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Girls unwanted - The role of parents' child-specific sex preference for children's early mental development

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Abstract
This paper proposes a novel son preference measure, which relates the preference to a specific birth and thus child. We find child-specific son preference to be more common among later born children and in families with fewer sons. Using the novel measure and an interaction instrumental variables approach, we estimate a penalty in early mental functions for unwanted girls of 0.7 standard deviations. This penalty appears to be partially driven by discrimination against girls and partially by pampering of boys. Children's health and parental inputs do not mediate the effect from son preference to mental development. Our findings highlight the relevance of parents' attitudes for a nurturing home environment and healthy brain development.
JEL: I12, I15, J13, J16, J24, O15

Keywords: Son preference, Early Childhood, Mental Development, Fertility, India.

1. Introduction

In India, son preference continues to be a well-documented phenomenon. The desire for having sons is rooted in cultural customs, religious and social beliefs, and economic incentives (Das Gupta 1987; Das Gupta et al. 2003; Pande and Astone 2007; Robitaille 2013). The implications for women and girls are significant. Already early in life daughters are breastfed for less time, receive less childcare time, vaccinations, and vitamin supplements, are less

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likely to be hospitalized, are shorter, and suffer excess mortality via abortion, infanticide and neglect.[1] However, discrimination against girls does not merely occur because of unequal treatment of boys and girls within families but also because of son biased fertility behavior which leads to girls living in larger families with fewer resources per child (Jensen 2003; Jayachandran and Kuziemko 2011; Rosenblum 2013; Jayachandran and Pande 2017). In families in which the desired number of sons is unmet, daughters are increasingly more unwanted as birth order is rising and fewer birth trials remain. In order to satisfy son preferences, some parents engage in son-biased fertility behavior and exceed the planned family size to try again for a boy (Clark 2000; Bongaarts 2013). Jayachandran and Kuziemko (2011) illustrate how the gender gap in breastfeeding increases with birth order because girls are weaned early to accelerate the birth of another son. Sex-selective abortion and female infanticide are alternatives to son-biased fertility and are also more commonly practiced among later born children (Muhuri and Preston 1991; Klasen 2003; Bhalotra and Cochrane 2010; Jha et al. 2011).

In this paper, we contribute to the existing literature in two ways. First, we propose an innovative measure of son preference, which relates the preference to a specific birth and thus child. We ask pregnant women about the preferred sex of the child they are pregnant with. Measured this way, son preference can be studied as a result of previous birth outcomes. Child-specific sex preferences further allow us to distinguish children that satisfy mother's sex preference from those that don't when studying the ramifications of son preferences for children. Second, we study children's mental development as an outcome of mothers' son preference.

Existing son preference measures typically either indirectly measure son preference based on fertility behavior at aggregate levels or capture a static preference for the sex composition or ordering of children at the individual level. The more boys are desired, given the ideal family size, the more intensive is the individual level son preference (Jensen 2003; Pande and Astone 2007; Robitaille 2013; Jayachandran 2017; Palloni 2017; Norling 2018).[2] However, son preference may change with birth order and sex composition, or simply over time, and precisely for that reason it is important to consider child-specific measures. Child-specific measures allow us to better understand the dynamics and path-dependence of son preference with respect to previous births. In addition, the

1. For evidence on differential treatment see, e.g., Oster (2009), Asfaw et al. (2010), Bhalotra and Cochrane (2010), Jayachandran and Kuziemko (2011), Barcellos et al. (2014), and Jayachandran and Pande (2017). For evidence on excess female mortality see, e.g., Das Gupta (1987), Sen (1989, 1990), Klasen (1994), Klasen and Wink (2002, 2003), Sen (2003), Jha et al. (2006), Anderson and Ray (2010), Jha et al. (2011), Anderson and Ray (2012), Bongaarts and Guilmoto (2015).

2. A number of alternative measures of son preference exist and we provide a more comprehensive discussion in section 2.

child-specific measure allows to uncover sex preferences that would remain undetected in sex composition preference measures (desired number of boys to all children), such as the preference for an eldest son but no preference for the remaining children.

Studies that investigate the consequences of son preferences for children typically compare outcomes of boys and girls (Oster 2009; Asfaw et al. 2010; Bhalotra and Cochrane 2010; Jayachandran and Kuziemko 2011; Barcellos et al. 2014; Jayachandran and Pande 2017). Palloni (2017) argues that such comparisons measure the average discrimination at the population level and highlighted the importance of child-specific sex preferences to quantify the discrimination coefficient. He uses panel data from Indonesia and the preferred sex ratio of *future* fertility to estimate the discrimination coefficient on children's health. Jayachandran and Kuziemko (2011) and Jayachandran and Pande (2017) rely on heterogeneous effects by the region's sex ratio and mothers' realized preference for the number of sons (i.e. the number of current sons equaling the number of currently desired sons) to proxy heterogeneity in discrimination potential. Our son preference measure avoids this bias by being specific to the child the mother is pregnant with, irrespective of the sex composition preference.

A crucial argument for studying early childhood development is that it lays the foundation for lifelong human capital accumulation (e.g., Heckman 2000; Attanasio 2015). Arguably more importantly, this evidence can contribute to shape the way we think about son preferences, precisely because the home environment is so important. Responsive caregiving, reduced stress, positive experiences and learning opportunities are key for children to grow mentally and socially (Walker et al. 2007, 2011; Black et al. 2017). Child-specific son preference may affect parent's caregiving and the home environment crucially. When the preferred sex does not match the realized sex, parents' resentment may result in a more stressful and less loving environment. The frustration is likely to increase with birth order because it results in either being short of sons, extending family size or using sex selection. The home environment may therefore differ for boys and girls of son preferring mothers within the household, irrespective of resource constraints leading to differential financial investments into boys and girls based on their differential expected future payoffs (Asfaw et al. 2010; Rosenblum 2013; Barcellos et al. 2014; Jayachandran and Pande 2017; Kugler and Kumar 2017; Bhalotra et al. 2020).

We measure child-specific son preference of 1,961 women in one district of the Indian state of Bihar and establish that, in accordance with expectations, son preference is more common among later born children and in families with fewer sons. At birth order three, the probability of having a son preference is 60 percentage points higher than at birth order one. At a given birth order, mothers with one son are 40 percentage points less likely to have a son preference than mothers without sons.

Next, we estimate the penalty in cognitive and non-cognitive functions faced by daughters who did not satisfy their mothers' child-specific son preference. We label this the son preference-specific girl-penalty in early skills. We use a model that interacts son preference with the sex of the child of interest and controls for both indicators separately. The interaction term indicates the unrealized son preference and its coefficient measures the son preference-specific girl-penalty. We estimate the son preference-specific girl-penalty by OLS and instrumental variables. In the OLS estimation, we address in detail selection into the interaction of son preference and child's sex, focusing on sex selective abortion and son-biased fertility. In the instrumental variables estimation, we use the firstborn's sex and the interaction of the firstborn's sex with the sex of the child of interest as instruments, assuming that sex selection is rare among firstborns and son preference is less common in families with sons.

We find a son preference-specific girl-penalty in overall mental development of 0.74 standard deviations and of 0.81 and 0.64 standard deviations in cognitive and language skills specifically (instrumental variables estimations). There is no evidence that motor functions are affected by son preferences, while the results for socioemotional skills are mixed. The interaction set-up of our empirical strategy allows us to disentangle how much of the son preference-specific girl-penalty is due to discrimination against girls and how much is due to preferential treatment of boys of son preferring mothers. To calculate the discrimination component, we subtract the preferential treatment component, which is the difference in outcomes between boys of son preferring and non-son preferring mothers, from the son preference-specific girl-penalty. The results suggest that both discrimination against girls and preferential treatment of boys contribute to the son preference-specific girl-penalty in early skills.

To investigate the mechanisms from son preference to mental development, we consider children's health, parental inputs (e.g. postnatal care visits), and mothers' mental health and empowerment as potential mediators. While we do find some evidence that son preference affects girls' wasting and anemia status as well as mothers' participation in decisions regarding the family diet and children's feeding, we find no evidence that these factors indeed function as mediators from son preference to children's mental development.

The evidence on children's early mental development is relevant because it (i) illustrates the potential loss in human capital due to son preference, (ii) demonstrates that it is empirically important to distinguish between child-specific son preferring and non-son preferring attitudes of mothers, and (iii) suggests that son preference may shape the home environment. Although, we cannot directly measure the son preference-specific girl-penalty in mothers' care and attention for their children, our results encourage to study how a nurturing home environment can be established. In the short term, one way forward may be to improve nurturing care of girls through effective early childhood development interventions in the presence of continuing gender discrimination (Attanasio 2015). In the long term, researchers and policy makers must focus on the depletion of son preferences in the first place to overcome unequal treatment. Traditional gender norms are known to be sticky and interlinked with religious and cultural aspects (Jayachandran 2015). While financial incentives for parents to raise girls have shown to pervert the sex composition to one boy families (e.g., Anukriti 2018), economic empowerment and representation of women in politics and the media have shown to effectively reduce gender bias (Qian 2008; Jensen and Oster 2009; Beaman et al. 2012; Carranza 2014; Ting et al. 2014; Field et al. 2019). In the future, similar interventions should be evaluated with respect to their impact on nurturing care of girls.

The paper is structured as follows. Section 2 reviews existing measures of sex preference and discusses the contributions of the child-specific sex preference measure. Section 3 introduces the survey and the data. Section 4 establishes the association between birth order, sex composition and son preference. Section 5 presents the OLS estimation strategy and results of the effect of son preference by children's sex on children's early mental development. Section 5 further discusses the heterogeneity in the effect on early mental development by children's sex composition and potential mechanisms of the effect on mental development. Section 6 presents the IV estimation strategy and results. Section 7 concludes.

2. The measurement of sex preferences

The measurement and analysis of sex preferences received substantial attention. There are indirect measures of sex preference that consider the continuation of childbearing or the wish to continue conditional on the sex composition of living children.[3] If women with living sons are less inclined to continue childbearing, then this is an indication of son preference (Das 1987; Arnold 1997; Arnold et al. 1998; Short and Kiros 2002; Filmer et al. 2009). At the extreme, sex selection is exercised if boys but no (further) girls are wanted (Muhuri and Preston 1991; Retherford and Roy 2003; Jha et al. 2006; Bhalotra and Cochrane 2010). We consider these indirect sex preference measures because they allow to analyze and infer sex preferences at aggregate levels, but they do not allow to link sex preferences to individuals. For example, a mother who has two daughters and wants to continue child bearing may not be son preferring but just wants to have three children. However, if, at the population level, mothers with two daughters are on average more likely to continue child bearing than mothers with one daughter and one son, then this is likely due to son preferences. A

3. Preferences for the continuation of childbearing may be inquired by asking about the wish for more children, how happy a woman would be if she got pregnant again soon, how happy a pregnant woman is with her pregnancy, and the wish to or actual use of contraceptives and sterilization.

key advantage of the indirect measures is that they allow to analyze fertility behavior and, thus, sex preferences with respect to the existing sex composition and size of a family.

Direct measures of sex preference are typically based on the ideal number or ordering of sons and daughters given the ideal total number of children. The more boys are desired, given the ideal family size, the more intensive the son preference (Arnold 1997; Clark 2000; Pande and Astone 2007; Bongaarts 2013; Robitaille 2013). It is also possible to construct a binary indicator of son preference. If more boys than girls are desired, an individual is said to be son preferring. Although, the direct measure enables the identification of sex preferences at the individual level, three concerns have been raised in the literature. The first concern regards the conditionality of the sex preference on desired total fertility because sex preferences are not independent of desired total fertility. For example, women who want an even number of children typically want relatively fewer sons than women who want an uneven number of children, because in contexts with son preferences the preferred sex of the marginal child tends to be male (Das Gupta and Mari Bhat 1997; Bhat and Zavier 2003; Jayachandran 2017). A second concern is that reported sex preferences may be anchored at women's current family size and sex composition due to ex-post rationalization of one's own family structure or due to actual changes in sex preferences after child bearing (Rosenzweig and Wolpin 1993; Bhat and Zavier 2003; Pande and Astone 2007). The last concern is that stated preferences may suffer from social desirability bias if respondents are aware of the sensitivity of the topic and respond in the socially appreciated way (Schief et al. 2019).

Alternative measures of sex preferences to address these concerns have been proposed. Jayachandran (2017) suggested a survey method in which parents are asked to assume a random hypothetical family size and indicate their preferred sex composition at that hypothetical family size. Similarly, Schief et al. (2019) ask for the exact ordering of sons and daughters at each hypothetical family size of their children's (or grandchildren) future family. Additionally, Schief et al. (2019) use implicit association tests in which drawings of families with either sons or daughters are associated with negative or positive words. Both Jayachandran (2017) and Schief et al. (2019) offer methods to isolate individual family size preferences from sex preferences by lifting the conditionality on one's own desired family size. Further, both address ex-post rationalization bias to some extent. Schief et al. (2019)'s implicit association test further speaks to the concern of social desirability bias.[4]

An additional concern, which received little attention so far, is that the direct measure essentially describes a sex composition preference. This has

4. Schief et al. (2019) show no correlation of the son preference measure based on the implicit association test and a validated social desirability scale (Hays et al. 1989).

two important implications. First, the sex composition measure is static and cannot be analyzed in relation to the sex composition of living children as indirect measures can. Second, and related, the sex composition measure is not informative about *child-specific* sex preferences. Take for instance a mother who wants three children and strongly desires one son but does not care about the sex of her other children. This mother would not be classified as son-preferring according to the sex composition measure (desired number of boys to all children). However, in the Indian context, like in many other settings, it is important to have at least one son, because the oldest son and his family will live with the parents when they are old and care for them, whereas daughters will move to their in-laws. It has been argued that the preference for an eldest son even drives the disadvantage in stunting of girls and boys in India in comparison to Sub-Saharan African countries (Jayachandran and Pande 2017). An important disadvantage of the sex composition measure resulting from this is that preferences for one son remain often undetected. Further, reverting back to the first implication, a mothers desire for a boy will likely grow with each birth at which her wish for a son remains unsatisfied.

In this paper, we propose a measure of *child-specific* sex preference that relates the preference to a specific birth and, thus, child. Specifically, we ask pregnant women about the preferred sex of the child they are pregnant with in the following way: "Would you prefer your child to be a girl or a boy or it doesn't matter?". Women's responses include "boy", "girl", "does not matter", and "up to god". In contrast to the sex composition preference, the child-specific sex preference measure is conditional on the number and sex composition of previous children and, importantly, can be a consequence of that. It allows to describe the process of sex preference formation dynamically and, thus, how sex preferences change as women progress through different parities and sex compositions. The child-specific measure, therefore, consolidates the advantage of indirect sex preference measures and allows to link sex preferences to individual mothers and their children. In addition, because it is specific to the child it uncovers individual sex preferences that sex composition measures cannot detect.

Further, the child-specific sex preference measure is particularly suitable to study the consequences of son preferences for children because it distinguishes women who bear "unwanted" girls (i.e., they wanted to have a boy but gave birth to a girl) from women that either satisfied their son preference for the respective child or who did not have a son preference for the child they were pregnant with. Importantly, it allows to explicitly address birth order and sex composition effects when studying the ramifications of son preference for children's outcomes.

Studies that assess the impact of son preference at child-level have relied on comparisons by children's sex (Jayachandran and Kuziemko 2011; Barcellos et al. 2014; Jayachandran and Pande 2017). However, comparisons by sex provide population-level averages of gender discrimination and its consequences (at different parities and sex compositions), but they do not allow to recover the effect of discrimination among daughters of mothers who wanted a boy instead. A number of studies that compare boys and girls have shown how the differences in their outcomes grow with birth order and number of older daughters in the family (Jensen 2003; Jayachandran and Kuziemko 2011; Jayachandran 2017). To some extent these differences occur because girls live in larger families with more girls (which are costly in dowry systems) and, hence, receive fewer resources on average (Jensen 2003; Rosenblum 2013).

We are aware of one study that explicitly discusses the relevance of measuring child-specific sex preferences to study children's outcomes. Palloni (2017) proposes the use of panel data to measure the desired sex composition of *future* fertility in Indonesia. From one survey wave to the next, mothers' desired number of future children and their sex composition can be observed. As for the sex composition measure, if more boys than girls are desired among future children, mothers are said to be son-preferring for the next born child observed in future panel waves. Palloni (2017) finds that children who match their mothers preferred sex have better health outcomes. Although Jayachandran and Kuziemko (2011) do not discuss the broader relevance of child-specific sex preferences, they have used a heterogeneity analysis in a similar spirit. They examine how the gender gap in breastfeeding changes when the ideal number of sons is reached at the parity of the considered child.[5]

In this paper, we use our child-specific sex preference measure to study how sex preferences vary by family size and children's sex composition. Further, we apply our measure of child-specific sex preference to estimate its effect on children's early mental functions when children are 10 to 20 months old. This is an important outcome because the first 1,000 days of life lay the foundation for life-long human capital accumulation (Heckman 2000; Attanasio 2015). However, because we measure sex preference specifically for individual children, the measure allows to estimate the effect of sex preferences on health and education outcomes during childhood and adolescence as well as health, empowerment, marriage and labor market outcomes in adulthood if longer term follow-up surveys are conducted. This opens up a relevant area of potential future research on the long-term consequences of son preferences. If the child-specific sex preference question was asked to pregnant women in existing panel surveys, such as, for example, the Young Lives Surveys or RAND Family Life Surveys, long-term consequences can be tracked and studied. In addition, in future research the feasibility to enquire child-specific sex preference in recall questions of cross-sectional surveys can be studied. Using sophisticated survey techniques that reduce recall and social desirability bias can be tested and validated against direct questions asked to pregnant women.

5. More specifically, they use the difference between the ideal and actual number of sons.

3. The survey

3.1. Context

The study is located in Madhepura district of the northeast Indian state of Bihar. Bihar is the third largest state in India by population and has the lowest GDP per capita. Bihar is a state with high son preference, high fertility and a relatively high female-to-male sex ratio at birth (Anderson and Ray 2010, 2012; Bongaarts 2013). In 2015/16, when the data for this study were collected, women in rural Bihar had 3.6 children on average versus 2.4 children in rural all India, 38 percent of Bihar's rural women wanted more sons than daughters versus 21 percent in rural all India, and the sex ratio at birth was 933 girls per 1000 boys versus 927 girls per 1000 boys in rural all India (International Institute for Population Sciences and ICF Incorporated 2017b,a; International Institute for Population Sciences 2017c,b).

Appendix figure A.I.1 shows the location of Madhepura within India and Bihar as well as the distribution of households across Madhepura.

3.2. Sample selection

We surveyed 1,961 pregnant women about the sex preference for the child they were pregnant with in March and April 2015. In November and December 2016, when the women's children were 10 to 20 months of age, we followed up the same women and measured their children's early development outcomes.

The data were collected as part of a randomized controlled trial of a participatory learning and action approach program implemented in women's self-help groups to improve health, nutrition, water, sanitation and hygiene (HNWASH) of communities (Subramanyam et al. 2017). In early 2015, the study population was recruited from a listing of households with pregnant women in six of Madhepura's thirteen subdistricts. In these subdistricts, 68 from a total of 95 gram panchayats were randomly sampled, comprising 180 villages. At village level, information on households with pregnant women were gathered from Anganwadi center registers.[6] Because in some villages lists of pregnant women were not available, the number of gram panchayats and villages reduced to 56 and 140, respectively. In total, 1,961 households with pregnant women were surveyed in March and April 2015.

During the follow up survey in November and December 2016, we interviewed 1,612 households and conducted 1,325 child development tests. Attrition in the sample of households was mainly due to respondents' absence

6. In 2015/16, 76% of all pregnant women in Madhepura had registered their pregnancies (International Institute for Population Sciences 2017a).

from home (N=175) and migration (N=117).[7] In Madhepura, it is common that women stay at their maternal home during pregnancy and move to their husband's home after giving birth which, in many cases, made it difficult to track these formerly pregnant women and their children. Fourteen households refused their participation. Among the 1,612 households interviewed, 166 children have died and in 121 cases children were not at home (N=83), did not live in the housheold (N=11), or child development tests were only partially completed (e.g. only the parent questionnaire was conducted) because the child was sick, crying or not cooperative (N=27).

We restrict our sample to non-missing observations in son preferences, birth order, sex of elder children and mother's wish for more children, which reduces the sample size to 1,603 observations. We further remove pregnant women from the sample who already had an ultrasound at the time of the 2015 survey and, therefore, potentially knew the sex of their child in order to avoid bias from incorrect preference reporting due to anchoring with the child's actual sex (Norling 2018).[8] This reduces the sample size by 190 observations to 1,413 observations. Missing socioeconomic background characteristics further reduce the 2015 sample to 1,402 observations.

In estimations on child development outcomes, the sample size is further restricted to one with non-missing test scores (N=1,018). In 2016, children should be between 10 and 21 months old but in some cases their ages were recorded as only a few months or almost three years. We allow for some error in age reporting and include children aged 6 to 24 months. For the three cases outside of this age range, we assume that the wrong child was tested. Missingness in background characteristics reduce the 2016 estimation sample to 900 observations.

Appendix Table A.I.1 compares the estimation sample for children's outcomes (N=900) to observations outside the estimation sample (N=1060 for most indicators) using 2015 data on socioeconomic background characteristics. Judged by statistical significance of differences in means, the estimation sample is slightly worse off in educational attainment and wealth, whereas, judged by standardized differences (i.e., the difference in means divided by the standard deviation), none of the differences reaches 0.2, a threshold above which standardized differences are considered large (Cohen 1988; Imbens and Rubin 2015). The highest standardized difference is 0.18 in mothers' educational attainment. We further compare the 2015 sample of 1,961 households and our 2016 estimation sample of 900 households to the NFHS-4 rural Bihar and rural Madhepura indicators reported in International Institute for

7. The 117 cases include 31 households for which we know they permanently migrated and 86 cases for which we were not able to locate the household.

8. Because sex detection is illegal when there is no medical reason for it, some women may withhold having had an ultrasound. Thus, excluding all women who reported to have had an ultrasound may not exclude all women who have indeed had an ultrasound.

Population Sciences and ICF Incorporated (2017b) and International Institute for Population Sciences (2017a), respectively (see Appendix Table A.I.2). These indicators include, for example, access to electricity, having health insurance, literacy and women's body mass index. The 2015 and 2016 estimation sample are fairly comparable to the NFHS-4 rural Madhepura indicators. However, Madhepura fares considerably worse than all Bihar according to both of our samples and the NFHS-4 indicators.

3.3. Summary statistics

Table 1 summarizes background characteristics of pregnant women and their households at the time of the 2015 survey. Eighty-two percent of households are Hindu and 16 percent are Muslim. Thirty-four percent are of caste category scheduled caste, 56 percent of so called other backward classes, and three and seven percent are categorized as scheduled tribe or general caste, respectively.[9] The average number of household members is 5.8 and 63 percent of households have more than two adult members (older than 18 years). In most cases, the additional adult household members are the pregnant woman's parents-in-law. Seventy percent of households are flagged as poor based on the below poverty line card (BPL card), which is issued by the Government of India and classifies households as poor and, hence, as eligible for certain government programs. The maximum level of completed education is no or primary education in half of the households, in another 18 percent of households completed middle school and junior secondary school were the highest educational levels, respectively.

Pregnant women are 23 years on average and their age ranges between 14 to 46 years. Eighty percent of pregnant women have no completed education and 6 percent have completed primary school. Despite these low levels of education, 23 percent of pregnant women can read a text message with difficulty or easily.

The families of pregnant women vary in terms of size and sex composition of alive children. Thirty-one percent of women have no children. Thirty, 20, and 19 percent of women are pregnant with a child of birth order two, three, or four or more, respectively. The maximum birth order is eight, but only seven children are of birth order larger than six. The majority (60%) of families have no son yet, 31 percent have one son, and nine percent have two or more sons. After the current pregnancy, 42 percent of women do not want further children and eight percent are unsure.

9. These are the categories used by the Government of India. However, we would like to point out that the terminology itself is often considered discriminatory.

Table 1. Summary statistics of pregnant women and their households at the time of the 2015 survey

	Mean	SD	Min	Max	N
HH characteristics					
Religion					
Hindu	0.82	0.38	0	1	1402
Muslim	0.16	0.37	0	1	1402
Caste category					
Scheduled caste	0.34	0.47	0	1	1402
Scheduled tribe	0.03	0.18	0	1	1402
OBC	0.56	0.50	0	1	1402
General category	0.07	0.25	0	1	1402
No. of HH members					
HH size	5.77	2.47	1	20	1402
>2 adults in HH	0.63	0.48	0	1	1402
BPL card[a]	0.70	0.46	0	1	1402
Education level (max. in HH)					
No education	0.24	0.43	0	1	1402
Primary	0.25	0.43	0	1	1402
Middle	0.18	0.39	0	1	1402
Junior Sec.	0.18	0.39	0	1	1402
Higher Sec.	0.11	0.31	0	1	1402
Tertiary	0.03	0.18	0	1	1402
Pregnant women					
Age	23.10	4.06	14	46	1402
Education level					
No education	0.79	0.41	0	1	1402
Primary	0.06	0.25	0	1	1402
Middle	0.06	0.24	0	1	1402
Junior Sec.	0.04	0.20	0	1	1402
$\geq$ Higher Sec.	0.04	0.21	0	1	1402
Mother can read	0.23	0.42	0	1	1402
Family composition					
Birth order					
1	0.31	0.46	0	1	1402
2	0.30	0.46	0	1	1402
3	0.20	0.40	0	1	1402
$\geq$4	0.19	0.39	0	1	1402
Number of sons					
0	0.60	0.49	0	1	1402
1	0.31	0.46	0	1	1402
$\geq$2	0.09	0.29	0	1	1402
Wants another child					
No more	0.42	0.49	0	1	1402
Unsure	0.08	0.27	0	1	1402
Wants more	0.50	0.50	0	1	1402

Notes: Table shows summary statistics in a sample restricted to the 2015 estimation sample – i.e., non-missing information on pregnant women's sex preference, birth order of current pregnancy, number of alive sons of pregnant woman, whether the pregnant woman wants more children and characteristics as listed in the table – and describes the socioeconomic characteristics as observed during the 2015 survey. [a]BPL card refers to "below poverty line"-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. SD refers to the standard deviation of the respective variable.

4. Child-specific son preference and the role of birth order and sex composition

During pregnancy, more than a third of women (35.67%, N=504) wanted to have a boy and only 58 women (4.10%) wanted a girl. The remaining women stated no specific sex preference and either reported that the sex of their child does not matter (22.05%, N=312) or that it is up to god (38.15%, N=539). Disaggregated by family size and sex composition of elder children, sex preferences for the next born child varied substantially. In Figure 1, we depict the percentage shares of sex preferences by birth order of the child the woman was pregnant with and number of alive sons. The combination of birth order of alive children and number of alive sons results in the sex ratio of alive children. Figure 1 illustrates a number of stylized facts with respect to preferences for sons and daughters:

(1) Son preference is most prevalent among mothers with daughters and no sons.
(2) Son preference is decreasing in the number of sons.
(3) Son preference is increasing in birth order conditional on the number of sons.
(4) A considerable share of mothers (26%) already have one, two or more sons and yet have a son preference for the next born child.
(5) Daughter preference almost exclusively occurs among pregnant women who have sons but no daughters.

Stylized facts 1 to 3 are in line with a son preference which is interdependent with birth order and sex composition. Stylized fact 4 is interesting because it suggests a preference for more sons than an eldest son among a large share of women. Specifically, stylized fact 4 implies that a considerable share of women, whose family's sex composition is skewed towards sons already, prefer an even larger sex imbalance among their own children. Stylized fact 5 illustrates that even in households with sex ratios that are skewed in favor of boys already, at most about a quarter of women want a girl. Overall, Figure 1 does not suggest that parents prefer to have a sex balance. Although, there are mothers who prefer to have a daughter if there are only sons in the household, this is not true when there are more sons than daughters in the household, e.g., one daughter and one or more sons.

Figure 1 further illustrates an interesting point with respect to the relevance of measuring child-specific son preference in comparison to measuring a sex composition preference as an alternative direct measure of sex preference. Among women who are pregnant with their second child and who do not have a son yet (0 sons, birth order 2 in Figure 1), almost 60 percent want a son. At the next higher birth order, son preference remains high and even increases among those who did not get the desired son at second birth (0 sons, birth order 3 in Figure 1) and it decreases to about half (30 percent) among those who got the

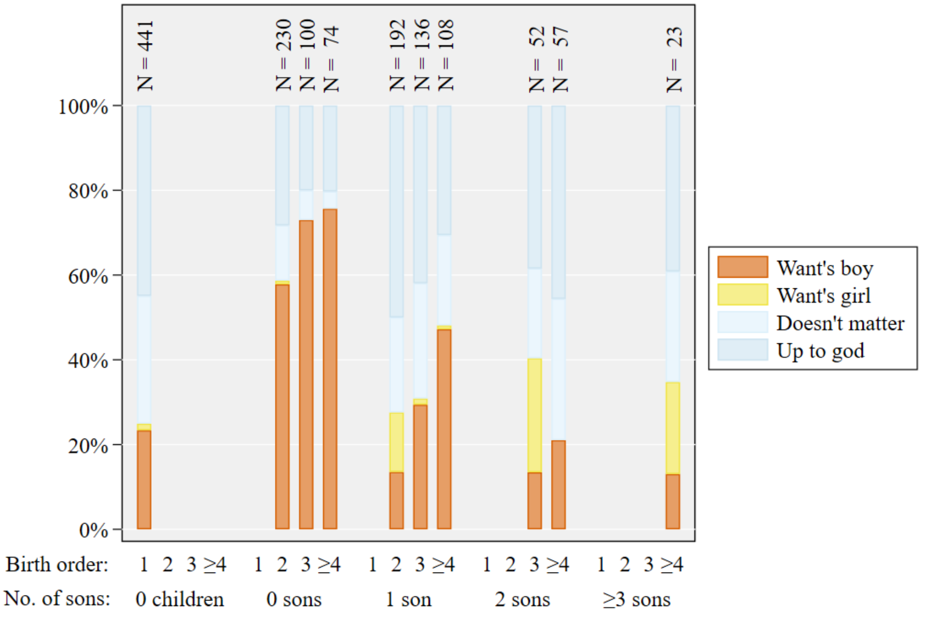

FIGURE 1. Share of mothers by sex preference, birth order and sex composition

Notes: Figure shows the share of mothers who stated to prefer a boy, to prefer a girl, who do not care about the sex of their child and who stated that the sex of their child is up to god by combinations of birth order of pregnancy and number of living sons. The sample excludes women who reported to have had an ultrasound and is restricted to non-missing information about whether the pregnant woman wants more children (N=1,413).

desired son (1 son, birth order 3 in Figure 1). If we think of Figure 1 in terms of progressing through different parities, this simple comparison illustrates that a sizable share of child-specific son preferences would not be discovered by a sex composition measure, i.e., pregnant women who had a child-specific son preference at birth order two but not at three would not be discovered. Of course not all families continue childbearing after the second child. However, those who want more sons are likely to continue childbearing and, thus, would show up at birth order three.

In Table 2, we investigate factors that correlate with child-specific sex preferences in a linear probability model. The coefficients in Table 2 present associations and not causal effects. One reason for this is potential reverse causality. Although, birth order and sex composition of alive children may induce specific sex preferences, sex preferences can also affect family size and sex composition via son-biased fertility behavior and sex-selective abortion.

In columns (1) to (3), we compare son-preferring mothers and their families with those who stated that the sex of their child does not matter or is up to god. The regressors in column (1) include birth order, number of sons, and whether the mother wishes to have another child. In column (2), we add household characteristics, mother characteristics, and subdistricts. Subdistricts were included because they potentially pick up regional variation in son preference, socioeconomic status, and access to resources or services such as health facilities with ultrasounds. Column (3) only includes household characteristics, mother characteristics, and subdistricts.

The results in columns (1) and (2) confirm the stylized facts. Son preference is much more common among later born children and in families with fewer sons. The probability of having a son preference at birth order two, three, or four or more is 33, 48, and 60 percentage points higher than at birth order one, respectively (column (2)). At a given birth order, the probability of having a son preference is 40 and 58 percentage points lower for mothers who have one or two or more sons than in no son families, respectively. The coefficients on birth order and number of sons are remarkably robust to the inclusion of socioeconomic characteristics and subdistrict indicators. Among household socioeconomic characteristics, only scheduled tribe affiliation is significantly (and negatively) associated with having a child-specific son preference. Tribes often differ in cultural customs and rituals and are frequently found to have lower son preferences than castes (Bhat and Zavier 2003; Pande and Astone 2007).

The adjusted R^2 in column (1), which only controls for family size, number of sons and the wish for more children, is 0.17 and only increases minimally (from 0.17 to 0.18) with the inclusion of household characteristics, mother characteristics, and subdistricts (column (2)). Household characteristics, mother characteristics, and subdistricts alone explain only 0.02 of the variation in son preference (not shown in Table 2). Thus, birth order and the number of sons explain much more of the variation in child-specific son preference than socioeconomic status and other background characteristics do. Socioeconomic characteristics are not child-specific and, therefore, may rather affect child-specific son preference via a sex composition preference. Yet, socioeconomic status may affect family size and sex composition if wealthier families prefer fewer children or more commonly use sex-selective abortion. As a result, high parity families would be a poorer selection of all families and families with sons a richer selection. If, at the same time, poorer families were more or less son preferring, then the coefficients on birth order and the number of sons may reflect such selection by socioeconomic status. However, conditioning on socioeconomic status does not change the coefficients on birth order and number of sons in column (2) in comparison to the unconditional coefficients in column (1). Hence, socioeconomic status may affect family size and sex composition, but the results do not suggest that socioeconomic status affects the relationship of family size and sex composition with son preference. Further, the results show that conditional on family size and the number of sons, socioeconomic status does not correlate significantly with child-specific son preference.

Table 2. Correlations of sex preferences with birth order, sex composition, and socioeconomic characteristics

	(1) Son pref.	(2) Son pref.	(3) Daughter pref.	(4) Daughter vs. son
Birth order				
2	0.335***	0.334***	0.028	0.029
	(0.036)	(0.039)	(0.019)	(0.025)
3	0.484***	0.477***	-0.053**	-0.093***
	(0.041)	(0.049)	(0.026)	(0.026)
≥4	0.574***	0.597***	-0.099***	-0.167***
	(0.044)	(0.055)	(0.030)	(0.035)
Number of sons				
1	-0.397***	-0.398***	0.073***	0.207***
	(0.037)	(0.035)	(0.023)	(0.031)
≥2	-0.595***	-0.577***	0.221***	0.530***
	(0.049)	(0.046)	(0.042)	(0.074)
Wants another child				
Unsure	0.021	0.027	-0.067**	-0.037
	(0.051)	(0.050)	(0.030)	(0.034)
Wants more	-0.002	0.004	-0.054**	-0.055*
	(0.035)	(0.035)	(0.023)	(0.028)
HH characteristics				
Hindu		0.060	-0.010	-0.021
		(0.050)	(0.025)	(0.042)
Scheduled caste		-0.016	-0.026	-0.044*
		(0.034)	(0.017)	(0.024)
Scheduled tribe		-0.176***	-0.042**	-0.021
		(0.064)	(0.017)	(0.038)
General category		-0.062	-0.051	-0.027
		(0.050)	(0.031)	(0.041)
HH size		-0.004	-0.004	-0.003
		(0.006)	(0.004)	(0.008)
>2 adults in HH		-0.029	-0.023	-0.033
		(0.034)	(0.023)	(0.030)
Wealth quintile				
2 (2nd poorest)		-0.063	0.028	0.076*
		(0.046)	(0.027)	(0.043)
3		-0.003	0.040	0.061*
		(0.037)	(0.025)	(0.036)
4		0.048	0.005	-0.019
		(0.048)	(0.023)	(0.037)
5 (richest)		-0.022	-0.002	0.014
		(0.043)	(0.023)	(0.034)
BPL card[a]		0.040	-0.003	-0.043
		(0.027)	(0.016)	(0.027)
Education (max. in HH)				
Primary		-0.055	-0.005	0.028
		(0.036)	(0.018)	(0.033)
Middle		0.017	0.039	0.049
		(0.042)	(0.024)	(0.033)
Junior Sec.		0.047	0.022	0.046
		(0.048)	(0.026)	(0.038)
Higher Sec.		0.024	0.043	0.057
		(0.063)	(0.034)	(0.038)
Tertiary		0.107	0.103	0.078
		(0.101)	(0.072)	(0.093)
Mother characteristics				
Education level				
Primary		0.009	0.018	0.057
		(0.071)	(0.039)	(0.074)
Middle		-0.034	-0.016	-0.022
		(0.066)	(0.035)	(0.067)
Junior Sec.		-0.047	0.070	0.111
		(0.082)	(0.047)	(0.091)
≥ Higher Sec.		-0.044	0.023	0.069
		(0.103)	(0.072)	(0.124)
Mother can read		-0.015	-0.005	-0.007
		(0.058)	(0.030)	(0.054)
Age		0.036*	0.008	-0.015
		(0.019)	(0.012)	(0.027)
Age^2		-0.001**	-0.000	0.000
		(0.000)	(0.000)	(0.001)
Subdistrict fixed effects		✓	✓	✓
Observations	1345	1345	902	557
R^2	0.17	0.20	0.12	0.30
Adj. R^2	0.17	0.18	0.09	0.25

Notes: Table shows estimations of a binary son preference indicator (wants boy=1, does not matter/up to god=0) in columns (1) and (2), a binary daughter indicator (wants girl=1, does not matter/up to god=0) in column (3), and binary daughter indicator (wants girl=1, wants boy=0) in column (4) on variables as listed in the table. The sample is restricted to the 2015 estimation sample and includes 500 women who want a boy, 57 want a girl, 308 say the sex does not matter and 537 state that the sex is up to god. [a]BPL card refers to "below poverty line"-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. Standard errors are clustered at the panchayat level and are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Columns (3) and (4) of Table 2 provide some insights about daughter preferences. In Column (3), we compare women who want a daughter with those who stated that the sex of their child does not matter or that it is up to god. Daughter preference is significantly negatively correlated with birth order and significantly positively correlated with the number of sons. The correlations have the opposite signs to those in column (2) and are considerably smaller in size. Interestingly, the wish for more children plays a significant role. Women who want daughters are more likely to not want more children. Similar to women who want a son, women who want a daughter are less likely from scheduled tribes in comparison to women who do not state a preference, but the coefficient size is much smaller in size. All variables together explain 9 percent of the variation in daughter preference, which is half of the adjusted R^2 for son preference in column (2).

In column (4), we further compare mothers who want daughters with those who want sons. The results are similar with respect to birth order and the number of sons to those in column (3), but the coefficient sizes are somewhat larger. Column (4) further shows significant differences in socioeconomic characteristics between women who prefer daughters and women who prefer sons. Women who want daughters are less often of a scheduled caste and more often of wealth quintile 2 or 3 than of the poorest quintile 1.

5. Son preference and children's mental development

In the remainder of the paper, we investigate the role of child-specific son preference for children's early mental development.

5.1. Measuring child development

We use the early childhood development test "Frühkindliche Entwicklungsdiagnostik für Kinder von 0-3 Jahren" (German for *Early childhood development diagnostics for children 0-3 years of age*, short title: FREDI 0-3) to measure children's skills and behavior (Macha and Petermann 2017; Mähler et al. 2016). FREDI 0-3 tests cognitive, language, motor, and socioemotional development and is similar in its set-up and items to the Bayley Scales of Infant Development (Michalec 2011). It includes playful tasks administered to the child and interview questions posed to the caregiver. FREDI 0-3 was normed to German children and its language items were validated to the language tests "Eltern Antworten – Revision" (German for *Parents Answers - Revision*, short title: ELAN-R) and "Sprachentwicklungstest für zweijährige Kinder (2;0–2;11

Jahre)" (German for *Language development test for two year old children (2;0–2;11 years)*, short title: SETK-2 tests) (Kiese-Himmel 2013, 2014).[10]

The test was adapted to the Indian context by the same psychologists who developed the original test. The adapted test comprises around 40 items and we administered different test versions for children younger or older than 15 months in 2016. We standardize scores for overall, cognitive, language, motor, and socioemotional skills of children with son preferring mothers relative to those with non-son preferring mothers and with respect to age group, a linear age in months trend, and a heteroskedastic residual variance. The overall development score weighs each scale equally.

5.2. Definition of son preference

In our preferred definition of child-specific son preference, we code son preference as an indicator that is 1 if the mother prefers a son and 0 if she stated "does not matter" or "up to god".

The definition of son preference may raise two concerns. First, the interpretation of the answer category "up to god" is ambivalent. If "up to god" correlates with the degree of religiousness and more religious people are generally more son preferring, then "up to god" at least partially indicates son preference. In the literature, "up to god" is sometimes interpreted as "does not matter" (e.g., Bongaarts 2013) or is excluded from the analysis (e.g., Jayachandran 2017). Second, our preferred definition of son preference excludes women who have a preference for a girl (N=37 in the estimation sample) rather than coding them as non-son preferring. We exclude daughter preferring mothers because we are not clear about the motives for having a daughter preference and mothers with daughter preferences may differ in ways that we cannot observe. Therefore, we prefer to think of the reference category as a neutral category.

In additional analyses, we put no restriction on the son preference indicator and estimate the effect of each sex preference response separately, i.e., "boy", "girl", "does not matter", and "up to god", on children's mental development by sex.

5.3. Estimation strategy

To estimate the effect of son preferences on children's early mental development, we interact son preference with the sex of the child of interest and control for

10. The ELAN-R is a measure of expressive vocabulary skills in early childhood. It consists of a questionnaire to be completed by parents and includes a detailed anamnestic part as well as a checklist with 319 words, which are assigned to different word types and fields. The SETK-2 measures the receptive and productive language processing abilities of two- to three-year-old children in four subtests directly conducted with the child.

both indicators separately. The interaction term indicates the unrealized son preference and its coefficient measures the son preference-specific girl-penalty. It describes the disadvantage faced by daughters of mothers who did not realize their son preference in comparison to daughters of non-son preferring mothers and sons of mothers with a realized son preference. We estimate the following model:

$$D_i = \beta_0 + \beta_1 SP_i * Girl_i + \beta_2 SP_i + \beta_3 Girl_i + \mathbf{X_i}^{'}\beta_4 + \varepsilon_i, \qquad (1)$$

where D_i is the standardized development score of child i. SP_i is a dummy for mother's son preference during pregnancy with child i, which equals 1 if the mother wants a boy and 0 if the sex does not matter to her or she thinks it is up to god. $Girl_i$ is the sex of child i, which equals 1 for girls and 0 for boys. X_i is a vector of covariates. For comparisons of *girls* of mothers with a son preference $(\beta_0 + \beta_1 + \beta_2 + \beta_3)$ to *boys* of mothers with a son preference $(\beta_0 + \beta_2)$, the coefficients of interest are $\beta_1 + \beta_3$. For comparisons of girls of mothers *with a son preference* to girls of mothers *without a son preference* $(\beta_0 + \beta_3)$, the coefficients of interest are $\beta_1 + \beta_2$. However, β_1 is the main coefficient of interest, because it measures the *son preference-specific girl-penalty* and reflects the relative discrimination component in the girl-boy comparison given son preference (gender-penalty) and the son preference-no son preference comparison given sex (son preference-penalty).

The interaction set-up controls for selection into son preference (SP_i) and captures potential biological differences in child development by sex ($Girl_i$). Girls in early childhood tend to perform better in language and socioemotional behavior whereas boys perform better in motor skills.[11] If children's sex poses an exogenous shock to the family, β_1 recovers the causal son preference-specific girl-penalty. Comparing the interaction set-up to a difference-in-differences approach, the analogy to the parallel trend assumption is that in the absence of gender discrimination, the level difference in child development outcomes between boys and girls would be the same for children of son preferring and children of non-son preferring mothers.

However, in the presence of sex selection and son-biased fertility behavior, sex is not entirely exogenous or unconfounded and sex selection and son-biased fertility behavior interact with son preference. Sex selection would violate the "parallel trend" assumption if it changed the composition of boys and girls of son preferring mothers with respect to characteristics that correlate with child development outcomes. For example, the son preference-specific girl-penalty would be downward biased, if more educated mothers had more sex selective abortions and, at the same time, their children's development outcomes were

11. See for evidence on language skills, for example, Bornstein et al. (2000), Galsworthy et al. (2000), Roulstone et al. (2002), Burman et al. (2008); for evidence on motor skills see, for example, Thomas and French (1985), Goodway et al. (2010), Spessato et al. (2013); and for motor development see, for example, DiPrete and Jennings (2012) and Owens (2016).

higher. The two subsequent subsections 5.3.1 and 5.3.2, address threats to causal identification due to sex selection and son-biased fertility.

The estimations include four sets of covariates: (i) birth order dummies and dummies for the number of elder boy siblings to capture the existing family structure; (ii) mothers' wish for more children, whether mothers are pregnant, and whether mothers have a newborn in 2016 to capture fertility intentions and continued child-bearing; (iii) socioeconomic background characteristics including dummies for caste category, household size, whether more than 2 adults live in the household, dummies for wealth quintile, having a below poverty line card, highest grade completed in the household, highest grade completed of the mother and maternal reading abilities; and (iv) subdistrict fixed effects to avoid identification from regional variation in son preference rather than idiosyncratic heterogeneity. The socioeconomic status variables of household wealth, below poverty line card, and highest grade completed were included as observed in 2016 because it is common for pregnant women to stay at their parental homes during pregnancy, whereas we want to capture the socioeconomic status of her permanent home, i.e., that of her husband, which is also the environment the child is exposed to.

Appendix Table A.I.3 summarizes background characteristics of the 2016 estimation sample by combinations of sex of the child and son preference of the mother. The results show that there are differences across groups with respect to caste category, mothers educational attainment, reading ability and age, and in particular with respect to the number of boys in the family, birth order and whether the mother wants more children.

5.3.1. Sex selection. With the rise of affordable prenatal sex detection technology since the 1980s, sex determination and hence sex selection became illegal in India under the Prenatal Diagnostic Techniques Act in 1994 (amended in 2003). Yet, sex ratios at birth indicate widespread sex selection (Bhalotra and Cochrane 2010; Jha et al. 2011; Anukriti et al. 2015). Sex selection is confounding our analysis if sex-selecting families are different to non sex-selecting families in characteristics that are correlated with child development. Others have used data from an earlier time when ultrasounds and abortions were less prevalent or from after the legal ban in 1994 to avoid this bias (Clark 2000; Jensen 2003; Barcellos et al. 2014; Jayachandran and Pande 2017; Kugler and Kumar 2017).

In our dataset, we observe whether children that were in utero in 2015 have died, either in utero or after birth, until the follow-up survey in 2016. Therefore, we are able to investigate whether children who are still alive in 2016 constitute a selected sample of all children that were in utero in 2015. One limitation is that we do not observe the sex of dead children.

In Appendix Table A.II.1 we regress children's death on son preference, socioeconomic charateristics, family size and the number of boys in the family. Significant correlates with children's death include being of wealth quintile

3 relative to the poorest wealth quintile 1 ($p < 0.1$, negative correlation), household size ($p < 0.01$, negative correlation), whether more than two adults live in the household ($p < 0.1$, positive correlation), and having one son relative to no sons ($p < 0.1$, negative correlation), whereas the coefficient on two or more sons is not significant. These results are reassuring because if sex selection occurred, we would expect wealthier and more educated households to select into children's death, which we do not observe. Further, the coefficient on son preference shows a negative and insignificant correlation with children's death.

The ratio of boys to girls in our sample is 1.041, which is at the lower end of the biological normal range of 1.04 to 1.07 (Waldron 1983, 1987; Parazzini et al. 1998) and corresponds to previous findings of Bihar's relatively low excess mortality at birth (Anderson and Ray 2010; Bongaarts 2013). It is possible that the sex ratio of 1.041 in the sample occurs by chance. The bootstrapped confidence interval ranges from 0.904 to 1.178 and, thus, includes non-natural sex ratios. Yet, these numbers show that we cannot reject that the sex ratio is natural.

5.3.2. Son-biased fertility behavior. Another concern is son-biased fertility behavior, which is the continuation of childbearing beyond the planned family size to reach the desired number of sons. If son-biased fertility behavior is exercised, girls tend to live in larger families with more daughters and, therefore, receive fewer resources (Clark 2000; Jensen 2003; Barcellos et al. 2014; Rosenblum 2013; Kugler and Kumar 2017). Further, son-biased fertility is likely to reduce birth spacing which may compromise children's mental development, for example, through early weaning and lower health outcomes (Jayachandran and Kuziemko 2011).

In this application, son-biased fertility behavior can only affect the son preference-specific girl-penalty (i.e. the coefficient on the interaction term) if parents have another child *in response* to the sex of the child the mother was pregnant with in 2015 in the subsequent year. Previous son-biased fertility behavior would not affect the coefficient on *Girl x Son Preference*, i.e. variation by sex conditional on son preference, but it is likely to affect the coefficient on *Son Preference*. At the time of the 2016 survey, 90 percent of the children in our sample are 18 months or younger. This gives parents very limited time to react to the child's sex by having another child. Following this logic, Barcellos et al. (2014) select a sample with children below 16 months of age. Yet, in 2016 there are 54 families (6% of the estimation sample) with a newborn already and 102 mothers (11%) are pregnant again. Moreover, parents might anticipate to become pregnant in response to having a girl and therefore wean girls or adjust the resource allocation early. Such anticipatory behavior would have to take place sufficiently long before the conduct of the child development test in order to affect test outcomes. In the estimations, we control for newborns and current pregnancy to account for realized son-biased fertility. However, we expect the bias from anticipation to be negligible.

5.4. Have girls of son preferring mothers lower mental functions?

Table 3 presents results for the average son preference-specific girl-penalty estimated by OLS. Each panel refers to one skill outcome: overall development, cognitive, language, motor, and socioemotional development. The columns refer to different model specifications and vary the set of control variables included. The coefficient on *Girl x Son Preference* measures the average son preference-specific girl-penalty. It is zero for motor development, large and negative for all other development scales and significant for overall development, language, and socioemotional behavior. The son preference-specific girl-penalty is 0.24 standard deviations for overall development and, more specifically, 0.27 and 0.25 standard deviations in language and socioemotional behavior, respectively.

The coefficients on *Girl* suggest that in the absence of son preference girls outperform boys in language and socioemotional skills and vice versa for motor skills. This finding is in line with the neuroscience and psychology literature, which finds exactly that girls tend to perform better in language and socioemotional behavior whereas boys perform better in motor skills.[12]

In columns (2) to (4) of Table 3, we gradually add control variables. In column (2), we add dummies for birth order and number of male children in the family. Families with many children but no sons might be more likely to practice sex selection or son-biased fertility than families with sons or smaller families, which are willing to continue childbearing. Further, having elder sons in the family might affect the number of stimulating toys at home or having elder daughters might affect the mother's probability to work in order to afford future dowry payments, which may reduce mother-child interactions (Alfano 2017; Bhalotra et al. 2020). However, when we control for birth order and number of sons in the family the results remain robust.

For son-biased fertility behavior to affect the child of interest, parents would have to continue childbearing in response to the child's sex. In column (3) of Table 3, we add whether the mother wants more children, whether she is pregnant or has a newborn already in 2016. The coefficients on the son preference-specific girl-penalty are robust to these son-biased fertility controls.

In column (4) of Table 3, we add socioeconomic status variables. If sex selection is more commonly practiced in wealthier and more educated families (Jha et al. 2011; Poertner 2015), we would expect the son preference-specific girl-penalty to be upward biased. The coefficients' robustness to the inclusion of socioeconomic status variables is in line with the findings on selection into death in section 5.3.1, which showed no selection by socioeconomic characteristics.

12. For evidence on language skills see, e.g., Bornstein et al. (2000), Galsworthy et al. (2000), Roulstone et al. (2002), Burman et al. (2008); for evidence on motor skills see, e.g., Thomas and French (1985), Goodway et al. (2010), Spessato et al. (2013); and for socioemeotional development see, e.g., DiPrete and Jennings (2012) and Owens (2016).

TABLE 3. OLS estimation results of the son preference-specific girl-penalty in mental development

	(1)	(2)	(3)	(4)
Overall development				
Girl x Son preference	-0.220*	-0.242*	-0.240*	-0.239*
	(0.130)	(0.128)	(0.130)	(0.131)
Girl	0.084	0.081	0.067	0.071
	(0.080)	(0.080)	(0.080)	(0.082)
Son preference	0.039	0.087	0.084	0.093
	(0.092)	(0.096)	(0.098)	(0.100)
Adjusted R^2	0.024	0.034	0.031	0.040
R^2	0.032	0.048	0.049	0.072
β bound	-0.204	-0.212	-0.231	-0.231
δ-statistic	-14.1	-7.9	-24.0	-31.4
Cognitive				
Girl x Son preference	-0.124	-0.144	-0.145	-0.149
	(0.140)	(0.137)	(0.137)	(0.139)
Girl	0.038	0.035	0.025	0.027
	(0.082)	(0.084)	(0.081)	(0.084)
Son preference	0.030	0.071	0.074	0.066
	(0.105)	(0.117)	(0.118)	(0.120)
Adjusted R^2	0.010	0.028	0.028	0.034
R^2	0.019	0.042	0.047	0.066
β bound	-0.091	-0.113	-0.119	-0.138
δ-statistic	-3.9	-4.7	-5.6	-14.6
Language				
Girl x Son preference	-0.255**	-0.273**	-0.268**	-0.268**
	(0.116)	(0.116)	(0.118)	(0.114)
Girl	0.178**	0.177**	0.155**	0.160**
	(0.070)	(0.071)	(0.074)	(0.076)
Son preference	0.113	0.166*	0.162*	0.177*
	(0.083)	(0.092)	(0.094)	(0.095)
Adjusted R^2	0.012	0.013	0.012	0.027
R^2	0.020	0.028	0.031	0.060
β bound	-0.252	-0.233	-0.245	-0.264
δ-statistic	36.8	-6.9	-13.6	-114.4
Motor				
Girl x Son preference	0.003	-0.018	-0.023	-0.020
	(0.136)	(0.132)	(0.134)	(0.137)
Girl	-0.169**	-0.168*	-0.151*	-0.148*
	(0.084)	(0.085)	(0.086)	(0.087)
Son preference	-0.123	-0.073	-0.073	-0.076
	(0.098)	(0.095)	(0.095)	(0.097)
Adjusted R^2	0.019	0.026	0.025	0.031
R^2	0.028	0.040	0.043	0.063
β bound	-0.033	0.027	0.021	-0.007
δ-statistic	0.1	-0.4	-0.5	-1.5
Socioemotional				
Girl x Son preference	-0.261*	-0.263*	-0.259*	-0.253*
	(0.131)	(0.133)	(0.135)	(0.139)
Girl	0.197**	0.192**	0.160**	0.161**
	(0.075)	(0.075)	(0.074)	(0.074)
Son preference	0.067	0.056	0.050	0.069
	(0.077)	(0.086)	(0.087)	(0.090)
Adjusted R^2	0.027	0.027	0.028	0.029
R^2	0.036	0.041	0.047	0.062
β bound	-0.257	-0.262	-0.255	-0.250
δ-statistic	43.1	72.7	35.2	35.9
Subdistrict fixed effects	✓	✓	✓	✓
Birth order & no. of sons		✓	✓	✓
Fertility intention			✓	✓
Socioeconomic status				✓
Observations	900	900	900	900

Notes: Table shows OLS estimation results of children's standardized early mental development on son preference and sex of children. Control variables include subdistrict fixed effects, (birth order & no. of sons:) birth order dummies 2 to ≥4, dummies for 1 to ≥3 elder sons, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, household size, whether no. of adult members exceeds 2, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, highest grade completed of mother, whether mother can read. The five panels refer to different outcomes, i.e., overall development, cognitive, language, motor and socioemotional skills. β bounds indicate treatment effects under proportional selection of unobservables. δ-statistics indicate the required selection on unobservables to explain away the estimated effect. Standard errors clustered at panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We check the robustness of the results by calculating treatment effect bounds and the relative degree of selection under proportional selection of observables and unobservables following Oster (2019). The β bounds in Table 3 indicate the treatment effects if selection on unobservables was as large as selection on observables taking into account the variation in the outcome variable that can be explained by observables and unobservables. The δ-statistics in Table 3 indicate how large the selection on unobservables would have to be to explain away the estimated treatment effect taking into account the variation in the outcome that can be explained. Oster (2019) suggests that a relative degree of selection (δ-statistic) below 1 (or above -1) would cause reason for concern. To calculate the β bounds and δ-statistics, we also follow Oster (2019) and assume a maximum R^2 of 1.3 times the highest R^2 of the model controlling for observables in columns (1) to (4) for each outcome separately. For the significant effects on overall development, language, and socioemotional skills, the β bounds do not cross zero and the δ-statistics are considerably larger than 1, ranging between 6.9 and 72.7 in absolute terms. These results suggest that the estimated effects are robust to unobservable selection under proportional selection of observables and unobservables.

5.5. Is it discrimination against girls or preferential treatment of boys?

The son preference-specific girl-penalty can be caused by discrimination against girls or preferential treatment of boys or both. For example, the disappointment of bearing a girl may lead to discriminatory behavior against girls of son preferring mothers in comparison to girls of non-son preferring mothers. On the other hand, the joy of bearing a boy may lead to pampering of boys of son preferring mothers in comparison to boys of non-son preferring mothers.

The coefficients in Table 3 on *Girl* × *Son preference*, *Son preference*, and *Girl* provide some insights into the composition of the effects. The omitted category in Table 3 refers to boys of mothers who do not have a son preference and the *Son preference* coefficient indicates the relative advantage of boys that were born to son preferring mothers. In the absence of unobservable selection, the *Son preference* coefficient, thus, indicates the preferential treatment of boys of son preferring mothers. The coefficient on *Girl* indicates how girls of non-son preferring mothers fare in comparison to boys of non-son preferring mothers. The discrimination against girls follows by either comparing the girls of son preferring and non-son preferring mothers ($\beta_3 \mathit{Girl} + \beta_1 \mathit{Girl} \times \mathit{Son\ preference}$) or comparing girls and boys of son preferring mothers ($\beta_2 \mathit{Son\ preference} + \beta_1 \mathit{Girl} \times \mathit{Son\ preference}$).

We prefer to think of this discrimination holding the son preference of the mother constant and varying the sex of the child because mothers select into the preference already during pregnancy but whether that preference is satisfied depends on the birth outcome. Following this, the preferential treatment of boys of son preferring mothers is 0.093 standard deviations in overall development and the discrimination of girls of son preferring mothers is 0.146 standard deviations. For language, the preferential treatment of boys amounts to 0.177 standard deviations and the discrimination against girls is 0.091 standard deviations. For socioemotional development, the preferential treatment of boys is 0.069 standard deviations and the discrimination against girls is 0.184 standard deviations. Further, for language the preferential treatment effect is significant (see Table 3) and for socioemotional development the discrimination effect ($\beta_2 Son\ preference + \beta_1 Girl \times Son\ preference = 0$) is significant. Comparing the absolute values of the preferential treatment and discrimination coefficients, there are no significant differences.

Overall, these results suggest that both preferential treatment of boys and discrimination against girls matter. Based on coefficient sizes it seems that preferential treatment of boys plays a bigger role for language and a smaller one for socioemotional outcomes, however, the effects do not differ from each other statistically.

A shortcoming of the analysis is that the coefficient on son preference might pick up unobservable selection into son preference and, therefore, does not solely reflect preferential treatment. For example, if son preferring mothers are different in ways which is not controlled for and which is beneficial for children's early development, then the preferential treatment effect would be upward biased. Although, this would not bias the son preference-specific girl-penalty, it can affect the conclusions we draw about how the son preference-specific girl-penalty is decomposed into preferential treatment of boys and discrimination against girls.

5.6. Girl-penalty by disaggregated sex preference

In Table 4, we add children of mothers with a daughter preference during pregnancy to the sample and consider each answer category to the sex preference question separately. The estimation sample comprises 37 women who stated a daughter preference. Children of mothers who stated "does not matter" serve as a reference category.

The son preference-specific girl-penalty is consistent with the results of Table 3 in that the coefficient on *Girl* × *Wants boy* is statistically significant for overall development, language and socioemotional development. The son preference-specific girl-penalty is larger in size, but insignificantly so, by 0.08, 0.09 and 0.20 standard deviations for socioemotional skills, overall development and language skills, respectively. The reason for the increase in effect size is that the coefficients on "up to god" are also negative for overall development, language and socioemotional development and even significant for language. This evidence suggests that the results in Table 3 are conservative estimates of the son preference-specific girl-penalty.

Particularly interesting are the effects for *Wants girl* and *Girl* × *Wants girl.* Boys of mothers with a daughter preference perform significantly better

TABLE 4. OLS estimation results of mental development on each sex preference response category

	Overall development	Cognitive	Language	Motor	Socio-emotional
Girl x Wants boy	-0.329*	-0.146	-0.468***	0.008	-0.332**
	(0.178)	(0.171)	(0.165)	(0.179)	(0.157)
Girl x Up to god	-0.155	-0.006	-0.311*	0.025	-0.149
	(0.180)	(0.197)	(0.171)	(0.187)	(0.165)
Girl x Wants girl	-0.613*	-0.578	-0.644**	-0.169	-0.583*
	(0.352)	(0.416)	(0.265)	(0.432)	(0.328)
Girl	0.158	0.026	0.358**	-0.184	0.242**
	(0.133)	(0.132)	(0.134)	(0.144)	(0.119)
Wants boy	0.081	0.051	0.269*	-0.160	0.021
	(0.145)	(0.156)	(0.143)	(0.140)	(0.124)
Up to god	-0.009	-0.016	0.137	-0.110	-0.064
	(0.120)	(0.147)	(0.137)	(0.131)	(0.111)
Wants girl	0.559***	0.459**	0.528**	0.264	0.492**
	(0.146)	(0.208)	(0.219)	(0.171)	(0.209)
Subdistrict fixed effects	✓	✓	✓	✓	✓
Birth order & no. of sons	✓	✓	✓	✓	✓
Fertility intention	✓	✓	✓	✓	✓
Socioeconomic status	✓	✓	✓	✓	✓
Observations	937	937	937	937	937
Adjusted R^2	0.045	0.032	0.029	0.031	0.033
R^2	0.079	0.067	0.064	0.066	0.068
β bound	-0.092	-0.056	-0.152	0.002	-0.051
δ-statistic	-1.7	-2.3	-1.5	-1.9	-1.3

Notes: Table shows OLS estimation results of children's standardized early mental development on each sex preference response category and sex of children. Control variables include subdistrict fixed effects, (birth order & no. of sons:) birth order dummies 2 to ≥ 4, dummies for 1 to ≥ 3 elder sons, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, household size, whether no. of adult members exceeds 2, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, highest grade completed of mother, whether mother can read. β bounds indicate treatment effects under proportional selection of unobservables. δ-statistics indicate the required selection on unobservables to explain away the estimated effect. Standard errors clustered at panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

by about half a standard deviation in all development scales except motor development in comparisons to boys of mothers who do not care about the sex of their child (the reference category). Further, girls of mothers with a daughter preference have significantly lower early development outcomes by about 0.6 standard deviations (except for motor skills) than boys of mothers with a daughter preference and girls of mothers who do not care about the sex of their child.[13]

13. The sample of children with daughter preferring mothers consists of only 37 observations and the effect could be driven by random sampling variation. We address this concern by randomly excluding six observations at a time. The coefficient on the interaction term of *Girl* × *Wants girl* varies in size between 0.41 and 0.83 and is mostly but not always statistically significant. The coefficient on *Wants girl* varies between 0.44 and 0.61 and is always significant. Therefore, the effects for daughter preferences do not seem to be driven by a few outliers.

Overall, there is little known about the causes and motives of daughter preference in India. Typically, in Bihar and elsewhere in India, there is a strict segregation of tasks already among children. Based on anecdotal evidence from Haryana, Jayachandran (2017) suggests that girls help with household chores and often look after their younger siblings, whereas boys are less docile and conflicts may arise from splitting family land when there are many sons in the family. Our observations from field work also suggest that girls are often tasked to care for their siblings and conduct household chores already at just a few years old. Possibly, having a daughter may not be something socially desirable but may be practical if there are sons in the family already. Our results prompt to study the causes and motives of daughter preferences in future research.

5.7. The intensity of the son preference-specific girl-penalty by birth order and sex composition

In section 4, we showed that son preference is strongly associated with birth order and sex composition of children. In this section, we test whether birth order and sex composition affect the intensity of the son preference-specific girl-penalty. This would imply a correlation between the *probability* of having a son preference and the *intensity* of discrimination by birth order and sex composition. We measure the discrimination *intensity* in a model that interacts the son preference indicator, the girl indicator, and its interaction with sex composition dummies:

$$\begin{aligned} D_i = \beta_0 &+ \beta_1 SP_i * Girl_i + \sum_k \beta_{2k} SP_i * Girl_i * \mathbb{1}(SexComposition_i = k) \\ &+ \beta_3 SP_i + \sum_k \beta_{4k} SP_i * \mathbb{1}(SexComposition_i = k) \\ &+ \beta_5 Girl_i + \sum_k \beta_{6k} Girl_i * \mathbb{1}(SexComposition_i = k) \\ &+ \sum_k \beta_{7k} \mathbb{1}(SexComposition_i = k) + \mathbf{X_i}' \beta_8 + \varepsilon_i, \end{aligned} \tag{2}$$

where $\mathbb{1}(SexComposition_i = k)$ is an indicator that equals 1 if the family has sex composition k, i.e., a specific combination of alive sons and daughters born before the child of interest. The sum of β_1 and the respective β_{2k} coefficient presents the intensity of the son preference-specific girl-penalty at sex composition k. Specifically, the sum of these coefficients presents the difference in development outcomes by sex due to mothers' son preference (because this is a triple interaction, the presented effects do not show the difference between girls of son preferring and non-son preferring mothers).

Figure 2 presents the son preference-specific girl-penalty in children's overall development by sex composition. Each cell shows the difference in development between boys and girls due to their mothers son preference at the respective

Overall development					
No. of daughters	≥2	β	0.236	-0.448	-0.678
		SE	(0.500)	(0.453)	(0.485)
		N	112	84	19
	1	β	0.224	-0.605	-0.570
		SE	(0.380)	(0.471)	(0.498)
		N	154	94	30
	0	β	-0.215	0.029	1.060
		SE	(0.336)	(0.637)	(0.788)
		N	266	116	25
		No. of sons	0	1	≥2

Figure 2. Son preference-specific girl-penalty by birth order and sex composition

Notes: Figure shows OLS estimations of the son preference-specific girl-penalty (β) in standardized overall development by sex composition of children born before the child of interest. SE refers to the standard error of β. N refers to the number of observations that fall into each sex composition category, whereas the total estimation sample includes 900 observations. The results are based on a fully interacted model of son preference, sex of the child of interest and sex composition of elder children. Control variables include subdistrict fixed effects, dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, caste category dummies, household size, whether no. of adult members exceeds 2, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, highest grade completed of mother, whether mother can read. Standard errors are clustered at the panchayat level and reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

combination of family size and sex composition. The number of observations that fall into each sex composition cell are indicated below the coefficient estimates. A priori it is not clear whether mothers with daughters are more discriminating than mothers with sons given that both "types" of mothers are son preferring. Mothers with daughters may have a very strong wish for a boy and may be more discriminating at higher birth orders if that wish is not fulfilled. On the contrary, mothers who have a son already but continue to have son preferences might have particularly strong son preferences.

Figure 2 shows a negative son preference-specific girl-penalty for firstborns and children in families with mixed-sex compositions. For children in families that have children of only one sex the son preference-specific girl-penalty is positive or close to zero. Unfortunately, given the small number of observations in each cell, we have no power to interpret or compare the coefficients in Figure 2 with confidence.

5.8. Mechanisms: From son preference to mental development

Throughout the analysis, the son preference-specific girl-penalty in language and socioemotional skills is most obtrusive. The formation of synapses for language and higher order brain processes, such as cognitive and socioemotional skills, occur later than synapses formation for seeing and hearing (Thompson and Nelson 2001; Tottenham 2017). The later the synapses formation takes place the longer the region of the brain remains plastic and is, therefore, sensitive to adverse experiences and environments (Tierney and Nelson 2009). Good health, mental stimulation and a loving, intimate, and reliable relationship with caregivers are essential for children's early brain development (National Research Council and Institute of Medicine 2000). The identified son preference-specific girl-penalty suggests lower nurturing care among daughters of son preferring mothers.

In this section, we look at potential mechanisms which mediate the effect from son preference to skills. First, we look at child health, which is an outcome of interest in itself and which, if impaired, can prevent healthy brain development (Prado and Dewey 2014). Second, we investigate parents' health and nurturing inputs, which have been shown to be relatively lower among daughters in India (Maitra 2004; Oster 2009; Asfaw et al. 2010; Jayachandran and Kuziemko 2011; Barcellos et al. 2014). Third, we look at mothers' mental health and her decision-making power and autonomy. Maternal mental health may reflect the emotional stress in facing the resentment of having a girl and has been shown to affect child development (Britto et al. 2017). Further, female autonomy has shown to be higher for mothers of sons in son preferring contexts (Li and Wu 2011; Kishore and Spears 2014; Javed and Mughal 2020). If women are aware of the costs in autonomy of bearing daughters when sons are preferred, the discontent about the loss of autonomy may reinforce gender discrimination.

Table 5 establishes the link from son preference to potential mediators. The top panel of Table 5 presents the son preference-specific girl-penalty in child health outcomes; specifically, whether the child is severely wasted, anemic or has been sick.[14] The sickness indicator is equal to 1 if, based on the mother's report, the child was sick in the past two weeks, had loose motions in the past three months, or suffered from pneumonia in the past three months. The sample sizes for wasting and anemia are low due to missing measurements. The son preference-specific girl-penalty is marginally significant for severe wasting and anemia and amounts to 7 and 11 percentage points, respectively.

The middle panel of Table 5 shows the son preference-specific girl-penalty in parental inputs; specifically, the number of postnatal care visits to proxy health inputs, whether the child is currently breastfed, and an activity index, which is a summation of six playful activities typically conducted with the child (e.g. telling stories or singing songs). The sample size on the number of postnatal care visits is low due to missing observations. We use 3-months age fixed effects

14. The severe wasting indicator was standardized according WHO reference tables. Anemia is defined according to WHO guidelines with respect to children's age.

TABLE 5. OLS estimation results of the son preference-specific girl-penalty in children's health, parental inputs, mothers' mental health and empowerment

	(1)	(2)	(3)
Children's health			
	Severely wasted	Anemic	Sick
Girl x Son preference	0.069*	0.108*	0.008
	(0.040)	(0.056)	(0.060)
Girl	-0.007	0.038	-0.014
	(0.023)	(0.051)	(0.045)
Son preference	0.006	-0.041	0.028
	(0.034)	(0.055)	(0.051)
Observations	693	605	888
Adjusted R^2	0.001	0.032	0.064
R^2	0.050	0.087	0.100
Mean	0.07	0.67	0.32
Parental inputs			
	No. PNC visits	Breast-feeding	Activity index
Girl x Son preference	-0.256	0.045	0.132
	(0.314)	(0.038)	(0.246)
Girl	-0.048	-0.013	-0.182
	(0.184)	(0.021)	(0.177)
Son preference	0.467*	-0.016	-0.158
	(0.245)	(0.034)	(0.177)
Observations	675	899	899
Adjusted R^2	0.066	0.174	0.034
R^2	0.113	0.206	0.070
Mean	1.91	0.91	5.54
Maternal mental health and empowerment			
	Mental health index	Participates in dietary decisions	Empowerment index
Girl x Son preference	-0.131	-0.147**	0.029
	(0.134)	(0.067)	(0.139)
Girl	0.127	0.056	0.028
	(0.091)	(0.041)	(0.083)
Son preference	0.074	0.115***	-0.031
	(0.103)	(0.039)	(0.094)
Observations	866	900	883
Adjusted R^2	0.014	0.050	0.087
R^2	0.053	0.086	0.122
Mean	-0.00	0.27	0.00
Subdistrict fixed effects	✓	✓	✓
Birth order & no. of sons	✓	✓	✓
Fertility intention	✓	✓	✓
Socioeconomic status	✓	✓	✓
3-months age fixed effects	✓	✓	✓

Notes: Table shows OLS estimations of different outcomes on son preference and children's sex. Wasting is standardized to WHO reference tables. Anemia is defined according to WHO guidelines. Sick is an indicator based on mother's report that the child was sick past 2 weeks, had loose motions past 3 months, or suffered from pneumonia in the past 3 months. Breastfeeding is a binary indicator of whether the child is currently breastfed. Activity index sums six playful activities (e.g. singing songs). Mental health is an index based on whether mother is frequently stressed, her satisfaction with her family life and her satisfaction with her life overall. Participation in dietary decisions is a binary indicator that is 1 if the mother is involved in decisions regarding the family diet and feeding of children. Empowerment is an index based on women's mobility and decision making power. Control variables include subdistrict fixed effects, (birth order & no. of sons:) birth order dummies 2 to $\geq$4, dummies for 1 to $\geq$3 elder sons, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, household size, whether no. of adult members exceeds 2, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, highest grade completed of mother, whether mother can read, (3-months age fixed effects:) and 3 months age fixed effects. The sample is restricted to the main OLS estimation sample of 900 observations and non-missings in the respective outcome. Standard errors clustered at panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

to account for potential censoring in breastfeeding and postnatal care.[15] We find no son preference-specific girl-penalty in any of the parental inputs. This is particularly surprising for breastfeeding because the early weaning of girls in son preferring contexts has been numerously documented (Jayachandran and Kuziemko 2011; Chakravarty 2015; Hafeez and Quintana-Domeque 2018). We further examined the effect on breastfeeding by children's age and the family's sex composition as well as on the times of breastfeeding per day and months of exclusive breastfeeding. None of these analyses suggest a son preference-specific girl-penalty in breastfeeding. Almost all children in our sample are at least 12 months old and more than half of the children are 16 months or older, such that if there was discrimination in breastfeeding, it should show in our sample. Studies that present evidence against the early weaning hypothesis are rare, but there are some studies, for example, from Tunisia, Morocco, and India (Obermeyer and Cardenas 1997; Tiwari et al. 2008; Suresh et al. 2014). A recent analysis of breastfeeding practices during infancy in Bihar shows that the main reason for the termination of breastfeeding was insufficient milk supply (59%), whereas only 2.5% mentioned further conception (Kumar et al. 2021). One reason why we do not observe early weaning of girls may be a reduction in the fertility rate. The total fertility rate in Bihar decreased from 4.5 in 2000 to 3.2 in 2015 and, consequently, women in our sample may be able to better spread fewer births over a longer period of time, whereas earlier studies such as (Jayachandran and Kuziemko 2011) consider son biased early weaning in the 1990s when fertility was considerably larger all over India.

In the bottom panel of Table 5, we test the son preference-specific girl-penalty in maternal mental health and empowerment. The mental health variable is an index based on principal component analysis that relies on how often the mother feels stressed or strongly worried, her satisfaction with her family life and her satisfaction with her life overall. The indicator on participation in dietary decisions equals 1 if the mother is involved in decisions about feeding her family a good balance of foods and decisions on changes in the child's diet as it grows up – such as feeding colostrum, starting complementary feeding and adding oil to a meal – and is 0 otherwise. The empowerment index is based on a principal component analysis of variables regarding the mother's mobility, decision making power, and whether she feels recognized as herself in her community. Specifically, mobility was enquired with respect to going to the market, the health facility, the neighbors home, relatives outside the village, and the place of worship. Decision making power regards participation in decisions about major household purchases, health care or treatment, visits to relatives, and family planning. The mental health and empowerment indices were standardized and can therefore be interpreted in standard deviations. The results at the bottom of Table 5 show a son preference-specific girl-penalty in

15. 1-month age fixed effects would lead to clusters with too few observations.

mother's participation in dietary decisions of 15 percentage points, but not in the more general empowerment index.

In Table 6, we test whether severe wasting, anemia, and participation in dietary decisions are mediators from son preference to early skills by adding them to the main specification as a covariates.[16] In columns (1) to (5) of Table 6, we reestimate our main specification with the regular set of covariates in a sample with non-missings in the potential mechanisms. The results in columns (1) to (5) are similar to our findings from Table 3, but the sample size is now lower, the son preference-specific girl-penalty tends to be higher, and is also significant for cognitive skills. When we add wasting, anemia and participation in dietary decisions to the model in columns (6) to (10), the son preference-specific girl-penalty remains virtually identical, suggesting these variables do not mediate the effect from son preference to mental development. Wasting and anemia significantly and negatively affect motor development. This makes intuitive sense given that anemic and poorly nourished children tend to be tired and less explorative (Lozoff et al. 1998). Further, mothers' participation in dietary decisions is negatively associated with socioemotional development, which is surprising given that female empowerment has been shown to positively affect women's and children's health inputs and outcomes (Thomas 1990; Hoddinott and Haddad 1995; Maitra 2004).

Taken together, none of the tested mediators can explain the son preference-specific girl-penalty. In line with previous evidence, we find that son preferences affect children's health outcomes. However, contrary to previous findings, we do not find significant evidence that girls of son-preferring mothers are breastfed for shorter time in comparison to boys. Further, the two mechanisms which we consider attributes of the home environment - the activity index and maternal mental health - were not significantly affected by child-specific son preferences. Presumably, these indicators do not capture the home environment appropriately. Barcellos et al. (2014) find that Indian parents spend more childcare time on sons than on daughters. Given a lack of data, we are unable to test time use and whether the environment is a loving and caring one. It is possible that social interactions and a loving environment are factors contributing to the son preference-specific girl-penalty in early skills; in particular because we do observe that that health outcomes do not mediate

16. This methodology is prone to introduce bias in the presence of intermediate confounders (Acharya et al. 2016). Intermediate confounders can introduce a spurious relationship between the interaction of son preference with the child's sex and child development, which leads to bias in the mediator and the son preference-specific girl-penalty net the mediator effect. However, we find zero effects of our mediators on child development (except for motor development) and the son preference-specific girl-penalty remains unaffected. Therefore, we conclude that our results do not suffer from such bias and the analysis is sufficient to show that the investigated variables do not mediate the effect from son preference to early skills.

TABLE 6. OLS estimation results of the son preference-specific girl-penalty in mental development controlling for children's wasting and anemia status and mothers' participation dietary decisions

	No mechanisms added					With mechanisms added				
	(1) Overall development	(2) Cognitive	(3) Language	(4) Motor	(5) Socio-emotional	(6) Overall development	(7) Cognitive	(8) Language	(9) Motor	(10) Socio-emotional
Girl x Son preference	−0.478***	−0.283*	−0.510***	−0.131	−0.507***	−0.471***	−0.287*	−0.524***	−0.065	−0.540***
	(0.143)	(0.151)	(0.138)	(0.179)	(0.182)	(0.142)	(0.157)	(0.134)	(0.178)	(0.189)
Girl	0.175*	0.119	0.312***	−0.147	0.233**	0.181*	0.122	0.315***	−0.152	0.253***
	(0.103)	(0.110)	(0.115)	(0.109)	(0.088)	(0.103)	(0.112)	(0.115)	(0.110)	(0.091)
Son preference	0.101	0.034	0.225**	−0.130	0.136	0.113	0.041	0.243**	−0.148	0.168
	(0.121)	(0.136)	(0.107)	(0.128)	(0.120)	(0.124)	(0.143)	(0.102)	(0.129)	(0.123)
Child is severely wasted						−0.200	−0.051	−0.163	−0.316**	−0.026
						(0.148)	(0.130)	(0.154)	(0.155)	(0.157)
Child is anemic						−0.028	0.014	0.106	−0.187**	−0.009
						(0.091)	(0.097)	(0.073)	(0.083)	(0.111)
Mother participates in diet decisions						−0.097	−0.038	−0.078	0.008	−0.182*
						(0.108)	(0.108)	(0.104)	(0.110)	(0.094)
Subdistrict fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Birth order & no. of sons	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fertility intention	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Socioeconomic status	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3-months age fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	530	530	530	530	530	530	530	530	530	530
Adjusted R^2	0.056	0.013	0.023	0.046	0.057	0.055	0.008	0.022	0.054	0.058
R^2	0.116	0.077	0.086	0.107	0.118	0.121	0.077	0.091	0.120	0.124

Notes: Table shows OLS estimation results of children's standardized early mental development on son preference and sex of children, controlling for children's wasting and anemia status and mothers' participation dietary decisions. Wasting is standardized to WHO reference tables. Anemia is defined according to WHO guidelines. Participation in dietary decisions is a binary indicator that is 1 if the mother is involved in decisions regarding the family diet and feeding of children. Control variables include subdistrict fixed effects, (birth order & no. of sons:) birth order dummies 2 to ≥4, dummies for 1 to ≥3 elder sons, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, household size, whether no. of adult members exceeds 2, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, highest grade completed of mother, whether mother can read, (3-months age fixed effects:) and 3 months age fixed effects. The sample is restricted to the main OLS estimation sample of 900 observations and non-missings in children's wasting and anemia status and mothers' participation dietary decisions. Standard errors clustered at panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

the effect although they are themselves affected by the son preference-specific girl penalty.

6. Instrumental variables estimation of the son preference-specific girl-penalty

To test the robustness of the main OLS estimation results, we follow an instrumental variables two-stage least squares estimation strategy. If the OLS strategy does not fully address selection into the interaction of son preference and sex, instrumental variables estimation can potentially resolve selection and provide causal estimates of the son preference-specific girl-penalty.

6.1. Estimation strategy

The instrumental variables strategy seeks to generate exogenous variation in son preference (SP_i) and the interaction of son preference with the child's sex ($SP_i * Girl_i$). To generate exogenous variation in the two endogenous variables, we use the sex of the firstborn child in the family and the interaction of the sex of the firstborn child with the sex of the child of interest as instruments in two first stages (Wooldridge 2015). Specifically, the two first stages are:

$$SP_i * Girl_i = \gamma_0 + \gamma_1 FB_i * Girl_i + \gamma_2 FB_i + \mathbf{X_i}'\gamma_3 + \varepsilon_i \tag{3}$$

$$SP_i = \delta_0 + \delta_1 FB_i * Girl_i + \delta_2 FB_i + \mathbf{X_i}'\delta_3 + \varepsilon_i \tag{4}$$

where FB_i is the sex of the firstborn sibling of child i, which equals 1 if it is a boy and 0 if it is a girl. The second stage estimation model remains as in equation (1) but using the two predictions of the interaction of son preference with the child's sex ($\widehat{SP_i * Girl_i}$) and son preference ($\widehat{SP_i}$).

The intuition of the firstborn sex instrument is as follows. In societies with son preferences, most parents would like to have at least one son. This means that the sex preference for later born children depends on how many sons are in the family already. In families with firstborn boys, the probability of having a son preference for later born children will be lower on average than in families with firstborn girls, because there is a son in the family already. This does not suggest that mothers of firstborn sons will not have a son preference at all for later born children – which depends on how many sons she wants and the sex composition of children born after the firstborn and before the child of interest –, it only means that mothers with firstborn sons are less likely to have a son preference. At the same time, the firstborn's sex is as good as random as sex selection is rarely used among firstborns (Retherford and Roy 2003; Bhalotra and Cochrane 2010; Jha et al. 2011; Rosenblum 2013; Poertner 2015; Kugler and Kumar 2017). To explore the exogeneity of the firstborn's sex, we regress a firstborn boy indicator on family and mother characteristics.

Appendix Table A.II.1 shows that only the coefficient on wealth quintile 3 is marginally significant and indicates that the middle wealth quintile is less likely to have a firstborn son than the poorest wealth quintile.

Previously, the firstborn sex instrument has been used as an instrument for family size (e.g., Jensen 2003; Lee 2008; Kugler and Kumar 2017). In contexts with son-biased fertility behavior, the firstborn's sex affects the decision to try again for a son and, hence, family size. Therefore, the effect of the firstborn's sex on family size mediates through son preference, our endogenous variable. This means family size is only affected by the firstborn's sex because of son preferences for the next born child.

The interaction of the firstborn's sex and the sex of the child of interest exploits the fact that the interaction of an exogenous variable (firstborn boy) and an endogenous variable (sex of the child of interest, which is arguably exogenous as well) is exogenous given that we control for the endogenous variable (sex of the child of interest) in the first and second stages (Wooldridge 2015; Nizalova and Murtazashvili 2016; Bun and Harrison 2019). Bun and Harrison (2019) show that we can consistently estimate the effect of son preference by children's sex given that the instrument for son preference, i.e., the firstborn's sex, is valid.[17]

For son preference to be a valid instrument, the exclusion restriction must be satisfied and, thus, there must be no correlation between the instrument and the second stage error term. We can think of a number of potential links between firstborn's sex and characteristics or behavior that can affect child development. Having a firstborn boy can affect, for example, work and savings behavior for dowry payments, family size and resource allocations, birth spacing and abortions, and, therefore, mothers' and children's health. However, for the exclusion restriction to be violated, (i) these links would have to be in place independent of the stated son preference and (ii) the instruments would have to affect laterborn boys and girls differently. The endogenous variable, unrealized son preference, varies by sex and hence the son preference-specific girl-penalty informs us about differences in child outcomes by sex. If the mental development of laterborn girls and boys is affected in the same way by the firstborn's sex, the son preference-specific girl-penalty would remain constant. For example, the biological consequences of short birth spacing would have to affect the health of laterborn boys and girls differently in order to bias the son preference-specific girl-penalty. In section 6.3, we test the validity of the exclusion restriction in an array of robustness checks and show that the results remain unaffected.

Compliers with the firstborn boy instrument are mothers who do not have a son preference for the child of interest because the firstborn is a boy but would have a son preference if the firstborn was a girl. This is different to a preference

17. Applications of IV estimations with endogenous interaction terms following this method include Nunn and Qian (2014); Dreher and Langlotz (2020); Dreher et al. (2020) and Norris (2020).

for a sex balance because, based on the variable coding, the alternative to having a son preference is not preferring a girl but being indifferent about the sex of the child. While this is obvious for mothers whose firstborn is a boy - mothers *don't care* about the sex of their next born child (opposed to having a girl preference) because the first born is a boy - it is difficult to disentangle a sex balance preference from a son preference for mothers whose firstborn is a girl. Jayachandran (2017) finds that in Haryana, a North-Indian state next to Delhi, the desired share of sons falls below 50 percent at family sizes four or higher and conclude a desire for eldest sons and a sex balance once this desire is satisfied. However, our data in section 4 did not suggest that balanced sex compositions were commonly desired. Ultimately, we are interested in whether the mother has a son preference or not. The reason for having a son preference may well be the number of girls exceeding the number of boys and, thus, the actual sex ratio does not equate the mothers preferred sex ratio.

One disadvantage of the instrumental variables strategy in comparison to the OLS estimation strategy is sample size. The instrumental variables estimation excludes children that do not have an older sibling, which reduces the estimation sample size by 266 observations.

6.2. Results from instrumental variables estimations

Tables 7 and 8 present results from the instrumental variables estimations. Table 7 shows results from the two first stages. In the first stage on the interaction of girl and son preference, the interaction coefficient of girl and firstborn boy is -0.330 and highly significant. The Sanderson-Windmeijer first stage F statistic for weak instruments is 95. In the other first stage on son preference, having a firstborn boy significantly reduces the probability of having a son preference by about 41 percentage points. The Sanderson-Windmeijer first stage F statistic is 60. The Kleibergen-Paap rk Wald F statistic for weak instruments of both first stages is 21 and confirms the instruments' relevance.

Table 8 presents the second stage results. Column (1) includes the standard set of covariates as used in the OLS estimation in column (4) of Table 3. We find a large and statistically significant son preference-specific girl-penalty of 0.853 standard deviations in overall development and, more specifically, of 0.852 and 0.780 standard deviations in cognitive and language skills, respectively. Also, motor and socioemotional development show sizeable effects of 0.344 and 0.395 standard deviations but are imprecisely measured. Overall, the precision of estimates is reduced compared to the OLS estimates in Table 3 as the sample excludes firstborns by nature of the instrument.

The instrumental variables estimates of the son preference-specific girl-penalty in Table 8 are large in comparison to the OLS estimates in Table 3. Column (2) of Table 8 presents OLS results in the smaller IV estimation sample for comparison. The OLS results are similar in size to those in Table 3 but the coefficients on socioemotional skills and overall development are not significant

Table 7. First stage IV estimation results of the son preference-specific girl-penalty in mental development

	Girl x Son Preference	Son Preference
Girl x firstborn boy	-0.330***	0.093
	(0.050)	(0.072)
Firstborn boy	0.002	-0.412***
	(0.010)	(0.054)
Subdistrict fixed effects	✓	✓
Birth order	✓	✓
Fertility intention	✓	✓
Socioeconomic status	✓	✓
SW first stage F-stat.	95	60
Kleibergen-Paap rk Wald F statistic	21	
Observations	634	634

Notes: Table shows results of two first stages of son preference interacted with the sex of the child of interest and son preference on the sex of the firstborn interacted with the sex of the child of interest, the sex of the firstborn, sex of the child of interest and control variables. Control variables include subdistrict fixed effects, (birth order:) birth order dummies 3 and $\geq$4, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, wealth quintile dummies, "below poverty line"-card, highest grade completed in HH, household size, whether no. of adult members exceeds 2, highest grade completed of mother, and whether mother can read. Standard errors clustered at the panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

anymore in the smaller sample (p-values are 0.117 and 0.110, respectively). Potential explanations for the difference between the OLS and IV estimates are measurement error in the OLS estimates, the estimation of local average treatment effects in the IV estimation, and alleviation of bias from selection into the interaction of son preference and sex in the IV estimation. It seems reasonable to assume that son preference is measured with some error and that the instrumental variables estimation resolves attenuation bias, although we cannot specifically test for this.

The instrumental variables strategy may identify local average treatment effects. Compliers are mothers who don't care about the sex of the child because the firstborn is a boy but would have a son preference if the firstborn had been a girl. Non-compliers might be mothers who satisfied their son preference at previous births, who do not have a son preference at the given birth order but would have for later births, or mothers who always or never want sons. If complier mothers are different to non-complier mothers in ways that increases the son preference-specific girl-penalty, then the local average treatment effect is larger than the average treatment effect from OLS.

If selection into the interaction of son preference and sex is such that wealthier families are more likely to abort girls (Jha et al. 2011; Poertner 2015), then the OLS estimates would rather be upward than downward biased. This is because we expect children from wealthier families to perform better and, therefore, boys of son preferring mothers would outperform girls of son preferring mothers already due to sample selection. Appendix Table A.I.3 shows that son-preferring mothers of girls are more educated and can read more often than son-preferring mothers of boys. This supports the hypothesis that the potential bias in the OLS estimates is directed downward.

Because we instrumented son preference and its interaction with children's sex, the results in Table 8 allow us to disentangle preferential treatment of boys and discrimination against girls. Preferential treatment of boys, measured by the coefficient on *Son preference*, accounts for 0.367, 0.332 and 0.240 standard deviations of the son preference-specific girl-penalty in overall development, cognitive skills and language, respectively. Discrimination against girls, which is the son preference-specific girl-penalty (in absolute terms) minus the coefficient on *Son preference*, accounts for 0.486, 0.520 and 0.540 standard deviations of the son preference-specific girl-penalty in overall development, cognitive skills and language, respectively. Although, the preferential treatment and discrimination coefficients are not statistically different from zero or each other, the results suggest that both pampering of boys and discrimination against girls contribute to the son preference-specific girl-penalty in early mental development.

6.3. Robustness checks of the instrumental variables estimations

The son preference-specific girl-penalty measures differences in children's mental development. Therefore, violations of the exclusion restriction are limited to the extent that they have to affect later born boys and girls differently. Yet, biological or social responses to certain factors, which are induced by the firstborn's sex, might differ across sexes. In columns (3) to (5) of Table 7, we conduct several robustness checks to investigate the sensitivity of our results to potential violations of the exclusion restriction.

In column (3), we add a number of potential confounding variables based on rationales laid out in the following. First, parents of a firstborn girl potentially reduce birth spacing to accelerate the birth of a boy (Jayachandran and Kuziemko 2011). Reduced birth spacing can lead to increased morbidity and mortality in children and among mothers (Bhalotra and Van Soest 2008; Milazzo 2014), which in turn affects child development. Early weaning is a specific link from short birth spacing to child health (Jayachandran and Kuziemko 2011). Therefore, we add birth spacing between the child of interest and the previous child to the model, and whether the child is currently breastfed.

Second, the birth of a firstborn girl could lead to abortions of subsequent female fetuses. This affects the health of the mother when abortions are unsafe and subsequently reduces caregiving capacities. Therefore, we control for self-reported health of the mother with respect to her health in general and whether she feels chronically tired. Tiredness is a symptom of anemia, which has been found to occur more frequently among mothers with firstborn girls (Milazzo 2014).

Table 8. Second stage IV estimation results of the son preference-specific girl-penalty in mental development

	(1)	(2)	(3)	(4)	(5)
			Robustness checks		
	IV	OLS	IV	IV	IV
Overall development					
Girl x Son preference	-0.853**	-0.228	-0.849**	-0.752*	-0.744*
	(0.416)	(0.140)	(0.405)	(0.417)	(0.405)
Girl	0.303*	0.034	0.282	0.055	-0.061
	(0.178)	(0.096)	(0.178)	(0.177)	(0.206)
Son preference	0.367	0.047	0.397	0.329	0.358
	(0.272)	(0.111)	(0.276)	(0.270)	(0.273)
R^2	0.055	0.077	0.067	0.066	0.078
Cognitive					
Girl x Son preference	-0.852*	-0.199	-0.865*	-0.800*	-0.813*
	(0.477)	(0.162)	(0.463)	(0.473)	(0.459)
Girl	0.304	0.034	0.305	-0.036	-0.187
	(0.210)	(0.116)	(0.205)	(0.221)	(0.245)
Son preference	0.332	0.046	0.318	0.311	0.296
	(0.256)	(0.133)	(0.251)	(0.254)	(0.250)
R^2	0.047	0.073	0.056	0.054	0.063
Language					
Girl x Son preference	-0.780*	-0.259**	-0.770*	-0.654	-0.643
	(0.427)	(0.125)	(0.426)	(0.426)	(0.425)
Girl	0.318*	0.104	0.302	0.115	0.012
	(0.191)	(0.085)	(0.190)	(0.208)	(0.242)
Son preference	0.240	0.119	0.291	0.194	0.244
	(0.278)	(0.111)	(0.283)	(0.276)	(0.280)
R^2	0.050	0.068	0.063	0.065	0.078
Motor					
Girl x Son preference	-0.344	0.034	-0.337	-0.257	-0.247
	(0.472)	(0.157)	(0.466)	(0.484)	(0.473)
Girl	-0.013	-0.191*	-0.030	-0.228	-0.146
	(0.201)	(0.104)	(0.202)	(0.201)	(0.242)
Son preference	0.235	-0.128	0.255	0.203	0.221
	(0.348)	(0.118)	(0.339)	(0.345)	(0.335)
R^2	0.055	0.071	0.066	0.061	0.072
Socioemotional					
Girl x Son preference	-0.395	-0.239	-0.379	-0.360	-0.342
	(0.370)	(0.150)	(0.386)	(0.388)	(0.404)
Girl	0.210	0.135	0.182	0.260	0.098
	(0.191)	(0.092)	(0.201)	(0.199)	(0.231)
Son preference	0.211	0.059	0.233	0.198	0.221
	(0.261)	(0.101)	(0.271)	(0.267)	(0.278)
R^2	0.062	0.065	0.076	0.063	0.078
Observations	634	634	634	634	634
Kleibergen-Paap rk Wald F statistic	21		21	20	21
Standard set of covariates	✓	✓	✓	✓	✓
Previous birthspacing			✓		✓
Currently breastfed			✓		✓
Mother's health			✓		✓
Age difference			✓		✓
Saving assets			✓		✓
Mother worked			✓		✓
Girl × birth order				✓	✓

Notes: Table shows second stage IV estimation results of children's standardized early mental development on son preference interacted with the sex of the child of interest, son preference, sex of the child of interest and control variables. The standard set of control variables includes birth order dummies 3 and ≥4, dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, caste category dummies, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, household size, whether no. of adult members exceeds 2, highest grade completed of mother, whether mother can read, and subdistrict fixed effects. Previous birth spacing refers to the time between the birth of child of interest and the previous birth. Currently breastfed refers to whether the mother is currently breastfeeding child of interest. Mother's health includes dummies for whether mother rates her health as good and feels chronically tired. Age difference is the age difference in months between firstborn and child of interest. Saving assets include whether the household owns a watch, livestock and size of land. Mother worked refers to whether mother worked for pay in past 12 months. The five panels refer to different outcomes, i.e., overall development, cognitive, language, motor and socioemotional skills. Sample is restricted to the OLS estimation sample and families of birth order two or higher. Standard errors clustered at the panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Third, daughters might be more often tasked to look after younger siblings than sons, which can affect mental development of the younger ones (Qureshi 2018). Indeed, in the study district we frequently sighted older sisters taking care of younger siblings. However, at the young age of the children in our sample (90% are 18 months or younger), children are typically not left to older siblings but are closely taken care of by their mothers or mothers-in-law. Additionally, the age gap between our child of interest and its firstborn must be sufficiently large. Both arguments make this channel unlikely to exist. Since we do not have data on caregiving abilities or frequencies, we cannot support our argument empirically in an exhaustive way. Instead, we control for the age gap between our child of interest and the firstborn.

Fourth, parents of a firstborn girl might work or save more in order to accumulate sufficient resources for dowry payments (Sekhri and Storeygard 2014; Alfano 2017; Bhalotra et al. 2020). This may reduce caregiving time and investments that are relevant for children's mental development. We are unable to observe savings directly and control for owning a watch, owning livestock and size of land owned as typical savings assets in column (3). In addition, we add an indicator for whether the mother worked in the past 12 months.

The results in column (3) show that adding these potential confounders has little effect on the son preference-specific girl-penalty. The coefficient sizes and significance remain stable across mental development outcomes.

In column (4), we address that parents of a firstborn girl potentially engage in son-biased fertility behavior. Those families have fewer resources per child available, which can negatively affect skill development. In column (1), we already control for family size, having a newborn, and pregnancy in 2016 and, thus, control for son-biased fertility in response to the firstborn's sex which occurs before or after the birth of the child of interest. In column (4), we further interact birth order and the sex of the child of interest as the instrument varies by child of interest. The coefficients reduce in size by about 0.1 standard deviations and the effect on language skills ceases to be significant (p-value=0.125). If we further add the controls from column (3), the coefficients do not change much.

In addition to the robustness checks presented in Table 8, we conducted falsification tests and estimated the reduced form impact of potential confounders on the instruments and control variables. Although, falsification tests cannot confirm the validity of the instrument, they can provide evidence to reject the instruments' excludability. The falsification test results show no significant correlations between the instruments and potential confounders in Appendix Table A.II.3.

Overall, these analyses show that the IV estimates are robust to a number of potential threats to excludability. The son preference-specific girl-penalty remains large in size and significant, with the exception of language skills, for which the effect becomes significant as its size reduces to 0.64 standard deviations. However, the size of the effect on language is still large and remains considerably larger than the OLS estimates.

7. Conclusion

We propose an innovative measure of son preference, which relates the preference to a specific birth and thus child. We ask pregnant women about the preferred sex of the child they are pregnant with in one district of the Indian state of Bihar. This child-specific measure allows to study how sex preferences are shaped by previous birth outcomes and to consider birth order and sex composition effects when studying the consequences of sex preferences on child outcomes. In addition, the child-specific measure uncovers sex preferences that would remain undetected in sex composition preference measures (desired number of boys to all children), such as the preference for an eldest son but no preference for the remaining children. Further, the child-specific measure allows to identify and measure discrimination against children that do not satisfy their mother's sex preference.

We find that child-specific son preference is more common among later born children and in families with fewer sons. At birth order three, the probability of having a son preference is 60 percentage points higher than at birth order one. At a given birth order, mothers with one son are 40 percentage points less likely to have a son preference than mothers without sons.

In a second step, we estimate the penalty in early mental development for girls born to son-preferring mothers. We use a model that interacts mother's son preference with the child's sex. The interaction term indicates the unrealized son preference and we label its coefficient the son preference-specific girl-penalty. We use OLS and instrumental variables estimation. We instrument the interaction of son preference with the child's sex and the son preference indicator in two first stages. The instruments we use are (i) the interaction of the firstborn's sex with the sex of the child of interest and (ii) the firstborn's sex. Given that the second stage interaction term varies by sex of the child of interest, any correlation between the instrument and the second stage error term would have to differ by sex of the later born child of interest in order to violate the exclusion restriction. We test this assumption in an array of robustness checks and our results remain stable.

We find a son preference-specific girl-penalty in overall development of 0.74 standard deviations and of 0.81 and 0.64 standard deviations in cognitive and language skills specifically (instrumental variables estimations). There is no evidence that motor development is affected by son preferences and the results for socioemotional development are mixed. Our results are suggestive that both discrimination against girls and preferential treatment of boys contribute to the son preference-specific girl-penalty in early skills.

Responsive caregiving, reduced stress, positive experiences and learning opportunities are key for children to grow mentally and socially. We investigate children's health, parents' inputs, mothers' mental health and empowerment as potential mediators from son preference to early skills. While we do find some evidence that son preference affects girls' wasting and anemia status and mothers' participation in dietary decisions, we find no evidence that these factors indeed function as mediators.

The presented evidence on children's early mental development is relevant for three reasons. Firstly, it illustrates the potential loss in human capital due to son preferences. Secondly, it demonstrates that it is empirically important to distinguish between son preferring and non-son preferring mothers. And thirdly, the results suggest that the home environment is likely affected by son-preferring discrimination.

While the probability to have a son preference increases with birth order and number of daughters for economic, religious, and cultural reasons, the effect on mental development may, at least partially, be due to direct discrimination in nurturing factors that exist at given birth order and siblings' sex compositions. Our results encourage to study how a nurturing home environment can be established. In the short term, one way could be to compensate prevailing discrimination against girls through targeted early childhood development programs at the household or institutional level, such as Anganwadi centers or Accredited Social Healths Activits.

In the long term, researchers and policy makers must focus on the depletion of son preferences in the first place to overcome discrimination. Traditional gender norms are known to be sticky and interlinked with religious and cultural aspects (Jayachandran 2015). Das Gupta and Chung argue that changes in the modern political system, urbanization and industrialization unravel son preferences via their impact on social norms and therefore the perceived value of females (Chung and Gupta 2007; Das Gupta 2010). Other analyses on the drivers of son preferences and gender norms have focused on females' economic empowerment, female representation, and financial incentives to have girls. While financial incentives have shown to pervert the sex ratio to one boy families (e.g., Anukriti 2018), economic empowerment and representation of women in politics and the media have shown to effectively reduce gender bias (Beaman et al. 2012; Carranza 2014; Field et al. 2019; Jensen and Oster 2009; Qian 2008; Ting et al. 2014). It should further be explored in what ways these interventions, targeted at adults, change son preferences and how they affect nurturing care.

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References

Acharya, Avidit, Matthew Blackwell, and Maya Sen (2016). "Explaining causal findings without bias: Detecting and assessing direct effects." *American Political Science Review*, 110(3), 512–529.

Alfano, Marco (2017). "Daughters, dowries, deliveries: The effect of marital payments on fertility choices in India." *Journal of Development Economics*, 125, 89–104.

Anderson, Siwan and Debraj Ray (2010). "Missing women: Age and disease." *The Review of Economic Studies*, 77(4), 1262–1300.

Anderson, Siwan and Debraj Ray (2012). "The age distribution of missing women in India." *Economic and Political Weekly*, pp. 87–95.

Anukriti, S (2018). "Financial incentives and the fertility-sex ratio trade-off." *American Economic Journal: Applied Economics*, 10(2), 27–57.

Anukriti, S, Sonia Bhalotra, and Hiu Tam (2015). "Missing girls: Ultrasound access and excess female mortality." *ISI Working Paper. New Delhi: ISI.*

Arnold, Fred (1997). *Gender preferences for children.* Macro International Incorporated.

Arnold, Fred, Minja Kim Choe, and Tarun K Roy (1998). "Son preference, the family-building process and child mortality in India." *Population studies*, 52(3), 301–315.

Asfaw, Abay, Francesca Lamanna, and Stephan Klasen (2010). "Gender gap in parents' financing strategy for hospitalization of their children: Evidence from India." *Health Economics*, 19(3), 265–279.

Attanasio, Orazio P (2015). "The determinants of human capital formation during the early years of life: Theory, measurement, and policies." *Journal of the European Economic Association*, 13(6), 949–997.

Barcellos, Silvia Helena, Leandro S Carvalho, and Adriana Lleras-Muney (2014). "Child gender and parental investments in India: Are boys and girls treated differently?" *American Economic Journal: Applied Economics*, 6(1), 157–189.

Beaman, Lori, Esther Duflo, Rohini Pande, and Petia Topalova (2012). "Female leadership raises aspirations and educational attainment for girls: A policy experiment in India." *Science*, p. 1212382.

Bhalotra, Sonia, Abhishek Chakravarty, and Selim Gulesci (2020). "The price of gold: Dowry and death in India." *Journal of Development Economics*, 143, 102413.

Bhalotra, Sonia and Tom Cochrane (2010). "Where have all the young girls gone? Identification of sex selection in India." Tech. rep., Institute for the Study of Labor (IZA).

Bhalotra, Sonia and Arthur Van Soest (2008). "Birth-spacing, fertility and neonatal mortality in India: Dynamics, frailty, and fecundity." *Journal of Econometrics*, 143(2), 274–290.

Bhat, P. N. Mari and A. J. Francis Zavier (2003). "Fertility decline and gender bias in Northern India." *Demography*, 40(4), 637–657.

Black, Maureen M, Susan P Walker, Lia CH Fernald, Christopher T Andersen, Ann M DiGirolamo, Chunling Lu, Dana C McCoy, Günther Fink, Yusra R Shawar, Jeremy Shiffman, et al. (2017). "Early childhood development coming of age: Science through the life course." *The Lancet*, 389(10064), 77–90.

Bongaarts, John (2013). "The implementation of preferences for male offspring." *Population and Development Review*, 39(2), 185–208.

Bongaarts, John and Christophe Z Guilmoto (2015). “How many more missing women? Excess female mortality and prenatal sex selection, 1970–2050.” *Population and Development Review*, 41(2), 241–269.

Bornstein, Marc H, O Maurice Haynes, Kathleen M Painter, and Janice L Genevro (2000). “Child language with mother and with stranger at home and in the laboratory: A methodological study.” *Journal of Child Language*, 27(2), 407–420.

Britto, Pia R, Stephen J Lye, Kerrie Proulx, Aisha K Yousafzai, Stephen G Matthews, Tyler Vaivada, Rafael Perez-Escamilla, Nirmala Rao, Patrick Ip, Lia CH Fernald, et al. (2017). “Nurturing care: promoting early childhood development.” *The Lancet*, 389(10064), 91–102.

Bun, Maurice JG and Teresa D Harrison (2019). “OLS and IV estimation of regression models including endogenous interaction terms.” *Econometric Reviews*, 38(7), 814–827.

Burman, Douglas D, Tali Bitan, and James R Booth (2008). “Sex differences in neural processing of language among children.” *Neuropsychologia*, 46(5), 1349–1362.

Carranza, Eliana (2014). “Soil endowments, female labor force participation, and the demographic deficit of women in India.” *American Economic Journal: Applied Economics*, 6(4), 197–225.

Chakravarty, Abhishek (2015). “Gender-Biased Breastfeeding in Egypt: Examining the Fertility Preference Hypotheses of Jayachandran and Kuziemko (2011).” *Journal of Applied Econometrics*, 30(5), 848–855.

Chung, Woojin and Monica Das Gupta (2007). “The decline of son preference in South Korea: The roles of development and public policy.” *Population and Development Review*, 33(4), 757–783.

Clark, Shelley (2000). “Son preference and sex composition of children: Evidence from India.” *Demography*, 37(1), 95–108.

Cohen, Jacob (1988). *Statistical power analysis for the behavioral sciences*. Erlbaum Associates, Hillsdale.

Das, Narayan (1987). “Sex preference and fertility behavior: A study of recent Indian data.” *Demography*, pp. 517–530.

Das Gupta, Monica (1987). “Selective discrimination against female children in rural Punjab, India.” *Population and Development Review*, pp. 77–100.

Das Gupta, Monica (2010). “Family systems, political systems and Asia’s ’Missing Girls’ - The construction of son preference and its unravelling.” *Asian Population Studies*, 6(2), 123–152.

Das Gupta, Monica and PN Mari Bhat (1997). “Fertility decline and increased manifestation of sex bias in India.” *Population studies*, 51(3), 307–315.

Das Gupta, Monica, Jiang Zhenghua, Li Bohua, Xie Zhenming, Woojin Chung, and Bae Hwa-Ok (2003). “Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea.” *The Journal of Development Studies*, 40(2), 153–187.

DiPrete, Thomas A and Jennifer L Jennings (2012). “Social and behavioral skills and the gender gap in early educational achievement.” *Social Science Research*, 41(1), 1–15.

Dreher, Axel, Martin Gassebner, and Paul Schaudt (2020). “The effect of migration on terror: Made at home or imported from abroad?” *Canadian Journal of Economics/Revue canadienne d’économique*, 53(4), 1703–1744.

Dreher, Axel and Sarah Langlotz (2020). “Aid and growth: New evidence using an excludable instrument.” *Canadian Journal of Economics/Revue canadienne d’économique*, 53(3), 1162–1198.

Field, Erica M, Rohini Pande, Natalia Rigol, Simone G Schaner, and Charity Troyer Moore (2019). “On her own account: How strengthening women’s financial control affects labor supply and gender norms.” Tech. rep., National Bureau of Economic Research.

Filmer, Deon, Jed Friedman, and Norbert Schady (2009). "Development, modernization, and childbearing: The role of family sex composition." *The World Bank Economic Review*, 23(3), 371–398.

Galsworthy, Michael J, Ginette Dionne, Philip S Dale, and Robert Plomin (2000). "Sex differences in early verbal and non-verbal cognitive development." *Developmental Science*, 3(2), 206–215.

Goodway, Jacqueline D, Leah E Robinson, and Heather Crowe (2010). "Gender differences in fundamental motor skill development in disadvantaged preschoolers from two geographical regions." *Research quarterly for exercise and sport*, 81(1), 17–24.

Hafeez, Naima and Climent Quintana-Domeque (2018). "Son preference and gender-biased breastfeeding in Pakistan." *Economic Development and Cultural Change*, 66(2), 179–215.

Hays, Ron D, Toshi Hayashi, and Anita L Stewart (1989). "A five-item measure of socially desirable response set." *Educational and psychological measurement*, 49(3), 629–636.

Heckman, James J (2000). "Policies to foster human capital." *Research in economics*, 54(1), 3–56.

Hoddinott, John and Lawrence Haddad (1995). "Does female income share influence household expenditures? Evidence from Côte d'Ivoire." *Oxford Bulletin of Economics and Statistics*, 57(1), 77–96.

Imbens, Guido W and Donald B Rubin (2015). *Causal inference in statistics, social, and biomedical sciences*. Cambridge University Press.

International Institute for Population Sciences (2017a). "National Family Health Survey 2015-16 District Fact Sheet Madhepura Bihar." Tech. rep., Government of India, Ministry of Health and Family Welfare.

International Institute for Population Sciences (2017b). "National Family Health Survey 2015-16 India Fact Sheet." Tech. rep., Government of India, Ministry of Health and Family Welfare.

International Institute for Population Sciences (2017c). "National Family Health Survey 2015-16 State Fact Sheet Bihar." Tech. rep., Government of India, Ministry of Health and Family Welfare.

International Institute for Population Sciences and ICF Incorporated (2017a). "National Family Health Survey NFHS-4, 2015-16: India." Tech. Rep. FR339, Mumbai: International Institute for Population Sciences.

International Institute for Population Sciences and ICF Incorporated (2017b). "National Family Health Survey (NFHS-4), India, 2015-16: Bihar." Tech. rep., Mumbai: International Institute for Population Sciences.

Javed, Rashid and Mazhar Mughal (2020). "Preference for boys and length of birth intervals in Pakistan." *Research in Economics*, 74(2), 140–152.

Jayachandran, Seema (2015). "The Roots of Gender Inequality in Developing Countries." *Annual Review of Economics*, 7(1), 63–88.

Jayachandran, Seema (2017). "Fertility decline and missing women." *American Economic Journal: Applied Economics*, 9(1), 118–39.

Jayachandran, Seema and Ilyana Kuziemko (2011). "Why do mothers breastfeed girls less than boys? Evidence and implications for child health in India." *The Quarterly Journal of Economics*, 126(3), 1485–1538.

Jayachandran, Seema and Rohini Pande (2017). "Why are Indian children so short? The role of birth order and son preference." *American Economic Review*, 107(9), 2600–2629.

Jensen, Robert and Emily Oster (2009). "The power of TV: Cable television and women's status in India." *The Quarterly Journal of Economics*, 124(3), 1057–1094.

Jensen, Robert Todd (2003). *Equal treatment, unequal outcomes?: Generating sex inequality through fertility behaviour*. Bazaar Chintan.

Jha, Prabhat, Maya A Kesler, Rajesh Kumar, Faujdar Ram, Usha Ram, Lukasz Aleksandrowicz, Diego G Bassani, Shailaja Chandra, and Jayant K Banthia (2011). "Trends in selective abortions of girls in India: Analysis of nationally representative birth histories from 1990 to 2005 and census data from 1991 to 2011." *The Lancet*, 377(9781), 1921–1928.

Jha, Prabhat, Rajesh Kumar, Priya Vasa, Neeraj Dhingra, Deva Thiruchelvam, and Rahim Moineddin (2006). "Low male-to-female sex ratio of children born in India: National survey of 1· 1 million households." *The Lancet*, 367(9506), 211–218.

Kiese-Himmel, Christiane (2013). "Elternfragebogen zur Wortschatzentwicklung im frühen Kindesalter: Eltern Antworten – Revision (ELAN-R)." In *Dorsch Lexikon der Psychologie*, edited by Markus A. Wirtz, p. 364. Verlag Hans Huber.

Kiese-Himmel, Christiane (2014). "Sprachentwicklungstest für zweijährige Kinder (SETK-2)." In *Dorsch Lexikon der Psychologie*, edited by Markus A. Wirtz, p. 364. Verlag Hans Huber.

Kishore, Avinash and Dean Spears (2014). "Having a son promotes clean cooking fuel use in urban India: Women's status and son preference." *Economic Development and Cultural Change*, 62(4), 673–699.

Klasen, Stephan (1994). ""Missing women" reconsidered." *World Development*, 22(7), 1061–1071.

Klasen, Stephan (2003). *Sex selection*, vol. 2, pp. 878–881. MacMillan Reference New York.

Klasen, Stephan and Claudia Wink (2002). "A turning point in gender bias in mortality? An update on the number of missing women." *Population and Development Review*, 28(2), 285–312.

Klasen, Stephan and Claudia Wink (2003). ""Missing women": Revisiting the debate." *Feminist Economics*, 9(2-3), 263–299.

Kugler, Adriana D and Santosh Kumar (2017). "Preference for boys, family size, and educational attainment in India." *Demography*, 54(3), 835–859.

Kumar, Vijay, Sanjay Kumar, Devdarshan Nitin Gandhi, and Mani Kant Kumar (2021). "Prevalence of exclusive breastfeeding and factors associated with faulty feeding in southwest Bihar." *International Journal of Contemporary Pediatrics*, 8(2), 229–233.

Lee, Jungmin (2008). "Sibling size and investment in children's education: An Asian instrument." *Journal of Population Economics*, 21(4), 855–875.

Li, Lixing and Xiaoyu Wu (2011). "Gender of children, bargaining power, and intrahousehold resource allocation in China." *Journal of Human Resources*, 46(2), 295–316.

Lozoff, Betsy, Nancy K Klein, Edward C Nelson, Donna K McClish, Martin Manuel, and Maria Elena Chacon (1998). "Behavior of infants with iron-deficiency anemia." *Child Development*, 69(1), 24–36.

Macha, Thorsten and Franz Petermann (2017). "FREDI 0 – 3." *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, 49(1), 50–56.

Mähler, Claudia, Friederike Cartschau, and Katharina Rohleder (2016). *Frühkindliche Entwicklungsdiagnostik für Kinder von 0 - 3 Jahren (FREDI 0-3)*. Hogrefe, Göttingen.

Maitra, Pushkar (2004). "Parental bargaining, health inputs and child mortality in India." *Journal of Health Economics*, 23(2), 259–291.

Michalec, David (2011). *Bayley scales of infant development: Third edition*, pp. 215–215. Springer US, Boston, MA.

Milazzo, Annamaria (2014). *Why are adult women missing? Son preference and maternal survival in India.* The World Bank.

Muhuri, Pradip K and Samuel H Preston (1991). "Effects of family composition on mortality differentials by sex among children in Matlab, Bangladesh." *The Population and Development Review*, pp. 415–434.

National Research Council and Institute of Medicine (2000). "From neurons to neighborhoods: The science of early childhood development."

Nizalova, Olena Y and Irina Murtazashvili (2016). "Exogenous treatment and endogenous factors: Vanishing of omitted variable bias on the interaction term." *Journal of Econometric Methods*, 5(1), 71–77.

Norling, Johannes (2018). "Measuring heterogeneity in preferences over the sex of children." *Journal of Development Economics*, 135, 199–221.

Norris, Jonathan (2020). "Peers, parents, and attitudes about school." *Journal of Human Capital*, 14(2), 290–342.

Nunn, Nathan and Nancy Qian (2014). "US food aid and civil conflict." *American Economic Review*, 104(6), 1630–66.

Obermeyer, Carla Makhlouf and Rosario Cardenas (1997). "Son preference and differential treatment in Morocco and Tunisia." *Studies in family planning*, pp. 235–244.

Oster, Emily (2009). "Proximate sources of population sex imbalance in India." *Demography*, 46(2), 325–339.

Oster, Emily (2019). "Unobservable selection and coefficient stability: Theory and evidence." *Journal of Business & Economic Statistics*, 37(2), 187–204.

Owens, Jayanti (2016). "Early childhood behavior problems and the gender gap in educational attainment in the United States." *Sociology of Education*, 89(3), 236–258.

Palloni, Giordano (2017). "Childhood health and the wantedness of male and female children." *Journal of Development Economics*, 126, 19–32.

Pande, Rohini and Nan Marie Astone (2007). "Explaining son preference in rural India: The independent role of structural versus individual factors." *Population Research and Policy Review*, 26(1), 1–29.

Parazzini, Fabio, Carlo La Vecchia, Fabio Levi, and Silvia Franceschi (1998). "Trends in male:female ratio among newborn infants in 29 countries from five continents." *Human Reproduction (Oxford, England)*, 13(5), 1394–1396.

Poertner, Claus C (2015). "Sex-selective abortions, fertility, and birth spacing." *Policy Research Working Paper*, (WPS7189).

Prado, Elizabeth L and Kathryn G Dewey (2014). "Nutrition and brain development in early life." *Nutrition Reviews*, 72(4), 267–284.

Qian, Nancy (2008). "Missing women and the price of tea in China: The effect of sex-specific earnings on sex imbalance." *The Quarterly Journal of Economics*, 123(3), 1251–1285.

Qureshi, Javaeria A (2018). "Additional returns to investing in girls' education: Impact on younger sibling human capital." *The Economic Journal*, 128(616), 3285–3319.

Retherford, Robert D and TK Roy (2003). "Factors affecting sex-selective abortion in India and 17 major states." Tech. rep., Mumbai, India: International Institute for Population Sciences and Honolulu: East-West Center.

Robitaille, Marie-Claire (2013). "Determinants of stated son preference in India: Are men and women different?" *The Journal of Development Studies*, 49(5), 657–669.

Rosenblum, Daniel (2013). "The effect of fertility decisions on excess female mortality in India." *Journal of Population Economics*, 26(1), 147–180.

Rosenzweig, Mark R. and Kenneth I. Wolpin (1993). "Maternal expectations and ex post rationalizations: The usefulness of survey information on the wantedness of children." *The Journal of Human Resources*, 28(2), 205–229.

Roulstone, Sue, Sue Loader, Kate Northstone, and Mike Beveridge (2002). "The speech and language of children aged 25 months: Descriptive data from the Avon Longitudinal Study of Parents and Children." *Early Child Development and Care*, 172(3), 259–268.

Schief, Matthias, Sonja Vogt, and Charles Efferson (2019). "The structure of son bias in Armenia: From implicit associations to explicit behavior." *Available at SSRN 3469644*.

Sekhri, Sheetal and Adam Storeygard (2014). “Dowry deaths: Response to weather variability in India.” *Journal of Development Economics*, 111, 212–223.

Sen, Amartya (1989). “Women's survival as a development problem.” *Bulletin of the American Academy of Arts and Sciences*, 43(2), 14–29.

Sen, Amartya (1990). “More than 100 million women are missing.” *The New York Review of Books*, 37(20), 61–66.

Sen, Amartya (2003). “Missing women—revisited.” *BMJ*, 327(7427), 1297–1298.

Short, Susan E and Gebre-Egziabher Kiros (2002). “Husbands, wives, sons, and daughters: Fertility preferences and the demand for contraception in Ethiopia.” *Population Research and Policy Review*, 21(5), 377–402.

Spessato, Barbara Coiro, Carl Gabbard, Nadia Valentini, and Mary Rudisill (2013). “Gender differences in Brazilian children's fundamental movement skill performance.” *Early Child Development and Care*, 183(7), 916–923.

Subramanyam, Malavika, Cara Ebert, Christian Bommer, Lisa Bogler, Abhijeet Kumar, and Sebastian Vollmer (2017). “Impact of the Gram Varta programme on health, nutrition and women's empowerment in India.” *3ie Final Grantee Report*.

Suresh, Sithara, Kamlesh Sharma, Manju Saksena, Anu Thukral, Ramesh Agarwal, and Manju Vatsa (2014). “Predictors of breastfeeding problems in the first postnatal week and its effect on exclusive breastfeeding rate at six months: experience in a tertiary care centre in Northern India.” *Indian journal of public health*, 58(4), 270–273.

Thomas, Duncan (1990). “Intra-household resource allocation: An inferential approach.” *Journal of human resources*, pp. 635–664.

Thomas, Jerry R and Karen E French (1985). “Gender differences across age in motor performance: A meta-analysis.” *Psychological bulletin*, 98(2), 260.

Thompson, Ross A and Charles A Nelson (2001). “Developmental science and the media: Early brain development.” *American Psychologist*, 56(1), 5.

Tierney, Adrienne L and Charles A Nelson (2009). “Brain development and the role of experience in the early years.” *Zero to three*, 30(2), 9.

Ting, Hsin-Lan, Chon-Kit Ao, and Ming-Jen Lin (2014). “Television on women's empowerment in India.” *The Journal of Development Studies*, 50(11), 1523–1537.

Tiwari, Ranjana, P. C. Mahajan, and Chandrakant Lahariya (2008). “The determinants of exclusive breast feeding inurban slums: A community based study.” *Journal of Tropical Pediatrics*, 55(1), 49–54.

Tottenham, Nim (2017). “The brain's emotional development.” In *Cerebrum: The Dana forum on brain science*, vol. 2017, Dana Foundation.

Waldron, Ingrid (1983). “Sex differences in human mortality: The role of genetic factors.” *Social science & medicine*, 17(6), 321–333.

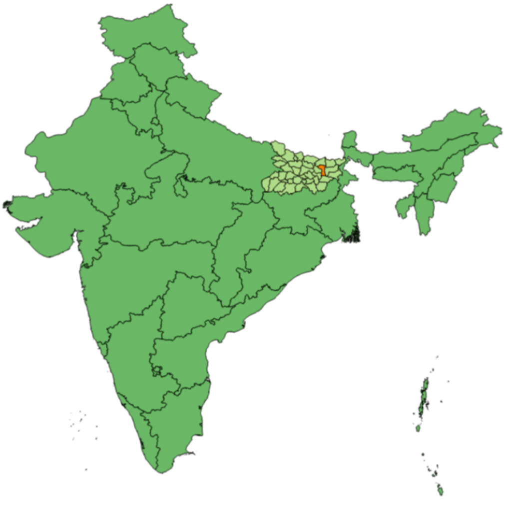
Waldron, Ingrid (1987). “Patterns and causes of excess female mortality among children in developing countries.” *World health statistics quarterly. Rapport trimestriel de statistiques sanitaires mondiales*, 40(3), 194–210.

Walker, Susan P, Theodore D Wachs, Sally Grantham-McGregor, Maureen M Black, Charles A Nelson, Sandra L Huffman, Helen Baker-Henningham, Susan M Chang, Jena D Hamadani, Betsy Lozoff, Julie M Meeks Gardner, C A Powell, Atif Rahman, and Linda Richter (2011). “Inequality in early childhood: Risk and protective factors for early child development.” *The Lancet*, 378(9799), 1325–1338.

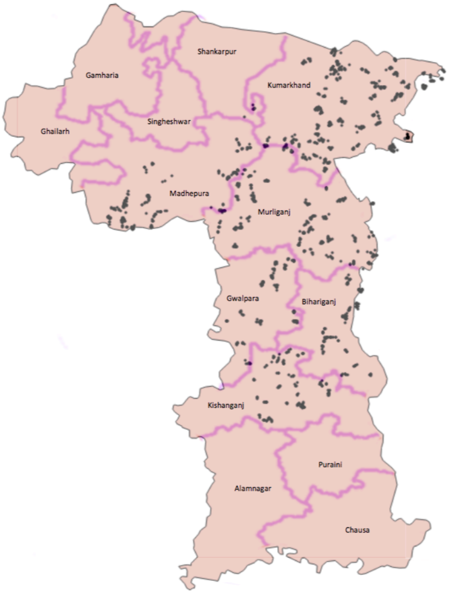
Walker, Susan P, Theodore D Wachs, Julie Meeks Gardner, Betsy Lozoff, Gail A Wasserman, Ernesto Pollitt, and Julie A Carter (2007). “Child development: Risk factors for adverse outcomes in developing countries.” *The Lancet*, 369(9556), 145–157.

Wooldridge, Jeffrey M (2015). “Control function methods in applied econometrics.” *Journal of Human Resources*, 50(2), 420–445.

Appendix I - Description of the sample



(A) Location of Madhpura district in India



(B) Distribution of households across six blocks

FIGURE A.I.1. Study location and distribution of households.

TABLE A.I.1. Representativeness of estimation sample in comparison to the attried sample

	Dropped sample			Estimation sample					
	Mean	SD	N	Mean	SD	N	Difference	p-value	Standardized difference
HH characteristics									
Religion is Hindu	0.82	0.38	1060	0.83	0.37	900	−0.01	0.533	−0.03
Scheduled caste	0.30	0.46	1055	0.33	0.47	900	−0.03	0.204	−0.06
Scheduled tribe	0.03	0.16	1055	0.04	0.20	900	−0.02*	0.057	−0.09
OBC	0.59	0.49	1055	0.55	0.50	900	0.04	0.108	0.07
General category	0.08	0.27	1055	0.07	0.26	900	0.01	0.579	0.03
Wealth quintile									
1 (poorest)	0.21	0.41	1060	0.19	0.39	900	0.02	0.290	0.05
2	0.19	0.39	1060	0.24	0.42	900	−0.04**	0.015	−0.11
3	0.20	0.40	1060	0.18	0.38	900	0.02	0.274	0.05
4	0.20	0.40	1060	0.22	0.41	900	−0.02	0.389	−0.04
5 (richest)	0.20	0.40	1060	0.18	0.38	900	0.02	0.211	0.06
BPL card[a]	0.68	0.47	1060	0.71	0.45	900	−0.03	0.144	−0.07
Improved toilet	0.14	0.34	1060	0.10	0.30	900	0.03**	0.024	0.10
Finished walls	0.30	0.46	1060	0.26	0.44	899	0.03*	0.085	0.08
Level of education in HH	3.18	1.93	1060	2.95	1.72	900	0.23***	0.006	0.13
HH size	5.78	2.48	1060	5.83	2.50	900	−0.05	0.677	−0.02
Mother characteristics									
Education level	1.98	1.55	1058	1.72	1.31	899	0.26***	0.000	0.18
Can read	0.34	0.48	1067	0.27	0.44	900	0.07***	0.000	0.16
Age	23.62	4.77	1058	24.07	4.72	899	−0.46**	0.034	−0.08
Son preference	0.35	0.48	903	0.38	0.49	900	−0.03	0.141	−0.07
Subdistricts									
Block: Bihariganj	0.10	0.30	1060	0.09	0.29	900	0.01	0.463	0.03
Block: Gwalpara	0.09	0.28	1060	0.11	0.32	900	−0.03**	0.042	−0.09
Block: Kumarkhand	0.36	0.48	1060	0.39	0.49	900	−0.03	0.242	−0.05
Block: Madhepura	0.16	0.36	1060	0.14	0.35	900	0.01	0.406	0.04
Block: Murliganj	0.22	0.41	1060	0.16	0.37	900	0.05***	0.004	0.13
Block: Uda Kishunganj	0.08	0.27	1060	0.10	0.30	900	−0.02*	0.092	−0.08

Notes: Table shows summary statistics of the 2016 estimation sample (N=900) and the dropped sample based on data collected in 2015. “Difference” refers to the difference in means in the dropped and estimation sample. “p-value” refers to the p-value of a test of whether the difference in means is different from zero. The “standardized difference” refers to the standardized difference in means in the dropped and estimation sample, i.e. the difference in means divided by the standard deviation. [a]BPL card refers to “below poverty line”-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.I.2. Comparison of the 2015 sample and the estimation sample to NFHS-4 rural Bihar and rural Madhepura indicators.

	Total sample of 2015			2016 estimation sample			NFHS4 rural Bihar	NFHS4 rural Madhepura
	Mean	SD	N	Mean	SD	N	Mean	Mean
Household profile								
Electricity	0.43	0.50	1960	0.44	0.50	900	0.54	0.51
Improved drinking water source	0.99	0.11	1960	0.99	0.11	900	0.98	1.00
Improved sanitation	0.12	0.33	1960	0.10	0.30	900	0.20	0.13
Clean cooking fuel	0.03	0.16	1959	0.02	0.13	900	0.11	0.05
Iodized salt	0.83	0.38	1808	0.81	0.39	834	0.93	0.96
Health insurance, any member	0.24	0.43	1937	0.24	0.42	890	0.13	0.09
Adult characteristics								
Literate women	0.31	0.46	1967	0.27	0.44	900	0.46	0.30
Women with YOS$\geq$10	0.14	0.34	1957	0.11	0.32	899	0.20	0.12
Nutritional status								
Woman's BMI$<$18.5kg/m^2	0.21	0.41	1914	0.22	0.41	886	0.32	0.34
Woman's BMI$\geq$ 25kg/m^2	0.06	0.24	1914	0.05	0.22	886	0.10	0.07
Anemia								
Pregnant women ($<$11 g/dl)	0.68	0.47	1864	0.71	0.45	865	0.58	0.58

Notes: The summary statistics in the 2015 sample and the 2016 estimation sample are based on own data collected in 2015. The indicators presented in the columns NFHS rural Bihar and BFHS rural Madhepura are taken from (International Institute for Population Sciences and ICF Incorporated 2017b) and (International Institute for Population Sciences 2017a), respectively. The indicators based on our own data follow the definitions of the NFHS-4 Bihar fact sheets (International Institute for Population Sciences and ICF Incorporated 2017b; International Institute for Population Sciences 2017a). For iodized salt, we measured the iodine content in salt and assume that the salt is iodized if the ppm value is $\geq$15. Because we only measure educational attainment in levels completed, we assume that completion of the secondary school certificate is equivalent to ten or more years of schooling. The indicators in the last two columns are as reported in the NFHS-4 Bihar and Madhepura fact sheets (International Institute for Population Sciences and ICF Incorporated 2017b; International Institute for Population Sciences 2017a).

Table A.I.3. Summary statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No SP		SP		Diff. sex		Diff. preference	
	Boys (Mean /SD)	Girls (Mean /SD)	Boys (Mean /SD)	Girls (Mean /SD)	(1)-(2) (β/SE)	(3)-(4) (β/SE)	(1)-(3) (β/SE)	(2)-(4) (β/SE)
HH characteristics								
Religion is Hindu	0.82	0.83	0.83	0.87	−0.01	−0.03	−0.01	−0.03
	[0.39]	[0.38]	[0.38]	[0.34]	(0.03)	(0.04)	(0.04)	(0.04)
Scheduled caste	0.35	0.33	0.28	0.35	0.02	−0.07	0.08*	−0.02
	[0.48]	[0.47]	[0.45]	[0.48]	(0.04)	(0.05)	(0.04)	(0.05)
Scheduled tribe	0.05	0.06	0.04	0.01	−0.01	0.03	0.01	0.05**
	[0.21]	[0.24]	[0.19]	[0.11]	(0.02)	(0.02)	(0.02)	(0.02)
OBC	0.51	0.54	0.60	0.59	−0.03	0.01	−0.09*	−0.05
	[0.50]	[0.50]	[0.49]	[0.49]	(0.04)	(0.05)	(0.05)	(0.05)
General category	0.09	0.06	0.08	0.04	0.02	0.04	0.01	0.02
	[0.28]	[0.24]	[0.27]	[0.21]	(0.02)	(0.03)	(0.03)	(0.02)
Wealth quintile								
1 (poorest)	0.23	0.19	0.20	0.20	0.04	−0.00	0.03	−0.01
	[0.42]	[0.39]	[0.40]	[0.40]	(0.03)	(0.04)	(0.04)	(0.04)
2	0.19	0.19	0.20	0.20	−0.00	0.00	−0.01	−0.00
	[0.39]	[0.40]	[0.40]	[0.40]	(0.03)	(0.04)	(0.04)	(0.04)
3	0.20	0.20	0.20	0.18	−0.00	0.02	−0.00	0.02
	[0.40]	[0.40]	[0.40]	[0.39]	(0.03)	(0.04)	(0.04)	(0.04)
4	0.21	0.20	0.21	0.17	0.01	0.04	−0.00	0.03
	[0.41]	[0.40]	[0.41]	[0.38]	(0.03)	(0.04)	(0.04)	(0.04)
5 (richest)	0.17	0.21	0.18	0.24	−0.04	−0.06	−0.01	−0.03
	[0.38]	[0.41]	[0.39]	[0.43]	(0.03)	(0.04)	(0.04)	(0.04)
BPL card[a]	0.62	0.65	0.65	0.69	−0.04	−0.04	−0.03	−0.03
	[0.49]	[0.48]	[0.48]	[0.46]	(0.04)	(0.05)	(0.05)	(0.05)
Highest grade in HH	5.57	5.33	5.52	4.99	0.24	0.53	0.05	0.34
	[4.50]	[4.79]	[4.47]	[4.59]	(0.39)	(0.49)	(0.43)	(0.47)
Mother characteristics								
Highest grade	2.22	1.95	1.51	2.24	0.26	−0.74*	0.71*	−0.29
	[4.10]	[3.79]	[3.34]	[4.07]	(0.33)	(0.40)	(0.36)	(0.39)
Can read	0.23	0.23	0.17	0.25	0.00	−0.08*	0.05	−0.03
	[0.42]	[0.42]	[0.38]	[0.44]	(0.04)	(0.04)	(0.04)	(0.04)
Mother worked in past 12 months	0.46	0.45	0.49	0.53	0.01	−0.04	−0.03	−0.08
	[0.50]	[0.50]	[0.50]	[0.50]	(0.04)	(0.05)	(0.05)	(0.05)
Age of mother (years)	24.59	24.83	25.30	24.58	−0.24	0.72*	−0.72*	0.25
	[3.99]	[4.47]	[3.75]	[3.30]	(0.36)	(0.39)	(0.37)	(0.41)
Child chactareistics								
Child's age in months	15.91	15.89	15.81	15.65	0.03	0.17	0.10	0.24
	[2.02]	[2.14]	[2.21]	[2.04]	(0.18)	(0.23)	(0.20)	(0.21)

Notes: Table continues on the next page.

Table A.I.3 continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No SP		SP		Diff. sex		Diff. preference	
	Boys (Mean /SD)	Girls (Mean /SD)	Boys (Mean /SD)	Girls (Mean /SD)	(1)-(2) (β/SE)	(3)-(4) (β/SE)	(1)-(3) (β/SE)	(2)-(4) (β/SE)
Family size & composition								
HH size	5.70	5.79	6.03	5.75	−0.09	0.28	−0.33	0.04
	[2.29]	[2.18]	[2.10]	[1.87]	(0.19)	(0.22)	(0.21)	(0.21)
> 2 adults in HH	0.47	0.52	0.42	0.42	−0.05	−0.00	0.05	0.10*
	[0.50]	[0.50]	[0.49]	[0.50]	(0.04)	(0.05)	(0.05)	(0.05)
No. of sons	0.63	0.59	0.34	0.31	0.03	0.03	0.29***	0.29***
	[0.73]	[0.70]	[0.56]	[0.53]	(0.06)	(0.06)	(0.06)	(0.06)
No. of daughters	0.65	0.64	1.49	1.26	0.01	0.23*	−0.84***	−0.62***
	[0.92]	[0.92]	[1.21]	[1.18]	(0.08)	(0.13)	(0.10)	(0.10)
Birth order								
1	0.35	0.36	0.15	0.24	−0.01	−0.09**	0.20***	0.12***
	[0.48]	[0.48]	[0.36]	[0.43]	(0.04)	(0.04)	(0.04)	(0.05)
2	0.28	0.29	0.32	0.32	−0.01	0.00	−0.04	−0.03
	[0.45]	[0.46]	[0.47]	[0.47]	(0.04)	(0.05)	(0.04)	(0.05)
3	0.19	0.17	0.26	0.20	0.02	0.06	−0.07*	−0.03
	[0.40]	[0.38]	[0.44]	[0.40]	(0.03)	(0.05)	(0.04)	(0.04)
≥4	0.17	0.18	0.27	0.24	−0.01	0.03	−0.10**	−0.06
	[0.38]	[0.38]	[0.44]	[0.43]	(0.03)	(0.05)	(0.04)	(0.04)
Wants more children								
Unsure	0.06	0.10	0.09	0.07	−0.04**	0.02	−0.03	0.03
	[0.23]	[0.30]	[0.28]	[0.26]	(0.02)	(0.03)	(0.02)	(0.03)
Wants more	0.44	0.58	0.40	0.64	−0.14***	−0.24***	0.04	−0.05
	[0.50]	[0.49]	[0.49]	[0.23]	(0.04)	(0.05)	(0.05)	(0.05)
Newborn	0.04	0.07	0.08	0.09	−0.02	−0.01	−0.03	−0.02
	[0.20]	[0.25]	[0.27]	[0.29]	(0.02)	(0.03)	(0.02)	(0.03)
Currently pregnant	0.08	0.16	0.12	0.18	−0.08***	−0.06	−0.04	−0.02
	[0.27]	[0.37]	[0.33]	[0.38]	(0.03)	(0.04)	(0.03)	(0.04)

Notes: Table shows summary statistics of of the 2016 estimation sample (N=900) as observed in 2016. Standard deviations (SD) are in brackets. β refers to the difference in means of the respective columns and SE to the standard errors of the difference in means shown in parentheses. [a]BPL card refers to “below poverty line”-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Sample restricted to main estimation sample.

Appendix II - Robustness checks and additional estimation results

Table A.II.1. Selection tests

	Not alive	Firstborn boy
Son preference	-0.029	
	(0.023)	
Received antenatal care	-0.011	
	(0.016)	
HH characteristics		
Hindu	-0.024	-0.065
	(0.032)	(0.046)
Scheduled caste	0.035	-0.007
	(0.026)	(0.041)
Scheduled tribe	-0.058	-0.064
	(0.040)	(0.093)
General category	-0.022	-0.087
	(0.040)	(0.076)
Wealth quintile		
2 (2nd poorest)	-0.007	-0.061
	(0.035)	(0.065)
3	-0.053*	-0.111*
	(0.028)	(0.064)
4	-0.051	-0.077
	(0.033)	(0.068)
5 (richest)	0.014	-0.085
	(0.030)	(0.079)
BPL card[a]	0.018	-0.052
	(0.028)	(0.043)
Highest grade in HH	0.006	0.001
	(0.003)	(0.005)
Mother characteristics		
Highest grade	-0.005	0.003
	(0.005)	(0.011)
Can read	0.029	-0.044
	(0.042)	(0.097)
Age	-0.014	-0.058
	(0.016)	(0.036)
Age^2	0.000	0.001
	(0.000)	(0.001)
Family size		
Household size	-0.036***	
	(0.006)	
$>$ 2 adults in HH	0.091***	
	(0.027)	
Wants more children		
Unsure	0.053	
	(0.044)	
Wants more	0.014	
	(0.021)	
Birth order		
2	-0.004	
	(0.029)	
3	0.040	
	(0.043)	
$\geq$4	0.054	
	(0.042)	
Number of sons		
1	-0.046*	
	(0.026)	
$\geq$2	-0.025	
	(0.044)	
Subdistrict fixed effects	✓	✓
Observations	990	634
Adjusted R^2	0.03	0.00
R^2	0.06	0.03
F-statistic	3.06	1.78

Notes: Column (1) presents results of a linear probability model estimation of whether a child has died between pregnancy in 2015 and follow-up in 2016 (binary indicator) on 2016 covariates as listed in the table. The sample in column (1) is restricted to the main estimation sample (N=900) plus children who have died and for whom we observe the relevant covariates in 2016. Column (2) presents results of a linear probability model estimation of the sex of the firstborn child being male on 2016 covariates as listed in the table. The sample in column (2) is restricted to the IV estimation sample (N=634). [a]BPL card refers to "below poverty line"-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. Standard errors are clustered at the panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.II.2. The son preference-specific girl-penalty in mental development (OLS) - all covariates shown

	Overall development	Cognitive	Language	Motor	Socio-emotional
Girl x Son preference	-0.240*	-0.142	-0.275**	-0.018	-0.254*
	(0.130)	(0.136)	(0.113)	(0.135)	(0.138)
Girl	0.085	0.035	0.185**	-0.163*	0.192**
	(0.082)	(0.086)	(0.074)	(0.086)	(0.075)
Son preference	0.093	0.060	0.179*	-0.073	0.068
	(0.099)	(0.118)	(0.094)	(0.099)	(0.088)
Birth order					
2	-0.132	-0.179*	-0.091	-0.107	-0.024
	(0.104)	(0.096)	(0.108)	(0.111)	(0.105)
3	-0.180	-0.180	-0.156	-0.082	-0.099
	(0.138)	(0.124)	(0.148)	(0.128)	(0.125)
≥4	-0.264*	-0.407***	-0.219	-0.175	0.039
	(0.137)	(0.140)	(0.154)	(0.143)	(0.123)
Number of sons					
1	-0.037	-0.043	0.013	-0.054	-0.030
	(0.080)	(0.094)	(0.098)	(0.087)	(0.073)
≥2	-0.017	-0.099	0.058	0.060	-0.115
	(0.156)	(0.161)	(0.140)	(0.189)	(0.146)
Fertility intention					
Wants more children					
Unsure	0.044	0.148	0.077	-0.149	0.135
	(0.140)	(0.133)	(0.125)	(0.122)	(0.162)
Wants more	-0.016	0.053	-0.060	-0.031	0.013
	(0.075)	(0.074)	(0.081)	(0.078)	(0.075)
Newborn	-0.003	-0.201	0.057	0.043	0.095
	(0.136)	(0.133)	(0.140)	(0.135)	(0.119)
Pregnant	0.031	0.137	-0.019	-0.005	-0.015
	(0.112)	(0.115)	(0.122)	(0.102)	(0.106)
Household characteristics					
Scheduled caste	0.026	-0.023	0.131	-0.103	0.072
	(0.082)	(0.081)	(0.083)	(0.079)	(0.077)
Scheduled tribe	0.255	0.074	0.228	0.123	0.357**
	(0.178)	(0.152)	(0.209)	(0.182)	(0.149)
General category	0.038	0.037	0.057	-0.055	0.106
	(0.149)	(0.147)	(0.132)	(0.157)	(0.136)
HH size	-0.003	0.014	0.008	-0.027	-0.001
	(0.028)	(0.023)	(0.019)	(0.030)	(0.028)
> 2 adults in HH	0.043	-0.105	0.085	0.060	0.068
	(0.092)	(0.087)	(0.098)	(0.091)	(0.074)
Wealth quintile					
2 (2nd poorest)	-0.037	-0.091	-0.054	-0.100	0.137
	(0.119)	(0.114)	(0.093)	(0.109)	(0.140)
3	-0.083	-0.154	-0.049	-0.084	0.041
	(0.124)	(0.108)	(0.110)	(0.130)	(0.135)
4	0.022	-0.051	0.031	-0.027	0.114
	(0.126)	(0.114)	(0.116)	(0.119)	(0.125)
5 (richest)	0.022	0.011	-0.053	0.017	0.108
	(0.118)	(0.106)	(0.109)	(0.108)	(0.142)
BPL card[a]	-0.014	0.111	-0.063	-0.090	-0.001
	(0.069)	(0.075)	(0.071)	(0.079)	(0.073)
Highest grade in HH	0.019	0.020*	0.019*	0.014	0.004
	(0.011)	(0.012)	(0.010)	(0.011)	(0.011)
Mother characteristics					
Highest grade	0.014	0.003	0.009	0.009	0.020
	(0.016)	(0.014)	(0.019)	(0.015)	(0.017)
Can read	0.019	0.020	0.108	0.019	-0.097
	(0.121)	(0.121)	(0.132)	(0.134)	(0.133)
Subdistrict fixed effects	✓	✓	✓	✓	✓
Adjusted R^2	0.039	0.035	0.024	0.030	0.024
R^2	0.071	0.067	0.057	0.062	0.057
Observations	900	900	900	900	900

Notes: Table shows OLS estimation results of children's standardized early mental development on variables as presented in the table. The results are the same as in Table 3 of the main text but here we also present the coefficients on covariates. [a]BPL card refers to "below poverty line"-cards issued by the Government of India which classify households as poor and, hence, as eligible for certain government programs. Standard errors are clustered at the panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A.II.3. Falsification test of the instrumental variables estimation: Potential confounding variables are used as outcomes in the reduced form estimation

	Previous birth spacing	Currently breastfed	Mother's health	Mother feels tired	Age difference	Land size	Own livestock	Own watch	Mother worked
Girl x firstborn boy	-2.556	-0.046	-0.021	-0.029	1.627	-1.917	0.007	0.065	-0.016
	(2.261)	(0.045)	(0.073)	(0.077)	(3.156)	(5.077)	(0.084)	(0.044)	(0.086)
Firstborn boy	1.334	-0.007	0.020	0.001	1.498	1.495	0.058	-0.003	0.002
	(1.508)	(0.021)	(0.054)	(0.046)	(2.383)	(2.110)	(0.054)	(0.032)	(0.070)
Sex of child	✓	✓	✓	✓	✓	✓	✓	✓	✓
Birth order	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fertility intention	✓	✓	✓	✓	✓	✓	✓	✓	✓
Socioeconomic status	✓	✓	✓	✓	✓	✓	✓	✓	✓
Subdistrict fixed effects	✓	✓	✓	✓	✓	✓	✓	✓	✓
Previous birthspacing		✓	✓	✓	✓	✓	✓	✓	✓
Currently breastfed	✓		✓	✓	✓	✓	✓	✓	✓
Mother's health	✓	✓		✓	✓	✓	✓	✓	✓
Mother feels tired	✓	✓	✓		✓	✓	✓	✓	✓
Age difference	✓	✓	✓	✓		✓	✓	✓	✓
Land size	✓	✓	✓	✓	✓		✓	✓	✓
Own livestock	✓	✓	✓	✓	✓	✓		✓	✓
Own watch	✓	✓	✓	✓	✓	✓	✓		✓
Mother worked	✓	✓	✓	✓	✓	✓	✓	✓	
R^2	0.482	0.173	0.213	0.238	0.770	0.080	0.183	0.279	0.169
Adjusted R^2	0.452	0.124	0.167	0.194	0.757	0.026	0.135	0.237	0.120
Observations	634	634	634	634	634	634	634	634	634
Mean	28.49	0.93	0.68	0.38	56.65	5.10	0.55	0.17	0.50

Notes: Tables shows OLS estimation results of potential confounding variables on the interaction of the sex of the firstborn child and the sex of the child of interest and the sex of the firstborn child, which are used as instruments in Table 8 of the main text, and control variables. Previous birth spacing refers to the time between the birth of child of interest and the previous birth. Currently breastfed refers to whether the mother is currently breastfeeding child of interest. Mother's health includes dummies for whether mother rates her health as good and feels chronically tired. Age difference is the age difference in months between firstborn and child of interest. land size refers to the size of land owned by members of teh household. Owns livestock and owns watch are binary indicators for whether these items are owned by a household member. Mother worked refers to whether mother worked for pay in past 12 months. (Additional) control variables include sex of the child of interest, (birth order:) birth order dummies 3 and ≥ 4, (fertility intention:) dummies for the wish for more children, having a newborn in 2016, and whether mother is pregnant in 2016, (socioeconomic status:) caste category dummies, wealth quintile dummies, "below poverty line"-card, highest grade completed in household, household size, whether no. of adult members exceeds 2, highest grade completed of mother, whether mother can read, and subdistrict fixed effects. Standard errors clustered at panchayat level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.