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The Effect of Paternal and Alloparental Support on the Interbirth Interval Among Contemporary North American Families

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The present study investigated whether the length of interbirth intervals between first- and secondborn children in a North American middle-class sample could be explained by paternal and alloparental support and firstborn children's gender. The sample consisted of 225 families in which mothers were expecting their 2nd child. Parents reported on paternal and alloparental support (maternal kin, paternal kin, and nonkin support). The results showed that higher maternal kin support and having a firstborn son was linked with shorter interbirth intervals. Mothers' longer work hours during the pregnancy with the second born was related to longer interbirth intervals. These results highlight the importance of maternal kin support and children's characteristics in understanding the timing of birth when parents have a 2nd child.

Keywords: alloparental support, paternal investment, interbirth interval

Due to the increased mobility and geographic dispersion of families in modern societies, parents can expect less help from their immediate kin than in earlier periods of human evolution (Kramer, 2010). Humans are cooperative breeders, and thus, caregiving of offspring involves considerable help from extended family members. Compared to other mammalian species, human fathers show an increased level of parental investment in their offspring (Hrdy, 2009; Sear, Mace, & McGregor, 2003). Some studies have suggested that cooperative breeding strategies might explain the relatively short interbirth intervals for human females, compared to other great apes (Hawkes, O'Connell, Jones, Alvarez, & Charnov, 1998). If children are raised with the assistance of alloparents, they can be weaned earlier and their mothers can reproduce at a higher rate (Hrdy, 2009). Hence, based on the *cooperative breeding hypothesis,* alloparental (kin and nonkin) care might lead to shorter birth intervals and the birth of a second child sooner.

Although research in contemporary industrialized societies has shown that paternal investment is associated with higher child health, adjustment, and well-being (Geary, 2005), fewer studies have examined the role of paternal support in relation to fertility decisions. In their review of 14 studies, Sear and Coall (2011) found that among high-fertility populations, father presence was associated with increased fertility in 63% of the eight studies examined, whereas in low-fertility populations, father presence was associated with a decrease in fertility in three of the six studies reviewed. Thus, although fathers play a role in reproductive decisions, support provided by alloparents may also be important.

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Preliminary support for this idea has been found primarily among traditional agricultural and nomadic societies. The presence and/or help of older siblings (primarily daughters) has been linked to increased reproductive rates in Trinidad (Flinn, 1989), Ifaluk (Micronesia; Turke, 1988), Morocco (Crognier, Baali, & Hilali, 2001), Bolivia (Crognier, Villena, & Vargas, 2002); and among Hungarian Gypsies (Bereczkei, 1998; Bereczkei & Dunbar, 2002), although no effects have been found among !Kung in southern Africa (Hames & Draper, 2004) or in rural Gambia (Sear et al., 2003). When interbirth intervals have been examined, shorter interbirth intervals (Bereczkei & Dunbar, 2002) or both longer interbirth intervals and longer reproductive careers (Crognier et al., 2001; Crognier, Baali, Hilali, Villena, & Vargas, 2006) have been found. In one of the few studies conducted on a European sample, Tymicki (2004) found that the presence of an older sibling (10 years or older) actually reduced the chance of transition to another child, with this effect stronger among controlled fertility birth cohorts compared to natural fertility birth cohorts (born prior to 1900) in Poland. This research also took into account whether grandparents and other kin (maternal aunts and uncles) were also available to presumably provide care. For those woman born prior to the availability of birth control, the transition to having another child was decreased by the *absence* of a nonreproductive maternal grandmother, maternal grandfather, and paternal grandmother but increased by the absence of a reproductive maternal grandmother. The presence of aunts or uncles (maternal younger siblings) was unrelated to having another child. For those women born after 1900 and thus experiencing birth control, absence of the maternal grandparents, paternal grandmother, and potential maternal aunts and uncles reduced fertility.

Additional research among traditional agricultural and nomadic societies has also found a strong influence for the role of grandparents on fertility (see Sear & Coall, 2011, for a review). The past 10 years has seen a surge of research among industrialized cultures. In European countries where institutionalized day care is readily available, those countries with the highest fertility rates show the highest proportion of grandparents who provide *any* grandparental care (Hank & Buber, 2009; Sear & Coall, 2011). This has been confirmed when examined in more detail with the Netherlands: Both maternal and paternal grandparents' help in childcare increased the number of additional grandchildren (Kaptijn, Thomese, van Tilburg, & Liefbroer, 2010; Thomese & Liefbroer, 2013). However, in countries where institutionalized day care is not readily available, *regular* grandparental care is associated with lower fertility (Hank & Buber, 2009). These findings suggest that when grandparent help augments maternal care, it can facilitate reproduction, but if it serves as a replacement for maternal care, no impact on reproduction is found. These contrary findings could also explain why other reviews that combine European countries have found no association between grandparental help in child care and fertility (e.g., Aassve, Meroni, & Pronzato, 2012). An alternative explanation for the inconsistent findings for the effects of grandparents is that effects depend on the kind of support assessed. Waynforth (2011) studied the grandparent effect with a 1970 British cohort study and found that contact with own parents rather than child care help or financial support was associated with an increased likelihood of having a child during the 4-year follow-up period. In a recent study focused on the British Millennium Cohort Study, Tanskanen, Jokela, Danielsbacka, and Rotkirch (2014) found that contact with paternal grandparents was associated with higher probability of parents having a second child, whereas contact with maternal grandparents was associated with lower probability of having a third or subsequent child. As suggested by Tanskanen et al., these results are in line with the sex-specific reproductive strategies theory (Sear & Coall, 2011), which assumes that paternal grandparents should improve parents' probability of having another child because the cost of reproducing is primarily borne by the daughter-in-law, whereas maternal grandparents may even decrease it in some circumstances in an effort to protect their daughter from the high fertility demands, instead choosing for a qualitative over quantitative strategy.

Taken together, sufficient evidence exists that suggests that even in contemporary industrialized societies paternal and alloparental support is associated with fertility decisions. With the exception of Tymicki (2004), no studies have

examined whether paternal support and alloparental support (grandparent and other kin support) when examined in the same investigation are associated with fertility decisions (i.e., when paternal support is taken into account, does other support matter, or vice versa?). Moreover, no studies have examined whether support by nonkin also plays a role. In contemporary societies where contact with grandparents may be limited, fathers or nonkin may take over the role in augmenting child care. Thus, the primary purpose of the current study was to examine whether paternal and alloparental support (defined here as maternal kin, paternal kin, and nonkin support) was linked to fertility decisions as measured by the interbirth interval between first- and secondborn children.

A second purpose of the present study was to examine whether gender of the firstborn child was related to the interbirth interval between first and second children. According to *parental investment theory,* parents make decisions about whether they can maximize their fitness (the passing of their genes to future generations) by either investing in their current offspring or focusing on future reproduction and having more children. Investment decisions are made based on the availability of parental resources in a given environment and the reproductive value of their offspring (Trivers, 1972). If a firstborn requires high parental investment that reduces parental resources, parents (consciously or unconsciously) may decide to delay the birth of another child. Prior studies have found support for the effect of the firstborns' gender on interbirth intervals, although the results are not always consistent in finding whether having a firstborn son or daughter is linked with a longer birth interval (e.g., Gibson & Mace, 2003; Teachman & Schollaert, 1989). Bearing sons imposes higher physiological costs for mothers than daughters: It has been found that When mothers' nutritional status (e.g., body mass index, arm circumference) is examined, they are more likely to be malnourished after giving birth to a son (Gibson & Mace, 2003; Mace & Sear, 1997). This might explain why in populations with high malnourishment, such as Kenyan and Ethiopian samples, longer interbirth intervals have been found when the firstborn was a boy (Gibson & Mace, 2003; Mace & Sear, 1997). However, in industrialized societies women are much less likely to be malnourished, and so any differences in energetic investment in male versus female offspring during pregnancy and lactation may no longer be a relevant factor in determining interbirth intervals. Among Korean families (with a strong preference for boys), shorter interbirth intervals were found when firstborns were girls (Arnold, 1985). Studies in contemporary North American populations have shown that couples having firstborn boys were less likely to defer having a second child than were those couples with firstborn girls (McDougall, DeWit, & Ebanks, 1999; Teachman & Schollaert, 1989), indicating an actual preference for girls. This effect is interesting given that when asked directly about child gender preferences, most parents in contemporary industrialized societies prefer to have a mixed-sex pair of children, and proceeding to have a third child is most likely to occur when the first two children are the same sex (Hank, 2007; Raley & Bianchi, 2006; Tian & Morgan, 2015). Nonetheless, father's investment in children tends to be higher for boys than girls. Fathers spend more time with boys and are more likely to marry and stay married when they have sons (Raley & Bianchi, 2006). Thus, the presence and involvement of fathers may be higher in families with firstborn sons, which could be linked with a shorter interbirth interval.

In sum, the goal of the present article was to examine whether paternal and alloparental care were related to birth spacing between first and second children in North American, middle-class families, while controlling for other variables such as parental age, education, employment status of both parents, and family income. Alloparental care was divided into care derived from maternal kin (grandparents and other relatives), paternal kin, and nonkin. Based on the cooperative breeding hypothesis, paternal and alloparental support should be associated with the length of the interbirth interval between first and second children, such that more support from fathers, extended kin, and nonkin should be related to a shorter interbirth interval. Given that contemporary research has found mixed results for whether maternal or paternal kin support predicts reproductive decisions, we do not have specific hypotheses concerning whether the associations should be stronger for maternal or paternal kin support. Further, we

expected shorter interbirth intervals when the firstborn child was male.

Method

Participants

Participants for this study were 225 two-parent American families who participated in a longitudinal study examining changes in family functioning with the arrival of a second child. Initially, 241 families provided data for the prenatal visit, but 16 families dropped out before the first postnatal visit. The couples who remained in the study had more years of education than did the couples who dropped out, but no other differences on variables studied here were found (see Volling et al., 2014, for more details). Couples were married or living together for an average of 5.8 years ($SD = 2.7$), with an average age of 33 years for fathers ($SD = 4.8$) and 32 years for mothers ($SD = 4.1$). All but one couple were married. The average age of firstborn children was 31.61 months ($SD = 10.12$) at the time of the second child's birth, with 46% of the firstborns being boys. About 10% of the families had a household income of US$35,000 or less, 30% of families fell between $35,000 and $70,000, 27% had incomes between $70,000 and $100,000, and 33% had incomes over $100,000. The majority of the parents identified as European American (85.9% mothers, 86.3% fathers), with the remaining parents from other racial and ethnic backgrounds in the United States. Most mothers were college-educated (38.2% had a bachelor's degree, and 46.2% had completed a master's or professional degree), as were most fathers (37.3% had a bachelor's degree, and 43.1% had a professional degree). For most families (85.6%), parents had wanted and planned for the second child.

Procedure

Women pregnant with their second child were recruited from obstetric clinics, flyers posted in local hospitals, child care centers, pediatrician offices, and childbirth education classes in a midwestern city in the United States. Families were eligible for the study if (a) the couple was living together or married, (b) the couple had one child with no known developmental delays, (c) the mother was pregnant with her second child, (d) the father was the biological father, (e) all secondborn infants were born full term (>37 weeks' gestation), and (f) English was the primary language spoken in the home.

Families participated in five time points (prenatal and 1, 4, 8, and 12 months' postpartum) of a larger longitudinal investigation examining family changes after the birth of a second child. Parental self-reports on demographic and paternal and alloparental support data obtained during the first wave (collected in the third trimester of mother's second pregnancy) and obstetric data related to the second child's birth (date and health status) were used for the current analyses.

Measures

Demographics and interbirth interval. Parents reported on the highest level of education completed, which we converted to years of education completed. The categories and conversions were as follows: *less than high school* = 10 years, *high school degree* = 12 years, *some college, associate's degree or technical degree* = 14 years, *bachelor's degree* = 16 years, *master's degree* = 18 years, and *professional degree* = 20 years. Annual family income was reported on a 22-level scale with $5,000 increments; that is, 1 (*less than $5,000*), 2 (*$5,000–9,999*), through 22 (*more than $150,000*). Maternal and paternal employment status was based on the number of paid hours worked per week. Interbirth interval is reported in months and was calculated by using the actual birth dates of the first and second child.

Paternal support. Paternal support was measured by the Checklist of Childcare Tasks (Ehrenberg, Gearing-Small, Hunter, & Small, 2001). Both mothers and fathers completed a couples interview and were asked who handled 11 child care tasks (e.g., preparing meals, getting child dressed, bathing child) on this scale: 1 (*wife only*), 3 (*wife and husband equally*), and 5 (*husband only*) in the past month. The mean across items was calculated, with higher scores reflecting greater father participation in child care ($\alpha = .73$.).

Alloparental support. Parents completed the Family Support Scale (Dunst, Trivette, & Hamby, 1994) using a 5-point scale ranging

from 1(*not at all helpful*) to 5 (*extremely helpful*) indicating how helpful grandparents, other relatives, friends, and social groups were in raising their children over the past 3–6 months. In the present study, we focused on nine items to derive three subscales: maternal kin support (two items: one on maternal grandparents and the other on maternal kin), paternal kin support (two items focused on paternal grandparents and other paternal kin), and nonkin support (five items focused on friends and other social groups). The mean score was used in analyses, with higher score indicating more support.

Results

Table 1 shows the correlations, means, and standard deviations of all variables. Interbirth interval was significantly correlated with maternal age, children's gender (0 = girl, 1 = boy), and maternal kin support. Older mothers had longer birth intervals, whereas maternal kin support and the firstborn being male was associated with shorter interbirth intervals. The interbirth interval following a male firstborn was 29.30 months ($SD = 9.05$), whereas following a female firstborn it was 32.75 months ($SD = 10.73$). Also of note is that paternal support was positively correlated with mother's level of education and working hours and negatively associated with father's working hours. Moreover, paternal support was unrelated to alloparental support. Maternal kin support was positively associated with mother's working hours. All analyses were conducted using SPSS Version 22.

Multiple-regression analysis was conducted with the interbirth interval as the criterion. In the first block, all demographic control variables (parents' age, education, paid working hours, and family income) were entered; the second block included paternal and alloparental support (maternal kin, paternal kin, and nonkin) and firstborn gender. Results are presented in Table 2. Maternal age, mothers' paid work hours, maternal kin support, and firstborn gender significantly predicted birth spacing. Specifically, the older the mothers were and the more hours they worked, the longer the interbirth interval; in addition, the more support from maternal kin and having a firstborn son, the shorter the interbirth interval. Family income and paternal support were negatively related to interbirth interval but just missed statistical significance ($ps = .063$ and.051, respectively). The more income families had and the more paternal support mothers received, the shorter the interbirth interval.

Discussion

The present article examined the effects of paternal and alloparental support and firstborn children's gender on birth spacing in a sample of middle to upper-middle class U.S. families. The results showed that support from maternal kin was negatively associated with length of the interbirth interval, with higher levels of support being associated with shorter interbirth intervals. Having a firstborn son was also associated with a shorter interbirth interval, with families whose firstborn was a male having a second child about 3 months sooner than did families with firstborn daughters. Older mothers and mothers who worked longer hours also had longer interbirth intervals. Finally, although just missing statistical significance, when all of the previously mentioned factors were taken into account, paternal support was also associated with shorter interbirth intervals.

Findings from the present study support the idea that humans, being cooperative breeders, may increase the pace of reproduction when more familial and kin support is available but may also be delaying childbearing when mothers are essential for providing economically for the welfare of the family. Although just missing significance, higher paternal investment was also related to a shorter interbirth interval. Paternal investment was also directly related to maternal working hours, suggesting that fathers may be augmenting mothers' child care tasks when mothers are employed outside the home. To explore this association further, we conducted post hoc analyses examining whether the correlation between paternal support and interbirth interval differed depending on whether mothers were involved in paid work either full time, part time, or not at all. A significant negative association between paternal support and interbirth interval was found for full-time employed mothers ($r = -.31$, $p < .01$), whereas no association was found for part-time employed ($r = .01$) or nonemployed ($r = .03$) mothers. Thus, paternal support may be working indirectly to affect the interbirth interval

Table 1
Pearson Correlations, Means, and Standard Deviations for Interbirth Interval, Demographic and Support Variables

Variable	*M*	*SD*	%	1	2	3	4	5	6	7	8	9	10	11	12
1. Interbirth interval	31.64	10.13		—											
2. Mother's age	31.61	4.13		.18**	—										
3. Father's age	33.15	4.76		.12	.78**	—									
4. Mother's education (years)	16.83	1.83		−.01	.48**	.41**	—								
5. Father's education (years)	16.67	1.95		.00	.29**	.27**	.57**	—							
6. Mother's work hours	20.00	18.08		.12†	.04	.01	.15*	−.10	—						
7. Father's work hours	44.73	12.35		−.02	−.15*	−.17*	−.01	.12†	−.14*	—					
8. Family income	15.75	5.43		.02	.38***	.34***	.37**	.33**	.28**	.04	—				
9. Paternal support	2.35	.50		−.07	.07	.00	.14*	−.05	.45**	−.37**	.10	—			
10. Maternal kin support	3.31	1.07		−.15*	−.09	−.11	−.01	−.12	.16*	−.06	−.06	−.05	—		
11. Paternal kin support	2.98	1.07		−.03	.03	−.06	−.07	−.09	−.02	.16*	−.04	−.04	.20**	—	
12. Nonkin support	2.97	.83		−.09	.00	−.02	−.09	−.10	−.05	.02	.09	.09	.27***	.20**	—
13. Firstborn gender[a]			46	−.17*	.04	−.06	.04	.04	−.07	−.01	.04	.04	.03	.05	.11

Note. Positive correlations indicate that the variable was higher for boys, whereas negative correlations indicate that the variable was higher for girls. This is a point-biserial correlation. In the sample, 46% were firstborn sons.
[a] Gender was coded as 0 = girls, 1 = boys.
† $p < .07$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2
Regression Analysis for Variables Predicting Birth Spacing

Variable	Model 1			Model 2		
	b	*SE b*	β	*b*	*SE b*	β
Maternal age	.98	.31	.40**	1.15	.30	.47***
Paternal age	−.36	.25	−.17	−.55	.25	−.26*
Maternal education	−.69	.52	−.13	−.47	.51	−.09
Paternal education	.04	.48	.01	.00	.00	.00
Mother's paid work hours	.11	.04	.20*	.15	.05	.29***
Father's paid work hours	.01	.06	.02	−.06	.07	−.07
Family income	−.28	.17	−.15	−.31	−.17	−.16†
Paternal support				−3.60	1.83	−.18†
Maternal kin support				−1.72	.72	−.19*
Paternal kin support				−.14	.69	−.02
Nonkin support				−.20	.90	−.02
Firstborn gender (male)				−4.00	1.44	−.21**
R^2		.10			.19	
F for change in R^2		2.47*			3.75**	

† $p < .07$. * $p < .05$. ** $p < .01$. *** $p < .001$.

between first and second children by providing more care when mothers are actively contributing family resources. These findings underscore the importance of biparental care in human families. Unlike most mammals, human fathers provide protection, resources, and social status for their children (Clutton-Brock et al., 2006; Gray & Anderson, 2010). Human paternal care is facultative, however, and not universal, and therefore, its significance can also be variable (Fernandez-Duque, Valeggia, & Mendoza, 2009). Here we show that paternal support may be particularly relevant for employed mothers.

The current study also demonstrates the evolutionary significance of maternal kin in the reproductive behavior of families in a modern, low-fertility society. These results are in line with the historical findings of Tymicki (2004), who found that the absence of maternal kin (grandparents, aunts, and uncles) was associated with lower fertility among the Polish, but are inconsistent with contemporary findings in the Netherlands, where both maternal and paternal grandparents care increased fertility (Kaptijn et al., 2010; Thomese & Liefbroer, 2013). It could be that our focus on the combined effects of paternal grandparents with other paternal kin may have washed out any effect that paternal grandparents might have had. Alternatively, it could be that for parents in the United States, maternal kin play a more important role. Mothers' work hours were also related to help from maternal relatives, suggesting that mothers appear to rely more on their family and kin rather than nonkin when they are employed. This may be particularly relevant for contemporary, young U.S. families that often live far from their own parents and other relatives. Is paid care the only alternative for these families?

The direct effect of firstborn gender on interbirth intervals is consistent with other studies on North American samples (McDougall et al., 1999; Teachman & Schollaert, 1989) and showed shorter interbirth interval after a firstborn male child. The gender effect could be explained by a parental preference for girls in the United States. Another explanation is that families with firstborn boys are more likely to stay together and have higher fertility because fathers invest more in boys than in girls (Morgan, Lyn, & Condran, 1988; Teachman & Schollaert, 1989), which could be the case in the present sample of intact families who were already expecting their second child. Based on this study, neither explanation can be ruled out, given that the sample consists of relatively young families, many of whom may still be planning additional children. Future studies should investigate gender effects among families with completed fertility, thus focusing on interbirth intervals after second- and later born children.

Even though the present study has several strengths, it is not without limitations. The sample consisted only of families who were already committed and planned to have a second child; thus,

some of the results might be due to selection effects of the specific sample. Furthermore, the parents had high monetary and other resources, which could have led to different fertility decisions than in a sample with fewer resources. Our assessment of paternal and alloparental support were both based on a limited range of behaviors. In the case of paternal support, we focused on child care activities, but fathers' investment in children also occurs through other activities such as play, teaching, and emotional availability and warmth (Pleck, 2010). Alloparental care was assessed based on only parental perceptions of how helpful the alloparent was perceived to be, but there were no assessments of what kind of support was provided and how often they helped. Also, only parent reports were used for measuring support, and future studies would benefit from the use of multi-informant data. Although the current study used interbirth interval length as a proxy for fitness, in low-fertility environments this might not be a valid indicator of reproductive success. The correlational nature of the study design limits the degree to which causality can be inferred from the data. Finally, as mentioned earlier, only in families with completed fertility can gender effects be tested with certainty.

Conclusion

The present study shows that even in an industrialized society where parents tend to rely on nonkin-based help (e.g., day care) and have higher resources, cooperative breeding (paternal and alloparental support) may continue to play a role in modern humans' life history. In addition, it was found that over and above the support families receive, firstborns' gender is also a factor in fertility decisions, although the exact psychological mechanisms for this effect are not entirely clear.

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