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Intergenerational relations and child development in England

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ABSTRACT: Evolutionary studies have shown that in many traditional populations the beneficial effects of grandparental presence for grandchildren may vary according to the sex and lineage of the grandparents, as well as by the sex of the grandchild. However, few studies have investigated the relevance of these factors in modern developed societies. The present investigation uses the Millennium Cohort Study (n = 4,636 children) to analyse the association between grandparental investment and child development in contemporary England. Grandparental investment is measured by parent-grandparent contact frequencies at the child's age of 3 and child development by "early learning goals" over the first year of primary school assessed with the Foundation Stage Profile (FSP). Children whose mothers reported contacts with maternal grandparents receive higher FSP scores compared to those with no contact at all. In addition, children whose fathers reported daily contacts with paternal grandfathers have lower FSP scores than other children. The study provides evidence of the relevance of grandparental investment on grandchild development also in developed societies. The results are discussed with reference to the grandmother hypothesis, sex-specific reproductive strategies and sex chromosome hypothesis.

KEY WORDS: child development, Foundation Stage Profile, grandchildren, grandparents, Millennium Cohort Study

Introduction

Grandparents may increase their inclusive fitness by investing in their grandchildren, with whom they share on average 25% of their genes (Hamilton 1964). Previous research has shown that in pre-modern and traditional populations grandparents may have improved their fitness by keeping grandchildren alive and the beneficial effect of grandparents could vary by sex and lineage of the grandparents, as well as by the sex of the grandchild (Fox et al. 2010; Sear and Mace 2008). However, in modern Western societies with low child mortality rates, grandparents are no longer needed to keep children alive (Coall and Hertwig 2010; 2011). This means that in modern societies the effects of grandparental

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investment should not be measured by grandchild survival, but rather by studying "softer" types of outcomes, such as grandchild development (Sear and Coall, 2011).

A review of 19 studies by Sear and Coall (2011) shows that grandparental support generally correlates with better child outcomes in modern societies. In these studies child outcome is measured by the child's psychological adjustment, mental and physical development, lack of depression, and academic achievement. The effect on children often appears to be mediated by the parent-grandparent relation: some recent studies have found that in contemporary societies, especially the quality of the relation between parents and grandparents influenced both fertility (Waynforth 2011) and child development (Scelza 2011).

Previous studies have shown that all grandparents may not benefit grandchildren equally (e.g. Snopkowski and Sear 2015). In pre-modern and traditional populations the presence of grandmothers are found to improve child survival rates (e.g. Jamison et al. 2002; Ragsdale 2004; Lahdenperä et al. 2004; Sear et al. 2000; 2003; Voland and Beise 2002), while grandfathers are found to have much less beneficial or even unbeneficial impact on child survival (e.g. Dong et al. 2016; Lahdenperä et al. 2007). In modern societies maternal grandparents are found to increase child well-being measured by psychological adjustment and development (Lussier et al. 2002; Tanskanen and Danielsbacka 2012; Tanskanen and Danielsbacka 2016). In addition, some studies have evidenced that the presence of paternal grandmothers may benefit granddaughters, while the presence of paternal grandfathers may benefit grandsons (Fox et al. 2010; Johow et al. 2011). Evolutionary researchers have explained biased grandparental effect by the grandmother hypothesis, sex-specific reproductive strategies, and sex chromosome hypothesis (Table 1).

The grandmother hypothesis (Hawkes et al. 1997) states that the long postmenopausal lifespan of females might be an evolved adaptation allowing post-reproductive grandmothers to provide assistance to their offspring contributing to the fertility of daughters and daughters-in-law, and the survival of grandchildren. Combined with the costs of reproductive conflict, especially between an older woman and her daughter-in-law (Lahdenperä et al. 2012), the grandmother hypothesis may account for the evolution of the long postreproductive life span in humans although it remains debated (see e.g. Coall and Hertwig 2010; Strassmann and Garrard 2011 for discussion; see Kachel et al. 2011 for a mathematical simulation). The grandmother hypothesis states that the grandmaternal support

Table 1. Theoretical predictions for differential grandparental effect: Is the specific grandparent type expected to improve child development?

	Maternal grandmother	Maternal grandfather	Paternal grandmother	Paternal grandfather
Grandmother hypothesis	Yes		Yes	
Sex-specific reproductive strategies	Yes	Yes		
Sex chromosome hypothesis			Granddaughter in particular	Grandson in particular

has played a major role in child rearing in our evolutionary past (Lahdenperä et al. 2004; Rotering and Bras 2015), and it may do so also in modern societies (Coall and Hertwig 2010). Based on the grandmother hypothesis grandmothers are expected to improve child development.

Evolutionary researchers have argued that humans exhibit sex-specific reproductive strategies (Euler 2011). In mammals, where males can never be completely sure that they are the biological fathers of an offspring, and females tend to invest more in each offspring due to pregnancy and lactation (Trivers 1972), females tend overall to provide higher parental investment than males. Because of their lower levels of parental investment, males can theoretically increase their reproductive success more than females by mating with many partners (but see Kokko and Jennions 2003), so that other things being equal, men can be expected to invest more in offspring quantity and women in quality. Sex-specific reproductive strategies lead to different reproductive interests between maternal and paternal grandparents (Euler 2011). Because females tend to invest more in their children than males, the investment from maternal grandparents towards their daughter and her children are more likely to benefit grandchildren than paternal grandparents' investment towards their son and his children (Coall and Hertwig 2010). Thus, the sex-specific reproductive strategies theory assumes that investment from maternal grandparents, in particular, may increase child development.

Paternity uncertainty hypothesis predicts that all grandparents do not invest grandchildren equally (Euler 2011). In the case of grandparents, paternity uncertainty means that only the maternal grandmother can be sure that the grandchild is genetically related to her, while maternal grandfathers and paternal grandmothers have one link of paternity uncertainty, and paternal grandfathers have two uncertain links (Coall and Hertwig 2010; Euler and Weitzel 1996). In line with the expectations based on paternity uncertainty several studies from modern societies show that maternal grandparents tend to invest more in their grandchildren than paternal grandparents, and grandmothers tend to invest more than grandfathers (e.g. Danielsbacka et al. 2011; Pollet et al. 2006; 2007; but see Pashos 2000).

However, it may be that maternal grandmothers not only invest in their grandchildren the most of all grandparent types but they may also have most beneficial impact on child development. That is to say, it is not the grandparental investment per se that may make a difference, but rather what grandparents are doing when they are with the grandchild (Coall and Hertwig 2010). Thus, there could differences not only in quantity but also in quality of investment between different grandparent types. Because maternal grandmothers can be sure that they are investing in their genetically related offspring, while interacting with the child they may commit to increase child development more than other grandparent types, for example, by intensively teaching them basic skills and involving to their activities. Thus, one may argue that based on paternity uncertainty hypothesis maternal grandmothers should most probably of all four grandparent types increase child development.

Predictions based on the grandmother hypothesis and sex-specific reproductive interests ignore the possibility that the sex of a grandchild may also bias

grandparental investment patterns. Increasing number of recent studies have taken into account not only the parental and grandparental sex, but also that of the grandchild (Chrastil et al. 2006; Fox et al. 2010; Johow et al. 2011; Kaptijn et al. 2013; Kirchengast and Putz 2016; Rice et al. 2010; Seki 2012; Tanskanen et al. 2011). These studies have suggested that grandparental investment may be affected by the different inheritance patterns of sex chromosomes.

With respect to autosome chromosomes, grandparents are equally related to their granddaughters and grandsons, but this is not the case with sex chromosomes (Euler 2011). For Y chromosome relatedness, maternal grandfathers are 0% related to both granddaughters and grandsons, while paternal grandfathers are 100% related to grandsons and 0% related to granddaughters. With respect to X chromosomes, maternal grandmothers are 25% related to granddaughters and grandsons, while paternal grandmothers are 0% related to grandsons and 50% related to granddaughters. Thus maternal grandparents should benefit equally from having granddaughters and grandsons, whereas paternal grandmothers should benefit more from having granddaughters than grandsons, and paternal grandfathers should benefit more from grandsons than granddaughters. These expected genetic benefits may translate into favouritism (Chrastil et al. 2006; Fox et al. 2010). Thus, the sex chromosome hypothesis assumes that paternal grandmothers should increase the level of development of granddaughters, while paternal grandfathers should increase grandsons' development.

The most common limitations of previous studies concerning the association between grandparental investment and child outcomes is that they do not separate different types of grandparents from each other (but see e.g. Tanskanen and Danielsbacka 2012). Since to date only few studies have explored the association between grandparental investment and child outcomes with respect to lineage, grandparental sex and grandchild sex (e.g., Scholl Perry 1996). The present study takes all these factors into account.

Here we analyse the relationship between grandparental investment and grandchild development in contemporary England. We measure grandparental investment by parent-grandparent contact frequency that is an indirect indicator for grandparental investment (Coall and Hertwig 2010). Although direct grandparental investment is often found to associate with improved child well-being (see Sear and Coall 2011 for review), a previous study found that the increased amount of contacts between child's parents and grandparents was associated with the increased learning test scores among children (Tanskanen and Danielsbacka 2016). In addition, Pollet, Nelissen and Nettle (2009) have shown that parent-grandparent contact frequency is a good indicator of grandparental investment in general, because it tends to correlate with different measures of grandparental financial investment towards grandchildren.

Material and methods

The study uses data from the Millennium Cohort Study (MCS), which is a large cohort survey. The aim of the MCS is to gather longitudinal information on children born at the beginning of the 21st century in England, Wales, Scotland and Northern Ireland. Children are the subjects of the study, and parents or parent

figures are the informants, who answer questions concerning their children. In the MCS information is gathered from the main respondents (mostly the biological mothers of the children) and from the partner respondents (mostly the biological fathers of the children) separately (see Hansen, 2010 for a more detailed data description).

The article uses the second wave of the MCS data (collected in 2003–2005) and the children's development scores as reported by their teachers (concerning the school year 2005–2006). The study sample includes those cases where the main respondent is the biological mother, and partner respondent is the biological father of the target child, and they are interviewed in the second wave of the MCS. In addition only those cases where both parents live in the same household with the child are included because grandparental effects could vary between family types. In cases of twins or triplets, only one child of the set is included. The child development assessments are systematically collected only from schools in England, not from other MCS countries (Johnson, 2008), which is why only cases from England are included in the analyses. After these exclusions the study sample included 4,636 children aged approximately three (M = 37.3 months, SD = 2.13, min. = 33.9, max. = 54.3).

The dependent variable is the Foundation Stage Profile (FSP) assessment, which measures child development. The relevance to analyse the child development scores is evident from the perspective of previous findings. Studies have shown that early achievement correlates, for example, with better educational performance and a higher salary in later life (e.g., Currie and Thomas 1999, 2001; Feinstein and Duckworth 2006). In the state schools of England, teachers complete the FSP assessment concerning "early learning goals" at the end of the children's first school year (at the age of 5). These assessments are collected by the Department for Children, Schools and Families, and the FSP records are merged to the MCS data. The MCS data includes FSP records from 95% of the cohort member children (Johnson 2008).

The FSP assessment consists of six subscales that include thirteen nine-point scale items (see QCA 2003). These subscales are personal, social and emotional development (disposition and attitudes, social development, emotional development); communication, language and literacy (language for communicating and thinking, linking sounds and letters, reading, writing); mathematical development (numbers as labels and for counting, calculating, shape, space and measures); knowledge and understanding of the world; creative development; and physical development (Cronbach's = 0.86). The FSP assessment score ranges from 0 to 117, and the higher the number the better the assessment (M = 86.8, SD = 18.6). To correct for the skewness of the FSP variable, it was transformed using square transformation and dividing this by 1000.

Grandparental investment is measured by parent-grandparent contact frequencies as reported by the children's parents in the second wave when the child was about 3 years old. In the second wave of the MCS the children's mothers were asked to report how often they see their parents (i.e., maternal grandmothers and grandfathers) and the fathers of how often they see their parents (i.e., paternal grandmothers and grandfathers) with an 8-point scale ranging from "never" to "every day". The scale was classi-

Table 2. Cross-tabulation of parent-grandparent contact frequency variable (%)

Contact frequencies	Maternal grandmother	Maternal grandfather	Paternal grandmother	Paternal grandfather
Never	2.0	5.8	2.4	6.4
1–3 times a month or less often	36.8	44.6	47.5	48.9
Once or twice a week	24.5	24.9	32.0	28.3
3–6 times a week	20.8	15.3	10.4	8.4
Every day	16.0	9.3	7.7	7.9
n	4,636	4,028	4,423	3,777

Table 3. Descriptive statistics (%/mean)

	%/mean	SD
Child's sex (%)		
Boy	50.0	
Girl	50.0	
Child's age in months (mean)	37.3	2.15
Child's ethnicity (%)		
White	83.2	
Mixed	2.7	
Indian	3.8	
Pakistani or Bangladeshi	6.6	
Black	1.9	
Other	1.8	
Child's number of siblings (mean)	1.2	0.98
Mother’s age (mean)	32.6	5.23
Father’s age (mean)	35.4	6.02
Parents’ education (%)		
Both parents reached level 4 or 5	22.2	
Mother reached level 4 or 5, father not	14.7	
Father reached level 4 or 5, mother not	13.5	
Neither of the parents reached level 4 or 5	49.6	
Perceived financial situation of the family (%)		
Living comfortably	28.6	
Doing alright	39.3	
Just about getting by	25.0	
Finding it quite or very difficult	7.2	
n	4,636	

fied into 5 categories: 0 = Never, 1 = 1–3 times a month or less often, 2 = Once or twice a week, 3 = 3–6 times a week, 4 = Every day. Those children who live in the same household with their grandparents are excluded from the analyses, because it is difficult to measure the investment of co-residing grandparents. For the analyses the grandparental contact frequency variable is transformed into a dummy variable (see Table 2).

Associations between grandparental investment and child development are studied using linear regression analysis. We control for several potential confounding factors: child's sex, age, ethnicity, number of siblings, mother's age, father's age, the financial situation of the family, and combined educational attainment of parents. Previous studies show that these factors often correlate with child development scores (Hansen and Jones 2008; Kiernan and Mensah 2011). Parental education is measured by the National Vocational Qualification (NVQ), and we have classified it in two categories (higher educated group = NVQ level 4 or 5; lower educated group = other). Combined education level of the main and partner respondent have four categories (1 = both parents have reached level 4 or 5; 2 = mother have reached level 4 or 5, father have not; 3 = father have reached level 4 or 5, mother have not, 4 = neither of the parents have reached level 4 or 5) (Table 3). With the exception of the child's age, number of siblings and parents' age all of the control variables are categorical and for the analyses they are transformed as dummy variable.

Results

Results are presented in Table 4 and first we included all children in analyses. The category "never" was chosen as the reference category. In the case of maternal grandmothers, those who have weekly contacts earn significantly higher development test scores and those who have daily contacts marginally significantly higher scores compared to reference category "never". For maternal grandfathers the differences are statistically significant in categories "once or twice a week", "3–6 times a week" and "every day". In addition, monthly contacts with maternal grandfathers are associated marginally significantly with higher test scores compared to reference group "never". For paternal grandfmothers the differences are not statistically significant in any category. In the case of paternal grandfathers "never" being the reference category daily contact with the paternal grandfathers correlates with the decreased test scores.

Next, we study whether contact frequencies correlate with the development scores of granddaughters (Table 4). In the case of maternal grandmothers and grandfathers and paternal grandmothers no significant associations were detected. For the paternal grandfathers, there is a mostly non-significant trend to associate with decreased test scores among granddaughters. Those granddaughters whose fathers reported weekly contacts with paternal grandfathers earn significantly lower test scores compared to reference group "never".

Then, the correlation between grandparental investment and grandsons' development is studied (Table 4). The results show that among grandsons, maternal grandmothers' contacts "3–6 times a week" and "every day" are asso-

Table 4. Associations between parent-grandparent contact frequency and child FSP scores (β-coefficients)

	All children	Granddaughters	Grandsons
Maternal grandmother			
Never	ref	ref	ref
1–3 times a month or less often	0.43	0.24	0.64
Once or twice a week	0.58*	0.50	0.68
3–6 times a week	0.61*	0.42	0.83†
Every day	0.54†	0.37	0.76†
n	4,636	2,319	2,317
Adj. R2	0.13	0.11	0.12
Maternal grandfather			
Never	ref	ref	ref
1–3 times a month or less often	0.32†	0.16	0.44†
Once or twice a week	0.40*	0.22	0.57*
3–6 times a week	0.44*	0.18	0.70*
Every day	0.50*	0.33	0.65*
n	4,028	1,993	2,035
Adj. R2	0.13	0.11	0.12
Paternal grandmother			
Never	ref	ref	ref
1–3 times a month or less often	0.18	0.23	0.16
Once or twice a week	0.12	0.26	0.02
3–6 times a week	0.22	0.18	0.30
Every day	–0.11	–0.18	–0.04
n	4,423	2,201	2,222
Adj. R2	0.12	0.11	0.11
Paternal grandfather			
Never	ref	ref	ref
1–3 times a month or less often	–0.15	–0.39	0.12
Once or twice a week	–0.17	–0.35	0.03
3–6 times a week	–0.22	–0.71*	0.34
Every day	–0.51*	–0.52	–0.45
n	3,777	1,889	1,888
Adj. R2	0.13	0.11	0.12

* $p<0.05$, † $p<0.1$

ciated marginally significantly with higher scores compared to reference group "never". Moreover, "never" being the reference group maternal grandfathers' contacts weekly and daily basis are associated significantly and daily basis marginally significantly with increased test scores among grandsons. In the case of paternal grandmothers and grandfathers there were no significant associations.

Discussion

This study analysed the effects of biased grandparental investment in the present-day England. We found that children whose mothers' reported contacts with maternal grandparents receive higher FSP assessment compared to those with no contact at all. These results are consistent with the prediction derived from the sex-specific reproductive strategies theory.

Previous studies of pre-modern and traditional populations have found that the presence of grandmothers (maternal grandmothers in particular) often increase grandchild survival (see Sear and Mace 2008 for review). In addition, a recent study that used the MCS data found an association between maternal and paternal grandmothers' investment and grandchildren's nutritional status (Tanskanen 2013). The present study found that maternal grandparents may have beneficial influence on their grandchildren and our results are in line with the two studies from modern societies, which showed that the investment of maternal, but not paternal grandparents correlates with grandchild well-being measured by lack of emotional and behavioral problems among children (Lussier et al. 2002; Tanskanen and Danielsbacka 2012). That is to say, it seems that the maternal grandmothers tend to have the highest impact on grandchildren, while other grandparents may show more variation in their influences.

We also found that daily contact with paternal grandfathers is associated with lower FSP scores compared to reference group "no contact at all". Interestingly, some studies from pre-modern and traditional populations have found that the presence of paternal grandfathers correlate with decreased child survival rates (see Sear and Mace 2008 for review). Even though, many studies from modern nations have found support for the beneficial effects of close ties to grandparents (e.g., Lussier et al. 2002; Tanskanen and Danielsbacka 2012; Tanskanen and Danielsbacka 2016), some studies also found negative effects of very high grandparental investment (e.g. Pittman 2007), probably because this is usually related to poverty and family instability in developed countries (Sear and Coall 2011). In this study only families with both biological parents in the household were included in the analyses. In addition, the financial condition of the family, and parents' education, among other factors, were controlled for. However, even after these adjustments, daily contact only from paternal grandfathers (but not with other grandparent types) was associated with lower developmental indicators.

It is not clear why daily contact with paternal grandfathers correlates with lower developmental test scores. It could be that while interacting with their grandchildren, paternal grandfathers do not always involve themselves intensively in their grandchildren's lives, maybe as a result of paternity uncertainty. If others are more involved in their interactions with the child, that child may benefit more by spending time with

them compared to spending time with paternal grandfathers. Also another potential explanation can be put forward for the result concerning paternal grandfathers. Paternal grandfathers are usually the oldest of all grandparent types, and advanced age may correlate with poor health. Perhaps daily contact with paternal grandfathers is a result of their poor health (i.e., paternal grandfathers need support from their children). That is to say, paternal grandfathers would not so much take care of their grandchildren, but receive support from their adult children and in-laws. Because the subjects of the MCS study were small children, grandparental contact frequencies are measured via the parents, and it is not clear do the grandparents invest in their children and grandchildren or do they receive support from their children (see Coall and Hertwig 2010 and responses for the discussion of the measurement of grandparental investment).

The present findings do not support the sex chromosome hypothesis, which assumes that paternal grandmothers should increase their granddaughters' development, in particular. In addition, the study does not support the sex chromosome prediction that paternal grandfathers increase the development of grandsons, in particular. Thus, the study did not find convincing evidence for the predictions that some types of grandparents increase, in particular, granddaughters' or grandsons' development. These results are also in line with previous studies investigating actual grandparental investment in contemporary societies (Chrastil et al. 2006; Kirchengast and Putz 2016; Tanskanen et al. 2011). However, studies from pre-modern populations have found at least some support for discrimination by grandparents in terms of the grandchild's sex (see Fox et al. 2010; Johow et al. 2011). It is not clear why sex discrimination seems to exist in pre-modern populations but not in modern societies. Future research is needed to reply to the question of sex discrimination in pre-modern versus modern societies.

To conclude, the present study shows that contacts between mothers and their parents are associated with improved child development in contemporary England. However, it could be that these findings are based on rather between-person than within-person effects. Thus, we call for future studies investigating associations between grandparental investment and child outcomes using longitudinal data and within-person modelling.

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Author contribution

AT designed the study, conducted the statistical analyses, interpreted the results and wrote the article.

Conflict of interest

The Author declares that there is no conflict of interests regarding publication of this paper.

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References

Chrastil E, Getz WM, Euler HA, Stark PT. 2006. Paternity uncertainty overrides sex chromosome selection for preferential grandparenting. Evol Hum Behav 27:206–23.

Coall DA, Hertwig R. 2010. Grandparental investment: Past, present, and future. Behav Brain Sci 33:1–59.

Coall DA, Hertwig R. 2011. Grandparental investment: a relic of the past or a resource for the future? Curr Dir Psychol Sci 20:93–8.

Currie J, Thomas D. 1999. Early Test Scores, Socioeconomic Status and Future Outcomes. National Bureau of Economic Research Working Paper No. 6943. Available at: http://www.econ.ucla.edu/people/papers/currie/NCDSDOC.PDF.

Currie J, Thomas D. 2001. Early test scores, school quality, and SES: Long-run effects on wage and employment outcomes. Worker Wellbeing in a Changing Labor Market 20:103–32.

Danielsbacka M, Tanskanen AO. 2012. Adolescent grandchildren's perceptions of grandparents' involvement in UK: An interpretation from life course and evolutionary theory perspective. Eur J Ageing 9:329–41.

Dong H, Manfredini M, Kurosu S, Yang W, Lee JZ. 2016. Kin and birth order effects on male child mortality: three East Asian populations, 1716–1945. Evol Hum Behav. Available at: http://dx.doi.org/10.1016/j.evolhumbehav.2016.10.001.

Euler HA. 2011. Grandparents and extended kin. In: CA Salmon and TK Shackelford, editors. Oxford handbook of evolutionary family psychology. New York: Oxford University Press. 181–207.

Euler HA, Weitzel B. 1996. Discriminative grandparental solicitude as reproductive strategy. Human Nature 7:39–59.

Feinstein L, Duckworth K. 2006. Development in the early years: its importance for school performance and adult outcomes. London: Centre for Research on the Wider Benefits of Learning.

Fox M, Sear R, Beise J, Ragsdale G, Voland E, Knapp LA. 2010. Grandma plays favourites: X-chromosome relatedness and sex specific childhood mortality. P Roy Soc B-Biol Sci 277: 567–73.

Hamilton WD. 1964. The genetical evolution of social behaviour I and II. J Theor Biol 7:1–52.

Hansen K editor. 2010. Millennium Cohort Study First, Second, Third and Fourth Surveys. A guide to the datasets. 5th edition. London: Centre for Longitudinal Studies.

Hansen K, Jones EM. 2008. Foundation Stage Profile and Devolved Administration Teacher Survey. In: K Hansen and H Joshi, editors. Millennium Cohort Study Third Survey: A User's Guide to Initial Findings. London: Centre for Longitudinal Studies. 98–117.

Hawkes K, O'Connell JF, Blurton Jones NG. 1997. Hadza women's time allocation, offspring provisioning, and the evolution of long postmenopausal life spans. Curr Anthropol 38:551–77.

Jamison CS, Cornell LL, Jamison PL, Nakazato H. 2002. Are all grandmothers equal? A review and a preliminary test of the "grandmother hypothesis" in Tokugawa Japan. Am J Phys Anthropol 119:67−76.

Johnson J editor. 2008. Millennium Third Survey Follow-up: A guide to the school assessment datasets. 1st edition. London: Centre for Longitudinal Studies.

Johow J, Fox M, Knapp LA, Voland E. 2011. The presence of a paternal grandmother lengthens interbirth interval following the birth of a granddaughter in Krummhorn (18th and 19th centuries). Evol Hum Behav 32:315–25.

Kachel FA, Premo LS, Hublin JJ. 2011. Grandmothering and natural selection. P Roy Soc B-Biol Sci 278:384–91.

Kaptijn R, Thomese F, van Tilburg TG, Liefbroer AC. 2010. How grandparents matter. Support for the cooperative breeding hypothesis in a contemporary Dutch population. Human Nature 21:393–405.

Kaptjin, R., Thomese, F., Liefbroer, A. C. & Silverstein, M. (2013). Testing evolutionary theories of discriminative grandparental investment. J Biosoc Sci 45:1–22.

Kiernan KE, Mensah FK. 2011. Poverty, family resources and children's early educational attainment: the mediating role of parenting. Brit Educ Res J 37:317–36.

Kirchengast S, Putz B. 2016. Discriminative grandparental investment: the impact of grandchild's gender and sociodemographic parameters. Anthropol Rev 79:151–67.

Kokko H, Jennions M. 2003. It takes two to tango. Trends Ecol Evol 18:103–4.

Lahdenperä M, Gillespie DOS, Lummaa V, Russell AF. 2012. Severe intergenerational reproductive conflict and the evolution of menopause. Ecol Lett 15:1283–90.

Lahdenperä M, Lummaa V, Helle S, Tremblay M, Russell AF. 2004. Fitness benefits of prolonged post-reproductive lifespan in women. Nature 428:178–81.

Lahdenperä M, Russell AF, Lummaa V. 2007. Selection for long lifespan in men: Benefits of grandfathering? P Roy Soc B-Biol Sci 274:2437–44.

Lussier G, Deater-Deckard K, Dunn J, Davies L. 2002. Support across two generations: Children's closeness to grandparents following parental divorce and remarriage. J Fam Psychol 16:363–76.

Pashos A. 2000. Does paternity uncertainty explain discriminative grandparental solicitude? A cross-cultural study in Greece and Germany. Evol Hum Behav 21;97–109.

Pittman LD. 2007. Grandmothers' involvement among young adolescents growing up in poverty. J Res Adolescence 17:89–116.

Pollet TV, Nelissen M, Nettle D. 2009. Lineage based differences in grandparental investment: Evidence from a large British cohort study. J Biosoc Sci 41:355–79.

Pollet TV, Nettle D, Nelissen M. 2006. Contact frequencies between grandparent and grandchildren in a modern society: Estimates of the impact of paternity uncertainty. J Cult Evol Psychol 4:203–13.

Pollet TV, Nettle D, Nelissen M. 2007. Maternal grandmothers do go the extra mile: Factoring distance and lineage into differential contact with grandchildren. Evol Psychol 5: 832–43.

QCA. 2003. Foundation stage profile: handbook. London: Qualifications and Curriculum Authority.

Ragsdale G. 2004. Grandmothering in Cambridgeshire, 1770–1861. Human Nature 15: 301−17.

Rice WR, Gavrilets S, Friberg U. 2010. The evolution of sex-specific grandparental harm. P Roy Soc B-Biol Sci 277:2727–35.

Rotering PP, Bras H. 2015. With the help of kin? Household composition and reproduction in The Netherlands, 1842–1920. Human Nature 26:102–21.

Scelza BA. 2011. The place of proximity: social support in mother-adult daughter relationships. Human Nature 22:108–27.

Scholl Perry K. 1996. Relationships among adolescents' ego development, their academic achievement, and the amount of their contact with and social distance from grandparents. Unpublished Ph.D. thesis, Pace University, New York.

Sear R, Coall DA. 2011. How much does family matter? Cooperative breeding and the demographic transition. Popul Dev Rev 37:81–112.

Sear R, Mace R. 2008. Who keeps children alive? A review of the effects of kin on child survival. Evol Hum Behav 29:1–18.

Sear R, Mace R, McGregor IA. 2000. Maternal grandmothers improve the nutritional status and survival of children in rural Gambia. P Roy Soc B-Biol Sci 267:461–7.

Sear R, Mace R, McGregor IA. 2003. The effects of kin on female fertility in rural Gambia. Evol Hum Behav 24–25–42.

Seki M. 2012. Intra-individual conflicts between autosomal and X-linked altruistic

genes: Evolutionary perspective of sex specific grandmothering. J Theor Biol 304:273–85.

Snopkowski K, Sear R. 2015. Grandparental help in Indonesia is directed preferentially towards needier descendants: A potential confounder when exploring grandparental influences on child health. Soc Sci Med 128:105–14.

Strassmann BI. Garrard WM. 2011. Alternatives to the grandmother hypothesis. Hum Nat 22:201–222.

Tanskanen AO. 2013. The association between grandmaternal investment and early years overweight in the UK. Evol Psychol 11:417–25.

Tanskanen AO, Danielsbacka M. 2012. Beneficial effects of grandparental involvement vary by lineage in the UK. Pers Indiv Differ 53:985–8.

Tanskanen AO, Danielsbacka M. 2016. Maternal grandfathers and child development in England. In: A Buchanan and A Rotkirch, editors. Grandfathers: global perspectives. London: Palgrave Macmillan. 217–28.

Tanskanen AO, Rotkirch A, Danielsbacka M. 2011. Do grandparents favor granddaughters? Biased grandparental investment in UK. Evol Hum Behav 32:407–15.

Trivers RL. 1972. Parental investment and sexual selection. In: B Campbell, editor. Sexual selection and the descent of man. Chicago: Aldine. 52–97.

Waynforth D. 2011. Grandparental investment and reproductive decisions in the longitudinal 1970 British cohort study. P Roy Soc B-Biol Sci 279:1155–60.

Voland E, Beise J. 2002. Opposite effects of maternal and paternal grandmothers on infant survival in historical Krummhörn. Behav Ecol Sociobiol 52:435–43.