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1 **Intention to have a second child, family support and actual fertility**
2 **behavior in current China: An evolutionary perspective**

3

4 Running title: Family support & birth intention-behavior gap

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19

20 **ABSTRACT**

21 **Objectives:** This study provides an evolutionary perspective to a classic topic in
22 demography, i.e., the discrepancy between reproductive intention and subsequent
23 behavior, in the context of China's two-child policy.

24 **Methods:** We conduct an event history analysis of longitudinal data from the 2015 and
25 2018 waves of the Xi'an Fertility Survey (sample size = 321 followed one-child
26 mothers) to test the hypotheses of how within-family support/conflict affects women's
27 fertility behavior.

28 **Results:** Only 50% of positive intentions (i.e., intending to have a second child) led to
29 another (live) birth within the three-year interval; meanwhile, 15% of uncertain
30 intentions and 5% of negative intentions resulted in a birth. Husband's and the
31 firstborn's emotional support raised the hazard of second childbirth along maternal life
32 course, which cannot be fully mediated by mother's fertility intention and thus,
33 contributed to an intention-behavior gap. Husband's sibship size had dual effects on
34 female childbearing behavior: A positive indirect effect mediated by fertility intention,
35 but a negative direct effect presumably due to sibling competition for intergenerational
36 support. Finally, after controlling for fertility intention, having a firstborn son was still
37 associated significantly with a lower second-childbirth hazard, presumably due to son
38 preference as well as concern over parental investment.

39 **Conclusions:** Our study identifies a discrepancy between maternal fertility intention
40 and realized childbearing, which was partly explained by (lack of) support from other
41 (multiple) stake-holders in family reproduction.

42

43 **Keywords:** Fertility intention; fertility behavior; sexual conflict; parent-offspring
44 conflict; sib conflict

45 **1 INTRODUCTION**

46 After about three decades of the so-called “one-child policy” (e.g., urban couples were
47 largely allowed to have one child only; Gu, Wang, Guo, & Zhang, 2007), a universal
48 two-child policy was implemented in China in 2016, to avoid the low-fertility trap and
49 a series of problems concomitant with low fertility such as quick population ageing and
50 shortage of labor force (Lutz, Skirbekk, & Testa, 2006; The Xinhua News Agency,
51 2015). Given that fertility intention—a plan to have a child—is the motivational step
52 most proximate to actual childbearing outcome (Ajzen, 1991; Liu & Lummaa, 2019;
53 Miller, 2011; Schoen, Astone, Kim, Nathanson, & Fields, 1999), the success of the
54 policy is expected to depend firstly on how women’s intentions to have a second child
55 can be realized. Previous studies have indicated that neither positive intentions (i.e.,
56 intending to have a(nother) child) nor negative ones can be fully realized; in other
57 words, there is some intention-behavior gap, a classic topic in demography and social
58 psychology (Ajzen, 1985; Bongaarts, 2001; Liu & Lummaa, 2019; Morgan & Taylor,
59 2006; Schoen et al., 1999; Zheng, 2011). Thus, to evaluate the potential challenges in
60 implementing the two-child policy, an analysis of the gap in current China, as well as
61 factors contributing to it, is required.

62

63 Generally, a negative fertility intention predicts realized reproductive behavior better
64 than a positive one (Kuhnt & Trappe, 2016; Machiyama, Mumah, Mutua, & Cleland,
65 2019; Schoen et al., 1999; Speizer & Lance, 2015). For example, in Italy, 60% of
66 mothers intending to have a second child did so within six years and thus, the intention-
67 behavior inconsistency rate was 40%; by contrast, the inconsistency rate for negative
68 intentions was just 20%, i.e., 20% of those who originally did not intend to have a
69 second child nonetheless reproduced again during the same period (Rinesi, Pinnelli,

70 Prati, Castagnaro, & Iaccarino, 2011). A longitudinal fertility survey (2007–2010)
71 conducted in Jiangsu Province, China, showed that across the between-survey interval,
72 the inconsistency rate was 56% for definitely positive intentions—i.e., among those
73 one-child mothers definitely intending to have a second child, more than half of them
74 failed to realize their intention—but just 2% for definitely negative intentions (Zheng,
75 2011).

76

77 One theoretical explanation for the intention-behavior gap could be that the various
78 socio-ecological constraints—i.e., the behavioral control in Ajzen’s terms (Ajzen,
79 1991)—that facilitate or limit one’s reproductive success are not fully perceived and
80 under own control when formulating one’s fertility intention (e.g., declining fecundity
81 with age, which could change a positive intention into a negative one later (Liefbroer,
82 2009)). As a result, the effects of such constraints on fertility behavior cannot be fully
83 mediated by fertility intention, but are additional to that of fertility intention, which then
84 causes an intention-behavior gap (see Ajzen, 1985). This view covers the six factors
85 that are used to explain the intention-behavior discrepancy in Bongaarts’s framework,
86 e.g., preferred family size is smaller than the actual one in the context of an unintended
87 pregnancy, but the reverse cases happen when fecundity declines with age or even
88 complete infertility happens (Bongaarts, 2001).

89

90 The support from family members—who are stakeholders in family decision-making—
91 will be a major one among such constraints (Liu & Lummaa, 2019; Miller, 2011).
92 Firstly, husbands play an especially important role in the formation and realization of
93 their wives’ fertility intention, not only through their own fecundity, but also through
94 the emotional and instrumental support (Liu & Lummaa, 2019; Thomson & Hoem,

95 1998). Owing to their higher investment in children and the costs incurred by bearing
96 and rearing children, wives are expected to prefer a smaller family size than husbands
97 (e.g., Borgerhoff Mulder, 2009; Parker, 2006). When a sexual conflict over family size
98 arises, there could be a conflict over contraceptive use and the realized fertility outcome
99 is a compromise between preferences of the two sides (Bankole, 1995; Bolund,
100 Bouwhuis, Pettay, & Lummaa, 2013; Borgerhoff Mulder, 2009; Mace & Colleran,
101 2009; Testa, 2012; Testa, Cavalli, & Rosina, 2014). Another factor that could influence
102 the likelihood of having a(nother) child is husband's sharing of housework and
103 childcare, i.e., a kind of paternal investment (Cooke, 2009; Kim, 2017; Park, Cho, &
104 Choi, 2010). However, the effect may follow a threshold pattern (Yoon, 2017); as a
105 result, the relationship between men's participation in housework and actual fertility
106 behavior might not be significant in some contexts, as observed in Finland and Japan
107 (Kato, Kumamaru, & Fukuda, 2018; Miettinen, Lainiala, & Rotkirch, 2015).

108

109 Parents/parents-in-law may also have an important influence on women's fertility
110 intention and behavior. First, humans follow a pattern of cooperative breeding and
111 intergenerational support in the form of informal childcare from post-reproductive
112 grandparents is expected to have a positive effect on reproductive-aged women's
113 fertility, especially in the societies lacking of formal childcare facilities (Chen, Short,
114 & Entwisle, 2000; Kaptijn, Thomese, van Tilburg, & Liefbroer, 2010; Kramer, 2010;
115 Lahdenperä, Mar, & Lummaa, 2014; Schaffnit & Sear, 2017). For example, in
116 contemporary South Korea, the likelihood of second childbirth among one-child
117 mothers co-resident with parents or in-laws was almost three times that among those
118 mothers without such a co-residence (Yoon, 2017). However, as also noted in
119 evolutionary anthropological and demographic literature, the positive effect of

120 intergenerational support could be diluted between the couple and their siblings owing
121 to sib competition/conflict (especially with husband's siblings; for the exception in
122 matrilineal societies, see Ji et al., 2013), which extends from fetus to reproductive age
123 (Aassve, Meroni, & Pronzato, 2012; Faurie, Russell, & Lummaa, 2009; Fox, Willführ,
124 Gagnon, Dillon, & Volland, 2017; Gibson & Gurmu, 2011; Gillespie, Russell, &
125 Lummaa, 2008; Lawson & Mace, 2009; Mace, 1996; Rickard, Russell, & Lummaa,
126 2007). For instance, in China, the husband's parents are less likely to take care of
127 grandchildren if the husband has siblings, which then lessens the positive effect of
128 parental childcare support on the likelihood of a mother with one child planning to have
129 a second child (Zhao & Zhang, 2019). Second, parents or in-laws may influence
130 women's fertility decision or behavior through emotional support or social pressure
131 (Bernardi, 2003). For instance, the likelihood of planning to have a second child would
132 be higher among Chinese mothers with one child, when the preferences of grandparents
133 for the number or sex of grandchildren have not been satisfied (Jin, Zhao, & Song,
134 2018).

135

136 So far, there have been few panel data based analyses of the relationship between
137 fertility intention and actual behavior since the implementation of the two-child policy
138 in China. Additionally, the studies conducted after the policy tend to emphasize the
139 function of social support—e.g., formal child care, maternity benefits and childcare
140 leave—in facilitating women's fertility behavior (e.g., Lv & Zou, 2018; Wu, 2016). By
141 contrast, the emotional and instrumental support within family has not received
142 sufficient attention. From an evolutionary perspective, such support comes from
143 husband and parents or parents-in-law, as well as the firstborn child (Liu, Duan, &
144 Lummaa, 2017; Liu & Lummaa, 2019). The last factor has been neglected in previous

145 studies; this is a pity, given the central place of the firstborn child in Chinese families
146 after more than 30 years of “one-child policy” and the theoretical significance of parent-
147 offspring conflict over family size from an evolutionary perspective (Goh & Kuczynski,
148 2009; Liu et al., 2017).

149

150 To address such gaps, we study the relationship between mother’s intention to have a
151 second child and actual fertility behavior and whether and how the above evolutionary
152 forces influence the relationship in current China. Our analysis is based on panel data
153 from the 2015 and 2018 waves of the Xi’an Fertility Survey.

154

155 **2 THE HYPOTHESES**

156 Our hypothesis construction was mainly based on two frameworks: the theory of
157 planned behavior and multiple-decision-maker framework of family reproduction
158 (Ajzen, 1991; Liu & Lummaa, 2019). The former one proposes mechanisms for
159 intention and behavior and implies inconsistency between intention and behavior as the
160 failure of intention to mediate all the effects of predictors for behavior (Ajzen, 1985).
161 The latter one proposes that maternal reproductive decision-making and behavior will
162 be influenced by other family members like husband, already-born children and
163 grandparents, as mentioned above.

164

165 First, the previous theoretical and empirical studies have indicated that a positive
166 intention is a relatively valid predictor of reproductive behavior, but the predictive
167 validity of negative intention would be higher (Kuhnt & Trappe, 2016; Machiyama et
168 al., 2019; Regnier-Loilier & Vignoli, 2011; Schoen et al., 1999; Speizer & Lance, 2015).

169 We had the following group of hypotheses:

170 **Hypothesis H1a:** Women who intended to have a second child were more likely
171 to give a live birth during the survey interval than those without such an intention.

172 **Hypothesis H1b:** The rate of consistency between fertility intention and
173 reproductive behavior in the case of a negative intention was higher than that of a
174 positive one.

175

176 The theory of planned behavior predicts that background variables (e.g., age, education,
177 family income, occupation, firstborn's sex, etc.) would be taken into account in
178 formulating one's intention (Ajzen, 1991). We had the following hypothesis:

179 **Hypothesis H2:** The effects of individual and family background variables on
180 reproductive behavior would be mediated by fertility intention; in other words, such
181 effects would not be significant, once fertility intention was also included in modeling
182 of actual reproductive behavior.

183

184 The third group of hypotheses was about the effects of husband's emotional support
185 (e.g., Bankole, 1995; Liu & Lummaa, 2019; Testa et al., 2014; Thomson & Hoem,
186 1998) and instrumental support (e.g., Cooke, 2009; Kim, 2017; Park et al., 2010; Yoon,
187 2017) on women's fertility behavior:

188 **Hypothesis H3a:** Husband's emotional support for the second childbirth
189 increased the likelihood of having a second child.

190 **Hypothesis H3b:** Husbands' participation in housework and childcare increased
191 the likelihood of having a second child.

192

193 Recently, it has been shown that the firstborn child could play an important role in
194 family reproductive decision-making via his/her emotional support (Liu & Lummaa,

195 2019). Thus, we expected the factor would also be relevant to actual fertility behavior:

196 **Hypothesis H4:** The likelihood of second childbirth was higher among the mothers
197 whose firstborn child supported them to do so.

198

199 In developing countries like China, many young couples live with their parents (mainly
200 the parents of the husband), who generally have more traditional pronatalist fertility
201 attitudes. Then, informal grandparental childcare tends to improve women's fertility
202 (Yang & Short, 2007). However, the siblings of husband or wife can dilute the
203 intergenerational support (e.g., Aassve et al., 2012; Zhao & Zhang, 2019). The fifth
204 group of hypotheses was:

205 **Hypothesis H5a:** Mothers influenced by their parents or parents-in-law in
206 reproductive decision-making were more likely to have a second child.

207 **Hypothesis H5b:** The husband's and wife's number of siblings had a negative
208 effect on childbirth likelihood.

209

210 It has been proposed recently that the emotional support from nuclear family members
211 play a dual role in family reproduction: On the one hand, it is a kind of subjective norm
212 and thus, according to the theory of planned behavior, its effect on final behavior can
213 be mediated by fertility intention; on the other hand, it represents a kind of constraint
214 or behavioral control, which means that its effect cannot be fully mediated by fertility
215 intention (Ajzen, 1991; Liu & Lummaa, 2019). We had the following hypothesis,

216 **Hypothesis H6:** The effects of emotional support from nuclear family members
217 (e.g., husband and the firstborn child) on actual behavior of having a second child would
218 be partly but not fully mediated by mother's fertility intention, i.e., both the direct
219 effects and the indirect effects via fertility intention would be significant.

220

221 **3 MATERIALS AND METHODS**

222 **3.1 The data**

223 Our study was based on the longitudinal data from the 2015 and 2018 waves of the
224 Xi'an Fertility Survey. The baseline survey was conducted in the Xi'an metropolitan
225 area, Shaanxi Province, from October, 2015 to January, 2016, when the respondents
226 already knew that the implementation of the universal two-child policy would start
227 shortly. The respondents in the 2015 baseline survey were mothers of one child, not
228 pregnant with the second child yet, and 20–44 years old. Before questionnaire survey,
229 a multistage and probability-proportional-to-size (PPS) sampling was implemented so
230 that at a given sampling stage (i.e., district/county, street/town, community/village), the
231 probability of a cluster being selected was proportional to the number of final-stage
232 sampling units—i.e., one-child mothers—contained in it. The vast majority of the
233 sampled mothers were then interviewed through telephone, but a few mothers filled the
234 questionnaire via a self-administered manner *in situ*. In total, 570 effective
235 questionnaires were collected. The follow-up survey (wave 2018) was conducted from
236 August to September, 2018; in other words, it was about three years after the baseline
237 survey. All 570 mothers interviewed in the baseline survey were re-contacted through
238 telephone, and 321 effective questionnaires were collected (i.e., effective follow-up rate
239 $\approx 56\%$).

240

241 The two waves of the Xi'an Fertility Survey had been approved by the Biomedical
242 Ethics Committee of Xi'an Jiaotong University (NO2015-636; NO2018-02). Their
243 conduction was in line with the Declaration of Helsinki and before starting a
244 questionnaire survey, each interviewee was informed of the research purpose and

245 expressed her consent to take part in it.

246

247 **3.2 Measures**

248 In the statistical modeling, the dependent variable was the actual fertility behavior, i.e.,
249 whether a one-child mother had a second child during the three-year interval. In the
250 2018 follow-up survey, respondents were asked, “Do you have a second child now?”
251 (Options: “yes” or “no”). If a mother answered “yes”, we further inquired the date of
252 second childbirth. The mothers’ answers were validated by the household registers
253 provided by local governments.

254

255 The predictors (at the time of baseline survey) for fertility behavior were as follows. 1)
256 Fertility intention. The respondents were asked in 2015, “Do you have a plan to have a
257 second child?” (Options: “planning to have”, “not decided” and “not planning to
258 have”). 2) Husband’s emotional support (“Does your husband support you to have
259 another child?”) and instrumental support (“How does your husband share the daily
260 housework and childcare?”). 3) The factors related to parents or in-laws, including
261 social pressure (“Are you influenced by your parents or parents-in-law in having a
262 second child?”) and own and husband’s number of siblings. The following background
263 factors were included as controlled predictors: Age, family settlement (rural vs. urban),
264 education, occupation, family annual income, and gender of the firstborn child.

265

266 The firstborn child’s emotional support was measured as “Does your firstborn child
267 support you to have another child?” Generally, a child can express simply what he/she
268 desires by age two, is preliminarily able to grasp simple causal relations between desires
269 and their outcomes (of realization) by age three and is mature enough to differentiate

270 beliefs (a precursor of attitude) from desires from age four (Flavell, 1999). In this
271 sample, 70% of firstborns were over age two and thus, they can express their desire for
272 a sibling (e.g., “I want to have a sister”, which could then be translated by mothers as
273 an emotional support for further reproduction) or even more complex attitude towards
274 having a second child (e.g., “I am (dead) against having another child in the family,
275 because doing so makes our family poorer”).

276

277 The descriptive statistics of the above variables are shown in Table 1.

278

279 **3.3 Statistical modeling**

280 We conducted an event-history analysis to test the above hypotheses. We first used the
281 bivariate Kaplan-Meier curve to describe the behavior of second childbirth by maternal
282 fertility intentions. Then, multivariate Cox (proportional hazards) regression models
283 were used to estimate the effects of hypothesis-related factors on actual fertility
284 behavior (Cox, 1972). A Cox model was,

$$285 \quad h(t) = -\frac{dP}{Pdt}$$

$$286 \quad h(t, x) = h_0(t) \exp\left(\sum_i \beta_i x_i\right) \text{ or } \ln\left(\frac{h(t, x)}{h_0(t)}\right) = \sum_i \beta_i x_i$$

287 Here, P referred to population size of mothers still having not given birth to a
288 second child. $h(t, x)$ represented the (instantaneous) hazard rate of having a second
289 child at time t under the influence of the series of hypothesis-related predictors (i.e.,
290 x_i). $h_0(t)$ represented baseline hazard function, i.e., the (instantaneous) hazard rate of

291 having a second child at time t when all predictors were zero. $\frac{h(t, x)}{h_0(t)}$ was thus hazard

292 ratio or simply *HR*.

293

294 We used Iacobucci's formula to evaluate the mediation role of fertility intention
295 (Iacobucci, 2012; Wen & Ye, 2014). The formula was as follows,

$$z_{mediation} = \frac{z_a \times z_b}{\sqrt{z_a^2 + z_b^2 + 1}} = \frac{\frac{a}{s_a} \times \frac{b}{s_b}}{\sqrt{\left(\frac{a}{s_a}\right)^2 + \left(\frac{b}{s_b}\right)^2 + 1}}$$

297 Here, a was the regression coefficient for the variable under question (e.g.,
298 husband's emotional support) when modeling—multinomial logistic regression—
299 fertility intention by including other hypothesis-related predictors as independent
300 variables, and b was the regression coefficient for fertility intention when modeling—
301 Cox regression—actual fertility behavior by including both fertility intention and other
302 hypothesis-related predictors as independent variables. s_a and s_b represented the
303 standard errors of a and b . The mediating effect would be identified as significant (at
304 the $\alpha=0.05$ level) if $|z_{mediation}| > 1.96$.

305

306 **4 RESULTS**

307 **4.1 Descriptive statistics**

308 We first report the descriptive statistics of variables used in the event-history analysis
309 of actual fertility behavior along maternal life course (Table 1). Here, the dependent
310 variable, i.e., fertility behavior, corresponded to the time interval between the 2015 and
311 2018 surveys, but all predictors corresponded to the baseline survey. Among the
312 successfully followed one-child mothers, 50 (or 15.58%) had a second child during the
313 between-survey interval.

314

315 At the time of the baseline survey, these 321 mothers averaged 32.82 years, 65.42% of
316 them lived in urban areas, and more than half of them had a college or higher education
317 level. Additionally, one third of the women worked in sectors inflexible with working
318 time, 46.42% worked in time-flexible sectors, and 17.13% were housewives. About
319 52% of mothers had a son as their firstborn.

320

321 At the time of the baseline survey, 15.58% of one-child mothers intended to have a
322 second child, 30.84% were undecided and the rest did not intend to have another child.
323 28.66% of all mothers said their husbands supported them to have a second child,
324 51.71% of husbands had a neutral attitude and 19.63% were not supportive. About
325 26.79% of mothers reflected that their firstborn children supported them to have another
326 child (average age ≈ 7.84 years, standard deviation s.d. ≈ 5.40 years), 29.60% of
327 firstborns were not explicitly supportive (average age ≈ 9.97 years, s.d. ≈ 5.25 years),
328 and 43.61% of firstborns were not asked about their attitudes presumably due to their
329 young age (average age ≈ 3.39 years, s.d. ≈ 4.63 years). Note: among the children above
330 age two, more than 75% were asked of their attitudes (the corresponding percentage
331 was 82.3% for children above age three); by contrast, the percentage was just 14%
332 among children under age two. That only 15.58% of the women intended to have a
333 second child but 28.66% of the husbands supported their partner to reproduce again
334 suggested some husband-wife conflict. Additionally, among those women intending to
335 have a second child, 18% and 36% of the firstborn children did not give emotional
336 support or were not inquired at all, respectively, suggesting some conflict between
337 parents and the firstborn children. According to the answers of these mothers, about
338 10% of husbands shared more than half of daily housework and childcare, 21% of
339 husbands shared half, and most of husbands shared less than half or even did not do

340 housework at all. About one in seven mothers said they were influenced by their parents
341 or parents-in-law in having a second child. On average, the mothers and their husbands
342 had about 1.5 and 1.6 siblings, respectively.

343

344 **4.2 Fertility intention and subsequent behavior**

345 In support of the hypothesis H1a on the intention-behavior link, we found that different
346 fertility intentions had evidently different consequences for actual behavior (Figure 1;
347 Table 2). According to model 1, the hazard of having a second child within the three-
348 year interval among those mothers intending to do so in the baseline interview was
349 about 12 times that of mothers not intending to reproduce again ($HR=11.77$, 95%
350 confidence interval or simply $CI=5.65-24.54$; undecided intention vs. negative
351 intention, $HR=2.73$, 95% $CI=1.23-6.08$). Even after including background factors and
352 family support factors into modeling (i.e., model 3), the above HRs were still significant
353 or marginally significant, suggesting that fertility intention had a direct effect on actual
354 fertility behavior.

355

356 The Kaplan-Meier curve indicated that distance between the three intention-behavior
357 curves increased over time. One year after the baseline survey, 20% of mothers with a
358 positive fertility intention had a second child, while the cumulative proportions in
359 mothers with undecided or negative intentions still remained zero. Two years after the
360 baseline survey, the corresponding cumulative proportions in the three categories of
361 mothers changed into 40%, 12.12% and 4.65%. Finally, in support of the hypothesis
362 H1b on the predictive validity of a fertility intention, we found that about three years
363 after the baseline survey, negative fertility intention had a higher validity in predicting
364 actual fertility behavior: The consistency between negative intentions and actual

365 behavior was 94.19%, while that with respect to positive intentions was just 50%.

366

367 **4.3 The effects of background factors and family support on fertility behavior**

368 Most background factors displayed a significant effect on actual fertility behavior.

369 Maternal age had a negative effect on fertility behavior: At a given time, the estimated

370 hazard of having a second child decreased by about 8% if a mother was a year older,

371 after adjustment for other predictors ($HR=0.91$, 95% CI : 0.84–0.99; model 2 of Table

372 2). On average, the hazard of reproducing again among rural mothers was 2.3 times that

373 of urban mothers ($HR=2.33$, 95% CI : 0.91–5.94). If a mother did not have a college-

374 level degree, she had a hazard of reproducing again 2.75 times that of a mother who

375 had finished a college or above level education ($HR=2.75$, 95% CI : 1.15–6.56). Family

376 annual income significantly raised the hazard of having a second child (middle vs. low

377 income: $HR=1.97$, 95% CI : 0.84–4.60; high vs. low income: $HR=2.63$, 95% CI : 1.02–

378 6.76). If the firstborn child was a girl, the hazard of reproducing again was more than

379 two times higher than when the firstborn child was a boy ($HR=2.47$, 95% CI : 1.27–

380 4.82).

381

382 In support of the hypothesis H2, we found that the effects of such background factors

383 on actual reproductive behavior were substantially mediated by fertility intention: Once

384 fertility intention was included in modeling, the effects of almost all the background

385 variables except for sex of the firstborn child became non-significant (model 2 vs.

386 model 3). Regarding the exception, a supplementary analysis indicated that during the

387 between-survey interval, there were 13 artificial abortions as reported by these mothers:

388 six corresponded to a negative fertility intention at the time of baseline survey, five

389 corresponded to an uncertain intention and only one case corresponded to a positive

390 intention; in other words, almost all induced abortions concerned mothers who did not
391 intend to have a second child. Additionally, of the 50 second childbirths, 33 followed a
392 firstborn daughter and 17 followed a son; among the 13 induced abortions, three
393 followed a firstborn daughter and 10 followed a son (aborting the second pregnancy
394 was associated significantly with the sex of the firstborn child: $\chi^2_1=6.11, P<0.05$).

395

396 In support of the hypothesis H3a, we found that husband's emotional support in the
397 baseline survey significantly raised the hazard of having a second child in the follow-
398 up interval (supportive vs. non-supportive: $HR = 12.02, 95\% CI = 1.55-93.09$; neutral
399 attitude vs. non-supportive: $HR = 8.14, 95\% CI = 1.07-61.77$; Table 2). When fertility
400 intention was included into modeling (i.e., model 3), the effect declined substantially,
401 but was still (marginally) significant (supportive vs. not supportive: $HR = 7.47, 95\% CI$
402 $= 0.94-59.51$; neutral attitude vs. non-supportive: $HR = 7.27, 95\% CI = 0.95-55.85$).

403 Thus, fertility intention partly mediated the effect of husband's emotional support;
404 further analysis indicated that the mediation effect mainly occurred in the case of
405 husband's supportive attitude under a positive intention of mother
406 ($z_{mediation (intending\ to\ have,\ supportive)} = 2.53$). Husband's instrumental support in terms of
407 sharing daily housework and childcare did not influence the hazard of having a second
408 child, regardless of whether fertility intention was included in modeling or not. In
409 summary, the hypotheses H3a and H6 with respect to husband's emotional support were
410 supported, but the survey data did not support the hypothesis H3b on husband's
411 instrumental support.

412

413 In support of the hypothesis H4 on the emotional support from the firstborn child, we
414 found that if the firstborn child held a supportive attitude in the baseline survey, the

415 hazard of having a second child was about 3.7 times that when the firstborn child was
416 not asked of his/her attitude towards having a sibling ($HR = 3.66$, 95% $CI = 1.69-7.93$;
417 Table 2); there was no difference between a non-explicitly supportive attitude and an
418 un-asked one ($HR = 1.66$, 95% $CI = 0.62-4.49$). When the mother's fertility intention
419 was included into modeling, the above effects did not change much and mediation
420 analysis indicated that the mediation effect of fertility intention only occurred in the
421 case of the firstborn's supportive attitude under a positive intention
422 ($z_{mediation}(\text{intending to have, supportive}) = 2.35$). In summary, the hypotheses H4 and the hypothesis
423 H6 with respect to the firstborn child's emotional support were supported.

424

425 Our survey data did not support the hypothesis H5a on parental influence, i.e., whether
426 a mother reported being influenced by her parents or parents-in-law did not affect
427 significantly her actual fertility behavior during the follow-up interval, regardless of
428 whether the mother's fertility intention was included in modeling or not (model 2 vs.
429 model 3). When fertility intention was not included in the modeling, the overall effect
430 from sibling number was also not significant, either for husband or for mother.
431 However, when fertility intention was included, the number of husband's siblings
432 became significant; according to model 3, the hazard of having a second child declined
433 by 32% if husband had one more sibling ($HR = 0.68$, 95% $CI = 0.48-0.98$; Table 2).
434 Mediation analysis indicated husband's sibship size was associated positively with
435 fertility intention (in the (multinomial) logistic regression analysis of intending to have
436 vs. not intending to have a second child: odds ratio = 1.60, 95% $CI = 1.08-2.37$). In
437 other words, the indirect effect was positive ($z_{mediation}(\text{intending to have, husband's siblings}) = 1.98$),
438 but direct effect was negative, which led to non-significant overall effect in model 2.
439 Thus, the hypothesis H5b with respect to husband's sibship size was supported, but that

440 regarding maternal sibling number was not supported.

441

442 **5 DISCUSSION**

443 Based on longitudinal data from two waves of the Xi'an Fertility Survey, this study
444 conducts an analysis of the relationship between one-child mother's intention to have a
445 second child and her actual childbearing behavior in a context of various support from
446 husband, the firstborn child and parents/parents-in-law in current China. Consistent
447 with previous studies, mother's fertility intention was a relatively reliable—especially
448 in the case of a negative intention—but not a perfect predictor of her short-term
449 reproductive behavior. Additionally, it mediated the effects from background factors
450 (e.g., age, education, family income), except for the gender of the firstborn child on
451 actual fertility behavior. We also find support for our hypotheses on within-family
452 support: The support from other family members significantly affected the likelihood
453 of second childbirth, which was only partly mediated by mother's fertility intention and
454 thus, contributed to an intention-behavior gap. Evidently, such support was not equally
455 important; for example, husband's emotional support was more important than his
456 instrumental support in promoting a second childbirth (Schaffnit & Sear, 2017 even
457 found a significant negative effect of the latter support on second childbirth in a British
458 survey sample).

459

460 Some of our important findings cannot be easily explained by relevant social
461 psychology and demography frameworks (e.g., Ajzen, 1991; Bongaarts, 2001; Miller,
462 2011), but can instead be understood from an evolutionary perspective. First, consistent
463 with the parent-offspring conflict theory and multiple-decision-maker framework of
464 family reproduction (Liu & Lummaa, 2019), this study shows the important role that

465 the firstborn child played in family reproduction, which has not received sufficient
466 attention from either researchers or mothers under study here. To our knowledge, the
467 current study is the first to show that owing to its dual nature, the effect of the firstborn
468 child's emotional support on maternal fertility behavior can be only partly but not fully
469 mediated by maternal intention. A comparison of the mediation effect for husband's vs.
470 the firstborn child's emotional support also suggests that the latter one was less well
471 considered by the mothers in formulating their intention. Furthermore, about 44% of
472 the firstborn children were not inquired about their attitude towards having a second
473 child at the time of the baseline survey (Table 1); however, one in four of such children
474 were aged above two years then and thus, old enough to express one's desire or attitude.
475 A child can get involved in influencing parental reproductive affairs sooner or later and
476 there are various methods that he/she might employ to influence parental reproductive
477 behavior, even after pregnancy: fussing, blackmail, etc. (Trivers, 1985). Indeed, there
478 were some reported cases of blackmail induced abortion after the implementation of
479 the two-child policy (e.g., Liu, 2015).

480

481 Another important finding concerns the sibship size. The previous studies have
482 identified either one or the other—but not both—of the following two effects: On the
483 one hand, having more siblings could be positively associated with one's own fertility;
484 on the other hand, it might dilute intergenerational support as a result of sibling
485 competition and thus, suppress the actual fertility behavior. The current study is one of
486 the few to show simultaneously such conflicting effects with empirical data (the
487 phenomenon is also called suppressing or antagonistic effect in statistics, see Wen &
488 Ye, 2014). Previously, a similar phenomenon was noticed in historical Krummhörn
489 (Germany) and Quebec (Canada) populations, which was then explained from a view

490 of the conflict between genetic inheritance of fecundity (i.e., having more siblings
491 means higher inherited fecundity; see also Pettay, Kruuk, Jokela, & Lummaa, 2005)
492 and sibling competition for parental resources (Fox et al., 2017). To the authors'
493 knowledge, there are two alternative explanations for a possible positive effect of
494 sibship size on one's own fertility: intergenerational fertility norm transmission (see
495 also Bao, Chen, & Zheng, 2017; Cavalli-Sforza & Feldman, 1981; Li & Jiang, 2017;
496 Liu & Lummaa, 2019; Mathews & Sear, 2013; Murphy & Wang, 2001; Yi & Chen,
497 2014); inheritance of fertility preference (e.g., Miller, 2011). Currently, the norm-
498 transmission perspective is dominant among demographers, but the other two have
499 gradually gained support too. Although scholars have not reached a consensus over the
500 positive effect, the dual effects of sibship size on one's fertility can be more or less
501 established now.

502

503 Third, this study shows that having already a daughter directly raised the hazard of
504 reproducing again (models 2 and 3). This result was not fully expected beforehand, as
505 a previous study on the same population showed that the gender of the firstborn child
506 did not influence maternal baseline fertility intention (Liu & Lummaa, 2019). One
507 explanation could be that although son preference is falling in China (Hou, Gu, &
508 Zhang, 2018; Shi & Yang, 2021; Zhuang, Jiang, & Li, 2021), it has not fully withered
509 away. As a result, those with a daughter and an unmet preference for a son more likely
510 continued to reproduce, as shown in India and among some rural-to-urban migrants in
511 China (Chaudhuri, 2012; Gellatly & Petrie, 2017; Hesketh & Xing, 2006; Jha et al.,
512 2011; Wang, Nie, & Liu, 2020). However, son preference might not be the sole
513 mechanism accounting for the observation. Given that induced abortions rather than
514 fertility intentions were associated with firstborn's sex (see section 4.3), we

515 preliminarily infer that another effect of firstborn's sex on actual childbearing could
516 also arise, when an unintended pregnancy happened. In current China, many couples
517 worry about investing in children especially sons, e.g., marrying a son costs a lot owing
518 to male surplus (see Helle, Lummaa, & Jokela, 2002; Jin, Liu, Li, Feldman, & Li, 2013;
519 Shi & Yang, 2021). In our baseline survey, as it happened, two mothers with a firstborn
520 son foresaw (potential) great pressure in parenting two children if they had another son
521 or there was sibling competition between two children. Presumably for the concern,
522 couples already having a son more likely aborted an unintended pregnancy; by contrast,
523 having a firstborn daughter could bring couples more affordability and courage to have
524 a second child. It is warranted to test the above preliminary inference with other larger
525 samples detailed and accurate in counting pregnancies and their outcomes.

526

527 There are some limitations with the current research. First, the sample size was not
528 large, which limited the power of some inferences and made a finer analysis of mothers
529 who explicitly inquired their firstborn children not very feasible. Second, the emotional
530 support from husband and the firstborn child was reflected by mother rather than
531 directly by them. Although mother's perceived support could be basically consistent
532 with their actual support (for the case of husband, see Miller, 1994) and best relevant
533 for her decision-making, a direct inquiry might provide some additional evolutionary
534 insight into family reproductive decision-making and behavior.

535

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543

544 **AUTHOR CONTRIBUTIONS**

545 Lianchao Zhang: Data curation (supporting); formal analysis; investigation (equal);
546 methodology (equal); software; validation (equal); visualization (lead); writing—
547 original draft preparation (equal). Jianghua Liu: Conceptualization; data curation
548 (lead); funding acquisition; investigation (equal); methodology (equal); project
549 administration; resources; supervision (lead); validation (equal); visualization
550 (supporting); writing—original draft preparation (equal); writing—review & editing
551 (equal). Virpi Lummaa: Supervision (supporting); visualization (supporting); writing—
552 review & editing (equal).

553

554 **CONFLICT OF INTEREST**

555 The authors declare that they have no competing interests to declare.

556

557 **DATA AVAILABILITY**

558 The data used in the study are available upon request from the corresponding author.

559

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777 **TABLE 1** Descriptive statistics of independent variables (one-child mothers; Xi'an Fertility Survey 2015)

Variables	Statistics †
Fertility intention	
Intending to have a second child	15.58% (3.97%)
Not decided	30.84% (5.05%)
Not intending to have a second child	53.58% (5.46%)
Age(years)	32.82 (0.67)
Family settlement	
Rural	34.58% (5.20%)
Urban	65.42% (5.20%)
Education	
Pre-college level	48.74% (5.49%)
College level or Graduate level	51.26% (5.49%)
Occupation ‡	
Time-inflexible	30.22% (5.02%)
Time-flexible	46.42% (5.46%)
Housewife	17.13% (4.12%)
Others	6.23% (2.64%)
Family annual income §	
Low income	47.63% (5.50%)
Middle income	29.97% (5.04%)
High income	22.40% (4.59%)
Gender of firstborn child	
Son	52.34% (5.46%)
Daughter	47.66% (5.46%)
Husband's attitude to having a second child	
Supportive	28.66% (4.95%)
Neutral	51.71% (5.47%)
Not supportive	19.63% (4.35%)
Husband's share of housework and childcare	
More than half	10.34% (3.34%)
Half	21.32% (4.49%)
Less than half	68.34% (5.10%)
Firstborn's attitude to having a second child	
Supportive	26.79% (4.84%)
Not explicitly supportive ¶	29.60% (4.99%)
Un-asked	43.61% (5.42%)
Being influenced by parents or in-laws in having a second child	
Yes	15.26% (3.93%)
No	84.74% (3.93%)
Number of wife's siblings	1.50 (0.14)
Number of husband's siblings	1.57 (0.14)

778 Notes: †For each categorical variable (e.g., education), “Statistics” refers to proportions of categories of
779 the variable (with 95% sampling error included in bracket); for each continuous variable (e.g., age,
780 number of wife's siblings and number of husband's siblings), “Statistics” refers to mean (with 95%
781 sampling error included in bracket). ‡Occupation was classified according to national occupation
782 classification and working sectors. §Family annual income: Low income, <40,000 Chinese ¥; middle
783 income, 40,000~80,000 Chinese ¥; high income, >80,000 Chinese ¥. ¶“Not explicitly supportive”:
784 either an uncertain attitude or an explicitly non-supportive attitude.

785

786 **TABLE 2** The Cox regression estimation of the effects of the related factors on actual fertility behavior
 787 during the follow-up interval

Variable	Model 1			Model 2			Model 3		
	<i>HR</i>	95% <i>CI</i>	<i>P</i>	<i>HR</i>	95% <i>CI</i>	<i>P</i>	<i>HR</i>	95% <i>CI</i>	<i>P</i>
Fertility intention (ref. = not intending to have)									
Intending to have	11.77	5.65–24.54	<.001				7.41	2.91–18.88	<.001
Not decided	2.73	1.23–6.08	.014				2.12	0.87–5.13	.097
Age				0.91	0.84–0.99	.020	0.95	0.87–1.04	.239
Family settlement (ref. = urban)									
Rural				2.33	0.91–5.94	.077	1.42	0.51–3.97	.501
Education (ref. = college level or above)									
Pre-college level				2.75	1.15–6.56	.023	2.07	0.81–5.28	.129
Occupation (ref. = time-inflexible) †									
Time-flexible				0.44	0.18–1.10	.080	0.56	0.21–1.47	.238
Housewife				0.67	0.23–1.92	.459	0.70	0.23–2.15	.536
Others				0.51	0.06–4.14	.529	0.59	0.07–4.82	.622
Family annual income (ref. = low income) ‡									
Middle income				1.97	0.84–4.60	.118	1.85	0.79–4.35	.157
High income				2.63	1.02–6.76	.045	1.64	0.64–4.24	.303
Gender of firstborn child (ref. = son)									
Daughter				2.47	1.27–4.82	.008	2.59	1.32–5.09	.006
Husband's attitude to having a second child (ref. = not supportive)									
Supportive				12.02	1.55–93.09	.017	7.47	0.94–59.51	.058
Neutral attitude				8.14	1.07–61.77	.043	7.27	0.95–55.85	.056
Husband's share of housework and childcare (ref. = less than half)									
More than half				0.81	0.24–2.69	.732	0.65	0.18–2.39	.520
Half				1.37	0.66–2.84	.396	1.58	0.76–3.29	.219
Firstborn's attitude to having a second child (ref. = not asked)									
Supportive				3.66	1.69–7.93	.001	3.22	1.42–7.29	.005
Not explicitly supportive§				1.66	0.62–4.49	.316	1.69	0.60–4.81	.322
Being influenced by parents or in-laws in having a second child (ref. = no)									
Yes				1.31	0.57–3.02	.519	0.92	0.39–2.16	.852
Wife's sibling number				1.16	0.83–1.64	.388	1.27	0.90–1.79	.173
Husband's sibling number				0.78	0.55–1.10	.151	0.68	0.48–0.98	.037
-2LL	520.47		<.001	453.51		<.001	434.62		<.001

788 Notes: *P*—statistical significance (i.e., *P*-value). The bolded numbers refer to significant effects. The -
 789 2LL (log-likelihood) of null model was 569.40. Abbreviations: *HR*—hazard ratio; *CI*—confidence
 790 interval; ref.—the reference/control level in modeling. †Occupation was classified according to national
 791 classification and working sectors. ‡ Family annual income: Low income, <40,000 Chinese ¥; middle
 792 income, 40,000–80,000 Chinese ¥; high income, >80,000 Chinese ¥. §“Not explicitly supportive”:
 793 either an uncertain attitude or an explicitly non-supportive attitude. To avoid multicollinearity, firstborn's
 794 age was not included in modeling.

795 **FIGURE 1.** Cumulative probability of giving birth to a second child since the baseline survey by fertility
796 intentions (Log rank test: P -value<0.001). x -axis refers to the number of months since the baseline survey.
797 y -axis refers to the cumulative proportion of having a second child. The three curves correspond to
798 “intending to have a second child” (solid curve), “undecided intention” (long-dashed curve), and “not
799 intending to have a second child” (short-dashed curve).
800