Religion and health: Catholicism and regional mortality differences in nineteenth-century Netherlands', *Social History of Medicine* 5 (1992) 229-253.

38. Frans van Poppel, Jona Schellekens and Aart C. Liefbroer, 'Religious differentials in infant and child mortality in Holland, 1855-1912', *Population Studies* 56 (2002) 277-289; Derosas, 'Fatherless families'.

We discern different types of family factors. An obviously very important one is household resources. Family income affects health in many ways: does the family have access to clean water and to medical care, does the family have the possibility to feed and house an additional child, etc.? To control as far as possible for income-related factors, we included the occupational position of the head of the household. We coded the occupations in the international coding scheme HISCO and grouped them using the HISCLASS classification scheme.[39] In our analysis, we were interested in rules and practices of care and competition between (extended) family members, resulting in higher or lower mortality hazards. However, the associated mortality risks of family members may also stem from other causes. The first one is shared genes. The fact that, for instance, a grandmother and a grandchild survive may be due to their shared genetic make-up. To some extent, we can control for this by including the bloodline. If, for instance, paternal grandfathers have an effect and paternal grandmothers do not, we can be quite sure that the father's genes were not responsible for the outcome. The second cause is death (or survival) clustering in families because of family-specific traditions in care, food preparation or hygiene. Such individual traditions may explain why deaths occur in some families more often than in others.[40] This problem of 'unobserved heterogeneity' is exacerbated when all the children of selected families are included in the analysis. For this reason, we include only one child per family. The third, already mentioned, factor is shared causes of death, e.g. an infectious disease. To eliminate this confounding factor, we use a regression technique (generalized linear modelling) that allows us to prevent lagged effects being overshadowed by immediate effects (see below).

In the lower left-hand corner of figure 1, we have a box labeled 'family systems'. Dependent on the norms governing co-residence of generations and inheritance, some regions have different configurations of co-resident kin than others. The regional division in family types in the Netherlands is very persistent. For the eighteenth century, Van der Woude counted co-resident kin in merely 3.6 percent of all households in the Noorderkwartier region, far less even than the Dutch average of 1960.[41] The other extreme is found in the south and eastern parts of the country. For instance in the arable farming part of Salland in 1748, 31 percent of all households had co-residing

39. Marco H.D. van Leeuwen, Ineke Maas and Andy Miles, HISCO. *Historical International Standard Classification of Occupations* (Leuven 2002); Marco H.D. van Leeuwen and Ineke Maas, HISCLASS. *A Historical International Social Class Scheme* (Leuven 2011).

40. Mattijs Vandezande, Sarah Moreels and Koen Matthijs, Explaining death clustering. Intergenerational patterns in infant mortality, Antwerp, 1846-1905. Working paper of the Scientific Research Community Historical Demography, WOG/HD/2010-13 (Leuven 2010).

41. Ad M. van der Woude, *Het Noorderkwartier. Een regionaal-historisch onderzoek in de demografische en economische geschiedenis van westelijk Nederland van de late middeleeuwen tot het begin van de negentiende eeuw* (Wageningen 1973).

kin.[42] In the middle of the twentieth century, this figure could still be as high as 50 percent in the rural regions of the east.[43] A household survey of the 1950s also described an intermediate zone in the southwest (Zeeland), the south (Brabant) and the central parts of the country (Utrecht). In our earlier research, we confirmed the existence of these three broad regions for the period around 1900, using data from the census.[44] In map 1, we show the percentage of extended households among the households in which the children in our sample were born (see next section). Again, we can see the difference between the northwestern part with nuclear families and the eastern and southern parts, with an intermediate zone in between. Several explanations have been proposed to account for the marked regional variation in households. Firstly, in the commercialized northwestern part of the country, agriculture was small-scale but profitable; in other words, farmers did not have to rely on family labour but could hire (seasonal) workers on the labor market.[45] In the southern and eastern regions, agriculture remained a self-sustaining family enterprise for a much longer period. Secondly, in the eastern areas, impartible inheritance was the rule. The designated heir (often the youngest son) stayed on the farm, and only became head when the father decided the time had come. The heir and his wife were bound by many obligations (often stipulated) to the elderly parents and living-in siblings in return for the opportunity to farm the family property. Interestingly, the practice could also be found among labourers in the eastern provinces, although less frequently than among farmers. In the other parts of the country, the connections between inheritance and co-residence are much less clear-cut. In the central parts, care contracts (possibly involving co-residence of two married couples) were mentioned in combination with partibility, whereas in the southwest the geographic location of many farms (with narrow plots with only one access to a road) simply prevented their division. This forced impartibility may have stimulated co-residence as well.[46] In the southern regions, strict partibility was practised. The ensuing fragmentation of holdings reduced the marriage prospects of farmer's children, leading to a late age at marriage as well as high

42. J.A. Verduin, 'Het gezin in demografisch perspectief', in: G.A. Kooy (ed.), *Gezinsgeschiedenis. Vier eeuwen gezin in Nederland* (Assen en Maastricht 1985) 69-110.

43. G.A. Kooy, *De oude samenwoning op het nieuwe platteland. Een studie over de familiehuishouding in de agrarische Achterhoek* (Assen 1959).

44. Jan Kok and Kees Mandemakers, '"Je zoudt maar last van mij hebben". Verwanten in het Nederlandse huishouden, 1860-1940', *Tijdschrift voor Sociale en Economische Geschiedenis* 6 (2009) 139-165.

45. Jan Kok and Kees Mandemakers, A life-course approach to co-residence in the Netherlands, 1850-1940, *Continuity and Change* 25 (2010) 285-312.

46. D. van Blom, 'Boerenerfrecht (met name in Gelderland en Utrecht)', *De Economist* 64 (1915) 849-898.

levels of permanent celibacy. In this area, many unmarried siblings remained together to farm the parental homestead.

Map 1   *Provincial-level percentages of extended families in households in which children were born, 1850-1909*

Source: Historical Sample of the Netherlands. Release 2010.01.

Is the effect of kin (grandparents, uncles, aunts) on infant and child survival generally the same in each region, and can we thus expect simple compositional effects? This would imply, for instance, that when co-resident kin is beneficial, we find a stronger overall effect in regions where more kin is actually available in the household. Or do the roles and expectations of kin, for instance how to take care of orphans, *differ* between family systems, as is suggested by the recent literature? To answer these questions, we will look at

the role of kin in the two regions with the greatest contrast, the nuclear family zone (North and South Holland, Friesland and Groningen) versus the 'stem family' region (Drenthe, Overijssel, Gelderland and Limburg).

The explanatory model in figure 1 also has a box labelled 'intra household resource allocation'. As this is largely uncharted territory, our hypotheses are very preliminary. We assume that, in the nuclear family region, the older generation co-resides with a married couple only if the older generation needs help. We also assume that the couple that takes one or both elderly parents into their household can afford to do so. Reports on this phenomenon show that the lowest social classes rarely took in their elderly parents into their households, simply because there was not enough space.[47] Thus, we expect neither fierce competition for resources (resulting in higher death rates of children) nor a great contribution to household resources and care from the grandparents in this situation. A different logic operates when the *younger* generation is facing problems, which are most apparent when one or both spouses die. In that case, co-residence with a grandparent stems from a decision to help, and we can expect a positive effect on the survival chances of grandchildren. In the stem family region, co-residence of three generations is more or less 'normal'. We can expect a squeeze in the stage of the family cycle when the first generation is reaching old age and when there are many young children in the third generation. A competition for resources may then result in higher infant or child mortality. A relief from this squeeze may be offered by uncles and aunts who can contribute to the family income or help the mother with caring. We do not know how Dutch stem families responded to a crisis in the middle generation. It seems likely that balancing consumption and production would become even more difficult. If this happened to married, non-inheriting children, their children might be taken in, making the consumer/producer ratio more unfavourable. To test these hypotheses, we will contrast 'normal' to 'crisis' situations in the two regions.

Finally, we include a box 'preferences for gender and number of children'. In the first section we have described how these preferences operated in Chinese and Japanese family systems. In the European context, we do not expect to find a correlation between gender composition and mortality, as gender-specific infanticide or child neglect was virtually nonexistent.[48] However – in the line of the 'lifeboat hypothesis' – we may surmise that in the stem families, grandparents were more keen to ensure the survival of the designated heir than of the non-heirs. As the rules on inheritance differed by locality, we

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47. Boudien de Vries, 'Familiehulp 1800-1890', in: Jacques van Gerwen and Marco H.D. van Leeuwen (eds.), *Studies over zekerheidsarrangementen. Risico's, risicobestrijding en verzekeringen in Nederland vanaf de Middeleeuwen* (Amsterdam/Den Haag 1998) 467-480, 472.
48. Derosas, 'Fatherless families'; Lynch, 'Why weren't (many) European women "missing"?'

will test whether sons or first- or last-born children benefited more than others from co-residence with grandparents.

Data and method

For this research, we made use of the Historical Sample of the Netherlands (HSN), which compiles life course data as completely as possible for a representative portion of the nineteenth- and twentieth-century population.[49] The sample is drawn from the birth registers from the period 1812-1922 (N=78,000). We make use of the Life Courses Release 2010.01 Data Set covering the now available data in three parts: a) the provinces of Utrecht, Friesland, Zeeland and the city of Rotterdam for the birth period 1850-1882 (N=5,827), b) the other parts of the Netherlands for the birth period 1863-1882 (N=7,767) and c) the entire country for the birth period 1883-1922 (N=23,579).

Most of the data for the construction of life courses are extracted from the population registers. Dynamic population registers were introduced in 1850 for the whole of the Netherlands. In the early registers, each household was entered on a double page with the head of the household first. The head was followed by his wife (if the head was a married male), children, other relatives, and other members of the household. Date and place of birth, relation to the head of the household, sex, marital status, occupation, and religion were recorded for each individual. All changes occurring in the household were recorded in the register. These changes were usually made at least within a month of occurrence of an event. New household members arriving after the registration had started were added to the list of individuals already recorded, and those moving out by death or migration were deleted with reference to place and date of migration or date of death. Thus, families and individuals are followed on a day-by-day basis for a long period.[50]

For our purpose, we created a data file with quarterly snapshots of the households of the 30,157 Research Persons for which we have information from the date of birth onwards.[51] In contrast to our earlier work on households,[52] we did not classify households according to a predetermined typology, but retained all details on co-residence with the samples of Research

49. Kees Mandemakers, 'The Netherlands. Historical sample of the Netherlands', in: Pat Kelly Hall, Robert McCaa, Gunnar Thorvaldsen (eds.), *Handbook of International Historical Microdata for Population Research* (Minneapolis 2000) 149-177.

50. For the way in which the life courses were constructed from the population registers, see Kees Mandemakers, 'Building life course datasets from population registers by the Historical sample of the Netherlands (HSN)', *History and Computing* 14 (2006) 87-107.

51. Due to privacy regulations, the information in the Release is less detailed after 1909.

52. Kok and Mandemakers, 'A life-course approach to co-residence'.

Persons. Thus, for every 91 days in a person's life course, as well as the day of death, we have a record with details on the number of sisters, brothers, aunts and uncles, sons and daughters, etc. This gives us a finely detailled picture of the number and type of kin present along the life course. A description of the distribution of the data across region, social class, religion, etc. is provided in the Appendix.

For every snapshot the presence of specific kin members is assessed, as well as whether the child is still alive or not. Since we do not know exactly when household changes took place, the additional snapshot at the death of the child assures that any changes in the household came before the death of the child. The longer the interval, the longer a child is at risk, and the larger the chance that the child will die. Therefore, the interval length needs to be taken into account. For this, we use a so-called generalized linear model. The model is called 'linear' because it uses a linear function to predict the outcomes: the sum of products of indicators, such as the presence of a certain kin member, and their estimated parameters. The result of the linear predictor is a transformation of the outcome variable using a link function.[53] Firstly, we opted for the binomial distribution to describe our outcome variable, using the canonical logit transformation as its link function. This specification makes the model identical to a common logistic regression. In this statistical technique, the outcome of interest is the *odds ratio*. Odds are a common way to express relative probabilities. For instance, suppose out of every 100 boys, 30 do not reach their first birthday, thus the probability of an infant boy dying in his first year is 30 percent. The odds are expressed as the probability of dying divided by the probability of surviving: 0.30/0.70=0.429. Suppose that the probability for girls dying is 20 percent, which means the odds are 0.20/0.80=0.250. We can then calculate the odds ratio as 0.429/0.250=1.716, thus in this example the odds of boys dying are more than 70 percent greater than the odds for girls. In our models, the odds ratios refer to the odds of groups of interest (e.g. children with a grandparent in the household) compared to the odds of a reference category (e.g. children with no grandparent in the household), keeping other factors that might influence mortality constant. Therefore, we do not observe 'absolute' probabilities of dying of specific subgroups, but the impact of specific factors on the relative likelihood (odds) to die when controlling for other factors.

Next, we opted for an observation-specific binomial denominator, which stands for the number of trials in the binomial distribution or, in this analysis, the length of an interval between two snapshots, measured in days.[54]

53. Peter McCullagh and John A. Nelder, *Generalized linear models. Second edition.* Monographs on statistics and applied probability (Boca Raton 1999) 37.
54. James Hardin and Joseph Hilbe, *Generalized linear models and extensions* (College Station Tx 2001).

For most snapshots this interval is about 90 days, but when an additional snapshot was taken at the death of the Research Person, the resulting interval has a more variable length, altering the 'time at risk'. Therefore, the second statistical adaptation is necessary to neutralize the differences in time at risk between children. By measuring covariates at discrete snapshots, we allow for some delay between the actual change and the snapshot. We stress this because with our approach we also want to focus on non-immediate effects of changes in the household composition, as opposed to the immediate effects which are assumed (often implicitly) in most of the literature. An additional advantage is that the delay reduces the impact of simultaneous deaths of both child and kin (e.g. due to epidemics, maternal mortality, etc.) on our results.

Results

In interpreting the estimated parameters of our statistical exercise, we should bear in mind that co-occurrence of kin co-residence and infant and child mortality was rare, especially in the western part of the country. And because we have to control for many variables that also affect mortality, strongly significant results can hardly be expected. We begin with a first exploration of the overall impact of household composition on regional differences, by comparing a model without household factors with a model including household factors.[55] In the second model of table 1, we focus on *competition* and *altruism,* by looking at the effect of the share of elderly and young persons, respectively, in households. In this table we present a complete model of mortality with all estimated variables in the first five years, whereas in the next tables we only show the relevant outcomes, while controlling for all the other factors. When we look at the odds ratios (see previous section for an explanation) for snapshots 1-18 in Model A, we see that the age-specific decline in the hazards of dying is very strong. We can also see that the odds of dying is higher for boys, for illegitimate children, twins (3.039 or three times as high as for non-twins), children born after a short inter-birth interval, children whose predecessor has died, and children from either young or old mothers. In addition, we witness the impact of strong periodical, social, cultural and regional factors. Children born after 1880 had a strongly decreased chance of dying. Children born in elite families had lower chances of dying than children of farmers, whereas all other groups had higher chances. The highest odds are found in the group 'occupation unknown or without'. This probably indicates that these children were living in households of either elderly persons (retired,

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55. See the Appendix for a description of the variables included.

without occupation), or households headed by women (occupations often not specified) or in institutions. As for religion, we observe that Roman Catholic children had slightly higher mortality hazards than the reference category of Liberal Protestants.[56] Surprisingly, the Orthodox protestant have even higher odds. This may have resulted from their cultural isolation, which made them less receptive to medical advice coming from outside their communities. However, it is also true that they are clustered in relatively unhealthy areas in the southwestern and central parts of the country. As expected, the Jews had low levels of infant mortality. Children living in cities had higher odds of dying than children living in rural areas. Finally, there are no significant mortality differences between what we call nuclear, stem and intermediate regions.

In Model A, we see that the odds of dying is lower (but not significantly so) in the nuclear region than in the intermediate region. Although the provinces of North and South Holland are part of the southwestern area with high rates of infant mortality, this is clearly compensated by the favourable circumstances in Friesland (and, to a lesser extent, Groningen).[57] Interestingly, the stem area does have significantly lower odds. If we compare Model A to B in which we included household composition, we notice that the odds of the stem area are somewhat higher and no longer significantly different from the intermediate region. Thus, we can conclude that household factors did have a moderate impact on overall regional mortality differences.

Model B in table 1 suggests a strong role for competition among young children. A 20 percent increase in the share of persons younger than 12 increases the odds of dying by 9.5 percent. In the Eurasia project a similar effect was found, but only in the complex families of Japan, China and Italy. In that project, the results for the elderly were mixed as well: in Italy, a rise of 20 percent in the proportion of elderly increased the death rate of infant daughters, but in southern Sweden it had the opposite effect. In China and Japan, female children suffered from the presence of elderly persons, whereas some positive effects were found, mainly for boys, in several European villages.[58] In model B, we see an overall positive effect of co-residing elderly in the Netherlands, but this outcome is not statistically significant.

56. For the categorization, see Jan Kok and Jan van Bavel, 'Stemming the tide. Denomination and religiousness in the Dutch fertility transition, 1845-1945', in Renzo Derosas and Frans van Poppel (eds.), *Religion and the decline of fertility in the Western World* (Dordrecht 2006) 83-105.

57. Peter Ekamper and Frans van Poppel, 'Zuigelingensterfte in Nederland, 1841-1939', *Bevolkingstrends* 1 (2008) 23-29.

58. Lee et al., 'Society and Mortality'.

TABLE 1　*Models of mortality in the first five years, children born 1850-1909, odds ratios. Model A without household composition and Model B showing impact of an increase (by 20%) of co-residing elderly (>65 years) and young (<12 years) persons)*

	Model A		Model B	
	No household covariates		With household covariates	
Snapshot 1	0.554	****	0.555	****
Snapshot 2	0.368	****	0.369	****
Snapshot 3	0.278	****	0.280	****
Snapshot 4	0.228	****	0.230	****
Snapshot 5	0.171	****	0.172	****
Snapshot 6	0.130	****	0.124	****
Snapshot 7	0.105	****	0.105	****
Snapshot 8	0.087	****	0.087	****
Snapshot 9	0.072	****	0.072	****
Snapshot 10	0.065	****	0.065	****
Snapshot 11	0.051	****	0.051	****
Snapshot 12	0.049	****	0.049	****
Snapshot 13	0.048	****	0.048	****
Snapshot 14	0.043	****	0.043	****
Snapshot 15	0.040	****	0.040	****
Snapshot 16	0.038	****	0.038	****
Snapshot 17	0.033	****	0.032	****
Snapshot 18	0.037	****	0.037	****
After 1880 (before=ref)	0.666	****	0.655	****
Male (female=ref)	1.170	****	1.170	****
Illegitimate (legitimate=ref)	1.414	****	1.466	****
Twin (no twin=ref)	3.039	****	2.951	****
Short inter-birth interval (longer than 400 days=ref)	1.469	****	1.448	****
Previous child died (not died=ref)	1.366	****	1.370	****
Mother younger than 20 (20-35=ref)	1.298	***	1.371	***
Mother older than 35	1.158	****	1.120	****
Elite (farmer=ref.)	0.803	*	0.804	*
Lower middle class	1.121	**	1.108	**
Skilled worker	1.277	****	1.257	****
Labourer	1.292	****	1.270	****
Unknown	1.613	****	1.589	****
Roman Catholic (Liberal Protestant=ref)	1.095	***	1.094	***
Orthodox Protestant	1.180	****	1.177	****
Jewish	0.735	***	0.738	***
No religion	0.544		0.544	**
Other and unknown	1.117	*	1.102	
Urban (rural=ref)	1.091	****	1.089	***
Nuclear part (Intermediate=ref)	0.970		1.035	
Stem part	0.933	**	0.975	
20% increase in share of youth (<12)			1.095	****
20% increase in share of elderly (>65)			0.916	

Source: Historical Sample of the Netherlands. Release 2010.01.

**** = significant < 0.001; *** = significant < 0.01; ** = significant <0.05; * = significant <0.1

TABLE 2   *The impact on an increase (by 20%) of co-residing elderly (>65 years) and young (<12 years) persons on mortality of infant and children, by presence of parents and dominant family system. Odds ratios, model with covariates*

Both parents present	Nuclear family region		Stem family region	
	Infants	Children	Infants	Children
20% increase in share of youth (<12)	1.077**	1.330****	1.083*	1.258***
20% increase in share of elderly (>65)	0.960	1.034	0.715**	1.035
One or both parents absent				
20% increase in share of youth (<12)	0.956	1.078	0.870	1.213
20% increase in share of elderly (>65)	0.663*	1.113	1.220	1.694

Source: Historical Sample of the Netherlands. Release 2010.01.
**** = significant < 0.001; *** = significant < 0.01; ** = significant <0.05; * = significant <0.1

In table 2, we take a more detailed look by differentiating between infants and children, between nuclear and stem family regions, and between 'normal' (both parents present) and 'crisis' situations (one or both parents absent). In 'normal' situations, infant and children suffered from crowding and competition for care and food among themselves, in both the nuclear and stem family regions. Elderly people did not compete with infants, in fact, their presence was very beneficial, in particular in the stem region. However, their presence seems to have had a slightly negative effect on children. As we expected, in the nuclear area, co-residence with grandparents was an important solution for crisis situations, such as the death of one of the parents, and we indeed find a positive effect of the elderly on the survival chances of infants. Strikingly, the opposite effect is visible in the stem region, in particular among children, although this is not statistically significant.

In table 3, we specify effects on mortality by type of kin, keeping the effect of other kin constant. Because the population registers in the period 1850-1862 do not provide details on the relationship of individuals to the head of the household, we use the birth cohorts 1863-1909 for this calculation (and the next in table 4). We will first look at the first five years of life taken together. It is very interesting to see that the death of the mother has much stronger effects in the nuclear region than in the stem region. In the first region, the death of the mother leads to an 39 percent increase in the odds of dying (odds ratio 1.390) versus 20 percent in the stem region (odds ratio 1.205). Clearly, the extended family plays a mitigating role in this region, but only when it concerns the absence of the mother. In contrast, the death (or absence) of the father seems to have had stronger (negative) effects on infant survival in the stem (odds ratio 1.307) than in the nuclear family area (odds ratio 1.105). Overall, living with grandparents is beneficial. Apart from the maternal grandfather, all have significant positive effects on survival, that is, the odds ratios are below 1.00. Uncles and aunts also appear in an 'altruistic' role in both regions, but more significant in the stem region as expected. The

role of 'other kin' is surprisingly strong, and negative in the sense that they increase the likelihood of dying. Probably, 'other kin' refers mainly to nieces and nephews of the sampled Research Persons, who play the same role as young siblings, thus competing for resources.

TABLE 3 *Effect of kin presence in the household on mortality in the first five years of life, the Netherlands, 1863-1914. Odd ratios, model with covariates*

	Nuclear region	Stem region
Father absent, mother present (both present=ref.)	1.105	1.307*
Mother absent, father present	1.390***	1.205
Both parents absent	1.003	0.795
Grandfather, maternal	0.877	0.880
Grandfather, paternal	0.586***	0.646***
Grandmother, maternal	0.749**	0.698**
Grandmother, paternal	0.815	0.690**
Older sisters (at least 9 years older)	0.959	1.012
Older brothers (at least 9 years older)	1.004	0.991
Uncles	0.848*	0.840**
Aunts	0.862	0.847*
Other kin	1.148***	1.154***
Non-related persons	1.009	1.019

Source: Historical Sample of the Netherlands. Release 2010.01.
**** = significant < 0.001; *** = significant < 0.01; ** = significant <0.05; * = significant <0.1

It is not easy to translate these outcomes into effects on infant and child well-being on a regional level. To begin with, not even in the stem region was living with extended kin the predominant experience. As map 1 has shown, extended families in the stem family provinces are about twice as frequent as in the nuclear family provinces, but still amount to only a quarter of all households. Moreover, the effects we found in table 3 were not particularly strong (more or less of the same magnitude as social class differences in mortality, see table 1). Furthermore, most of the effects are in the same direction. Thus, it is unlikely that differences in household composition between the two regions would lead to strong differences in aggregate infant and child mortality rates.

In table 4 we use the same categories as in table 2. The smaller absolute numbers per category are reflected in less significant results. Still, the outcomes are very instructive. In 'normal situations' grandparents generally always play a positive role, but their effect is only statistically significant in the stem family region where they occur most frequently. Here, the maternal grandmother has the strongest positive effect. Her presence results in an odds ratio of 0.539, thus it lowers the odds of infants dying by 46 percent.

Remarkably, her role is reversed (but not significant) in the nuclear region. Older sisters are more helpful than older brothers, but the outcomes are not significant. Possibly, couples in the nuclear area took in the wife's mother when she was old and needy and more a burden than an asset in the household. The effect of non-related persons (e.g. servants, boarders and lodgers) appears positive in both regions (apart from infants in the stem area). Apparently, their presence is either a sign of a healthy family economy (servants) or they add to the family budget (boarders and lodgers).

TABLE 4   *Effect of kin presence in the household on infant and child mortality, in crisis and non-crisis situations, the Netherlands, 1863-1914. Odds ratios, model with covariates*

Both parents present	Nuclear family region		Stem family region	
	Infants	*Children*	*Infants*	*Children*
Grandfather, maternal	0.767	0.727	0.688	0.809
Grandfather, paternal	0.720	0.431	0.651*	0.643
Grandmother, maternal	0.773	1.096	0.539***	0.725
Grandmother, paternal	0.937	0.616	0.631**	0.809
Older sisters (at least 9 years older)	0.961	0.993	1.002	1.031
Older brothers (at least 9 years older)	1.002	1.026	0.998	1.000
Uncles	0.844	0.859	0.742**	0.867
Aunts	0.987	0.583*	0.862	0.677*
Other kin	1.096	1.171	1.166**	1.225*
Non-related persons	0.907*	0.914	1.030	0.870*
One or both parents absent				
Grandfather, maternal	1.228	1.029	1.551	1.019
Grandfather, paternal	0.252	-	0.303	1.523
Grandmother, maternal	0.405***	0.606	1.000	0.261*
Grandmother, paternal	0.878	0.376	0.937	0.181
Older sisters (at least 9 years older)	0.846	0.853	1.069	1.402
Older brothers (at least 9 years older)	1.006	0.843	0.807	0.582
Uncles	0.920	0.659	0.967	0.612
Aunts	0.865	0.854	0.865	0.475*
Other kin	1.123	1.325*	1.042	1.558****
Non-related persons	1.140***	1.137	1.107*	0.944

Source: Historical Sample of the Netherlands. Release 2010.01.
**** = significant < 0.001; *** = significant < 0.01; ** = significant <0.05; * = significant <0.1

In the situation of family crisis, the picture is quite different. Now, the maternal grandmother plays a very important role in keeping infants alive, but only in the nuclear area. For children older than one, we see a positive role of the maternal grandmother in the stem region. In the same area, nieces

and nephews ('other kin') are quite harmful to children whose parents have died. As we expected, the stem family is not functionally adapted to take in additional children, and the balance between producers and consumers is put under stress. However, grandmothers and aunts can counteract this. In both areas, infants have higher hazards of dying when non-related persons are present. This probably reflects situations in which they are living in an institution or are boarded out with strangers.

We have seen that, in almost all situations, grandparents played a positive role in keeping grandchildren alive. Did grandparents in three-generation families in the stem family area favour the potential heir? Our statistical exercises (the models are not shown here) did not yield significant interaction effects with the presence of grandparents either for male children or for the first or the last child. Thus, there is no evidence of a 'household hierarchy' in the stem region with an impact on survival chances, as the recent literature suggests.

Conclusion

Research on the relation between mortality and household structure is currently moving from stereotypes of 'nuclear hardship', 'lifeboat' and 'corporate ethics' to a more nuanced view on families, in which the position of individuals within household hierarchies is crucial. However, the local mechanisms and rules behind these hierarchies are still largely unknown. Moreover, we do not know when and to what extent the household configuration led to intra-household competition and when to intra-household altruism. In order to detect these local mechanisms, we have focused our exploratory research on two areas in the Netherlands, one where the nuclear family was dominant, and had been so for a long time, and one with a strong presence of three generation or 'stem' families.

Our results are not always easy to interpret. Although the sample is large, the research persons are scattered over a large area and a broad time period and are found in widely diverging social and familial settings. This makes it difficult to focus on infant and child mortality in specific settings without losing explanatory power. However, we were able to show that family composition – beyond the presence of the parents – is an important variable in explaining household-level variation in infant and child mortality. Presence of kin (extended) appears to be just as important as maternal factors and household resources. For instance, the positive effects of the presence of grandparents can compensate for the loss of the father or mother, as shown in table 3. Uncles and aunts as well played a positive, altruistic role in both regions. In the Netherlands, a family setting which was optimal for infants' and children's well-being included parents, grandparents, (unmarried) uncles and

aunts, possibly servants, boarders and lodgers. Moreover, the family should not have too many young children, whereas having older brothers and sisters did not seem to add much.

By and large, we found that different types of kin had the same (positive or negative) influence on mortality in the two regions. And because the intensity of kin co-residence differed between nuclear and stem family regions, we can expect some effects on overall regional mortality differentials. However, these effects are probably small, because extended families were still a minority, even in the stem region. Also, the presence of 'other kin' (mostly nieces and nephews) counteracted the positive effects of grandparents, uncles and aunts on the survival of young children.

By focusing on crisis situations, we tried to answer the question of whether different 'rules' applied in the stem versus the nuclear family area. We found that elderly persons in the household had a positive effect on infant survival in 'normal' situations in the stem region, whereas in crisis situations they helped in the nuclear region but not in the stem region. This seems to confirm Wall's suggestion that the nuclear family was more flexible in crisis situations than stem (or joint) families. However, the similarity between the regions in family responses to crisis situations seems more important than differences. We should bear in mind that these regions include widely varying populations. In future research, it might be advisable to focus on the agrarian populations of the different regions, as the notion of family systems is most appropriate to the 'rules' of inheritance and co-residence among farmers. Also, mortality is a rather crude indicator of infant and child well-being, and the study of its interaction with household dynamics requires a complex model with many variables. It will be interesting to see whether our findings on the impact of extended, co-resident kin on well-being can be confirmed with other possible indicators, such as level of schooling and height.

We can conclude that kin co-residence affected infants and child well-being in various ways. Inclusion of this variable certainly enriches our perspective on processes of intra-household competition as well as altruism.

APPENDIX *Description of variables, first observation of each child*

	N	%
Province		
Groningen	1,219	4.04
Friesland	3,241	10.75
Drenthe	824	2.73
Overijssel	1,752	5.81
Gelderland	2,545	8.44
Utrecht	2,344	7.77
North Holland	5,043	16.72
South Holland	6,435	21.34
Zeeland	2,100	6.96
North Brabant	3,486	11.56
Limburg	1,168	3.87
Urban		
Rural	20,982	69.58
Urban	9,175	40.42
Religion		
Roman Catholic	10,133	33.60
Liberal Protestant	15,055	49.92
Orthodox Protestant	3,431	11.38
None	113	0.37
Jewish	483	1.60
Other and unknown	942	3.12
Gender		
Female	14,726	48.50
Male	15,530	51.50
Legitimacy		
Legitimate	29,099	96.49
Illegitimate	1,058	3.51
Twin		
No twin	29,597	98.14
Twin	560	1.86
Interval		
No short interval	28,501	94.51
Short Interval	1,656	5.49
Survival status previous child		
Previous child survived	26,926	89.29
Previous child died	3,231	10.71

	N	%
Age of mother		
Mother younger than 20	167	0.55
Mother 20-35	20,532	68.08
Mother older than 35	9,458	31.36
Occupation head of household		
Elite	441	1.46
Lower middle class	3,986	13.22
Skilled worker	5,205	17.26
Farmer	3,864	12.81
Labourer	13,664	45.31
Unknown/without	2,997	9.94
Period		
Before 1880	11,489	38.10
After 1880	18,668	61.90
Total	30,157	

About the authors

Jan Kok is professor in Comparative History of the Life Course at Radboud University Nijmegen and member of the e-Humanities Group KNAW. He publishes in the field of historical demography and family history.

E-mail: J.Kok@let.ru.nl.

Mattijs Vandezande holds a master's degree in History and is currently a PhD student at the Centre for Sociological Research, KU Leuven. He is preparing a dissertation on 19th-century death clustering and high-risk families. His interests lie with young age mortality, family sociology, and the statistical modeling of life courses.

E-mail: Mattijs.Vandezande@soc.kuleuven.be.

Kees Mandemakers is senior research fellow at the International Institute for Social History (IISG), heading the Historical Sample of the Netherlands (HSN) and professor of Large Historical Databases at the Erasmus School of History, Culture and Communication of the Erasmus University Rotterdam. Main research interest: Methodology of large historical databases, Family and Demography, Social stratification and mobility, Social history of education. For publications, see http://www.iisg.nl/staff/kma.php.

E-mail: kma@iisg.nl.