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Family planning practices: Examining the link between contraceptives and child health

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Abstract

We use nationally representative data from the National Family Health Survey (NFHS-5) on women and their children aged below 5 years to evaluate the causal impact of contraceptive use on child health outcomes. Using exogenous variation in the district average of women's exposure to family planning information through media as an instrument, we estimate that the use of contraception leads to a 1.3 SD (0.46 SD) increase in a child's height-for-age (weight-for-age) z-scores respectively. We also note that contraceptive use reduces the likelihood of a child being stunted by 15.2 pp and underweight by 11.8 pp respectively. Moreover, we find that contraceptive use leads to a decline in household size and an increase in household size depletes children's nutritional statuses, thus providing support to the well-documented resource-dilution hypothesis as a potential mechanism through which our findings perpetrate for India. We document sizeable benefits in terms of child health of exposure to family planning apart from population stabilization targets of a country and suggest a greater focus on the access to (and use of) contraceptive measures from a policy perspective.

JEL Classifications: I15; J13; C26
Keywords: Child health, Malnutrition, Contraception, Family Planning, Media, Instrumental Variable, India

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1 Introduction

Child malnutrition is a rising and persistent issue affecting most of the low and middle-income countries across the globe. As of 2020, the World Health Organization (2021) estimates suggest that 149 million children under 5 years of age are stunted, 45 million are wasted and 38.9 million are overweight. Aside from having a long lasting physiological effect on children, undernutrition has also been linked to poor mental development, lower academic performance and behavioral abnormalities (Martins et al., 2011; Dercon and Sánchez, 2013). Besides, undernutrition has significant economic consequences through loss of human capital and productivity, perpetuating poverty and abating the development of nations. Shekhar et al. (2006) and World Food Programme Report (2013) observe that the economic cost of malnutrition can range from 2-3% of a country's GDP to as high as 17% in the most severely impacted countries. For India, in particular, child malnutrition has been a chronic problem. India slipped in its ranks from 94 to 107 out of 121 countries as per the Global Hunger Index, 2022 (Livemint, 2022; Kumar, 2022). Despite decades of investments and interventions[1], India continues to be home to a third of the world's stunted children and one-half of all under-5 mortality is attributable to undernutrition.

Considerable evidence suggests that children from larger families, with more siblings and higher birth orders typically have poorer health, human capital outcomes and cognitive development (Blake, 1981; Horton, 1986; Silles, 2010; Booth and Kee, 2009; Desai, 1995; Knodel et al., 1990). These findings rely largely on the quantity-quality trade-off of children or the resource dilution hypothesis which emphasize the scarcity of parental time and physical resources per child as the family grows (Becker, 1960; Becker and Lewis, 1973; Becker and Tomes, 1976; Doepke, 2015; Chen, 2021; Li et al., 2008; Dang and Rogers, 2016). Thus, one can plausibly expect that limiting fertility rates may lead to greater attention, care and resource allocation towards existing children. With this in mind, in this paper, we examine the impacts of limiting fertility through the use of contraceptives on child health for India.

Growing literature on the benefits of better family planning and access to contraceptives documents improvements in maternal and child health (Molitoris, 2017; Miller and Karra, 2020; Cleland and Sathar, 1984; Yeakey et al., 2009; Cleland et al., 2012; Trussell and Pebley, 1984; Miller et al., 1992; Gipson et al., 2008; Dehingia et al., 2020; Finlay, 2012; Singh et al., 2012; National Research Council, 1989). Specifically, the use of contraceptives not only reduces the total number of births, but the number of unintended and high-risk pregnancies in very young women or women at higher parities (Kelly et al., 2020; Dills and Grecu, 2017; Luca et al., 2021). Contraception has also shown enhancement of women's perinatal outcomes and child survival, reduction in the risk of premature birth and low birthweight, through lengthened birth intervals

(Conde-Agudelo et al., 2006; Department of Maternal Newborn Child and Adolescent Health, 2011; Ananat and Hungerman, 2012; Fink et al., 2014; Rutstein, 2005). Long term impacts of better family planning practices on enhancement of women's assets, earnings, body mass indices (BMI) as well as her children's schooling and BMI have also been noted in Canning and Schultz (2012).

For India, in particular, the national family planning programme has evolved since its inception in 1952.[2] At present, in addition to population stabilization, the programme aims to promote reproductive health, reduce maternal and child mortality through introduction of newer contraceptive measures, emphasis on birth spacing methods and strengthening community-based distribution of contraceptives. Given this context, it is worth exploring the spillover effects of such family planning efforts on children's outcomes, particularly malnutrition since it is arguably one of the biggest hindrances on the growth path of India. As per the National Family Health Survey (NFHS-5) in 2020, stunting in children under 5 has risen in 13 out of 22 states since 2015-16 and wasting in 12 states and union territories (Chatterjee, 2021; Saha, 2021; Singh, 2020; Seth and Jain, 2021). This raises troubling questions about the efforts to tackle the malnutrition issue and speaks to the importance of understanding the causes and channels through which it can be addressed.

Owing to the vast economic and social consequences of malnutrition and its detrimental impacts on future outcomes of children, extensive literature on its determinants exists. One strand of the literature looks at the role of inadequate dietary intake, poor household environment, improper sanitation, lack of care and improper breastfeeding practices in explaining chronic undernutrition of children (Black et al., 2008; Ijarotimi, 2013; Chandrasekhar et al., 2017). Other works establish the role of maternal education and empowerment on the nutritional outcomes of children (Smith and Haddad, 1999; Smith et al., 2003; Imai et al., 2014; Thomas et al., 1990; Barrera, 1990; Güneş, 2015; Keats, 2018; Hahn et al., 2018; Masuda and Yamauchi, 2020; Le and Nguyen, 2020; Hossain, 2020). Here, we make a novel attempt to estimate the causal impact of contraceptive use on child nutrition indicators.

To do so, we utilize the fifth wave of the National Family Health Survey (NFHS-5) conducted in 2019-21 in India. Specifically, we use the individual level data on women of reproductive age and the corresponding information on all their children under the age of 5. We examine the impact of whether a couple has ever used any type of contraceptive method on the nutritional outcomes of their children to estimate our desired effect. For our baseline analysis, we focus on the two most commonly used anthropometric measures of child health, i.e. height-for-age z-score (HAZ) and weight-for-age z-score (WAZ). Utilizing the district-level average media exposure of women to family planning information as an instrument for her contraceptive use, we follow an Instrumental Variable (IV) framework with state fixed effects for our estimation.

The results are compelling. We find robust evidence that, having controlled for a host of mother's, child's and household's characteristics, contraceptive use by parents leads to a 1.3 SD increase in a child's HAZ and a 0.46 SD increase in her WAZ. We also explore the effect of contraceptive use on the probability of a child being *stunted* (based on HAZ) and *underweight* (based on WAZ). We find evidence that using contraceptives reduces the likelihood of the child being stunted by 15.2 pp and underweight by 11.8 pp. We conduct several robustness checks to test the sensitivity of our results. First, we discuss the validity of our instrument using falsification tests. Second, to address concerns about disproportionate representation of household with more children versus fewer in our sample, we redo our analysis collapsing the data at household level. We continue to find a similar and positive impact of the couple's use of contraceptive on *average* child health indicators in the household. Third, we also find positive effects on HAZ and largely similar effects for WAZ, albeit smaller, using NFHS- 4 for the years 2015-16. This result not only confirms the persistence of the malnutrition problem in India but also indicates that parents' reproductive practices have remained an important predictor of child health over time.

In addition to the baseline, we find noteworthy heterogeneous effects by the sex of the child, wealth status of the household, geographic location and caste of the household. Finally, we analyze the quantity-quality trade-off as a potential mechanism driving our results. We document that the use of contraception does in fact reduce the household size; and that smaller household size results in improvements in a child's HAZ and WAZ scores. As such, we provide evidence in support of the resource dilution hypothesis in terms of children's nutritional outcomes.

Our findings suggest that policies that promote use of contraceptives and encourage sound practices of family planning may aid India in reaping non-negligible benefits in terms of child health in conjunction with fulfilling its target of population stabilization. Given that we find consistently important effects of use of contraceptives on children's anthropometric measures in 2015-16 as well as 2019-21, we assert that these results ought to serve as a benchmark for policy discussions. As such these discussions assume more importance given the grave concern of hunger and malnutrition in India with India sliding down the ranks in the Global Hunger Index (Livemint, 2022; Kumar, 2022).

2 Data

2.1 NHFS data

The data for our paper comes from the fifth round of the National Family Health Surveys (NFHS-5) of India for the year 2019-21. NFHS is a nationwide cross-sectional demographic health survey for India. It provides information on various topics such as population demographics, health and nutrition status, women empowerment, gender role attitudes, marital histories, domestic violence and fertility preferences. It is conducted by the International Institute for Population Sciences (IIPS) in Mumbai administered under the Ministry of Health and Family Welfare (MoHFW), Government of India, and is a part of the global Demographic Health Survey (DHS) program.[3] The sample is drawn using stratified random sampling.[4]

We use the individual women's data as well as children's data from NFHS-5. Individual women's data consists of one record for every eligible woman in the reproductive age of 15 and 49 years and collects information about her background characteristics, health knowledge, health behaviours, fertility patterns, child's health and nutritional status as well as household characteristics. We restrict the women's data to include women married only once to ensure that the woman's responses about contraceptive use pertains to her current union.

The children's data consists of one record for every child of the interviewed woman born upto five years preceding the survey. It collects information on both demographic and anthropometric characteristics on children between the ages 0 to 59 months. We merge the two data sets and our unit of analysis is the children born to the woman in the last five years. Our final sample consists of 228,414 observations.

2.2 Measurement of child nutritional status

NFHS-5 contains information on the nutritional status of children under the age of 5. For our baseline analysis, we measure child health with their anthropometric measures of nutritional surveillance, viz. height-for-age z-score (HAZ), and weight-for-age z-score (WAZ). These anthropometric measures are calculated for children under 5 by their age and sex, based on the Centers for Disease Control and Prevention (CDC) Standard Deviation-derived Growth Reference Curves which are derived from the National Center for Health Statistics (NCHS)/CDC Reference Population (Le and Nguyen, 2020). Child's anthropometric measures reflect the nutrition and growth status of children in both the long run and the short run (Thomas et al., 1991; WHO, 2008). These anthropometric measures are described as the number of standard deviations below or above the median of the international reference population.[5]

2.3 Contraceptive use

The survey also provides information on a couple's contraceptive use. The contraceptive methods may include using a contraceptive pill, injections, IUD, condoms, sterilization, rhytmic/periodic abstinence, withdrawal, lactational amenorrhea, foam/jelly, female condom and standard days method. We do not differentiate between the methods of contraception and define our variable of interest as *Everused* such that it takes value 1 if the couple has ever used any of these contraceptive methods or tried to delay pregnancy, and 0 otherwise.

2.4 Selection of controls

Following Oster (2019)'s (p.187) argument that all non-experimental work in economics is subject to omitted variable bias, and "the most straightforward approach to such concerns is to include controls that can be observed", we include for a host of child, woman and household controls, chosen carefully and comprehensively in our estimation.[6] Our child level controls include birth order, whether the child is a twin/multiple birth, child's birth size, age, sex, whether the child has received polio, BCG, DPT and measles vaccinations. Mother's controls include age, education level, body mass index (BMI) to incorporate a measure of her general health status, whether she is covered by health insurance, intake of iron supplements during pregnancy, and frequency of antenatal visits during pregnancy. Household level controls include wealth index, household size, indicators of residence in a rural or urban area, indicators for religion (Hindu, Muslim, Christian or other religion including Sikh, Jain, Buddhist and others) caste (Backward or other).

2.5 Descriptive patterns - Analytical sample

Our analytical sample consists of 228,414 observations. Table 1 presents the descriptive statistics of the variables used in our analysis. Mean HAZ is at -1.3 standard deviations (SD) and mean WAZ is at -1.39 SD. Our variable of interest, *Everused* suggests that almost 77% percent of women have used some contraceptive method.

In terms of child demographics, roughly 48.2% (50.8%) of the sample consists of girls (boys) and the average age of a child is approximately 29.6 months. Only about 2.5% of the children are twins or belonged to a multiple birth and approximately 89.8% of children are average or above in size at birth. Approximately 83% of children have received the polio vaccination, 85% have the the DPT vaccinations and 94% (53%) the BCG (measles) vaccinations.

An average woman's age is approximately 27 years; 78% have completed primary education and approximately 27% of women are covered by health insurance. On average, around 87.5%

of women received some iron supplements during pregnancy, and had roughly 5 antenatal visits during pregnancy to the healthcare center.

Household level demographics reveal that an average household in our analytical sample consists of 6.2 members, and belong to the poor-to-middle income category in terms of wealth index.[7] Roughly 80 percent of the households reside in rural areas, approximately 83.5% are backward castes and majority (74%) are Hindus.

[Table 1 here]

3 Empirical framework

3.1 Estimation strategy

We use the following empirical specification to investigate the effect of a couple's contraceptive use on the HAZ and WAZ of children:

$$Y_i = \beta_0 + \beta_1 Everused_i + \beta_2 \mathbb{X}_i + \beta_3 \mathbb{M}_i + \beta_4 \mathbb{H}_i + \lambda_s + \epsilon_i \quad (1)$$

where Y_i refers to the outcome of interest (HAZ or WAZ) of child i; $Everused_i$ denotes an indicator variable equal to 1 if child i's parents have ever used contraceptive measures and 0 otherwise; $\mathbb{X}_i$ is the vector of child specific controls; $\mathbb{M}_i$ is the vector of child i's mother's characteristics; $\mathbb{H}_i$ is the vector of child i's household controls; λ_s denotes state fixed effects. Our parameter of interest, β_1 captures the effect of the couple's use of contraception on their child's health outcomes. All standard errors are clustered at the survey cluster level.

3.2 Identification strategy

Our estimation strategy includes a comprehensive set of controls to alleviate concerns of omitted variable bias. We also include state fixed effects to account for any systematic state-level unobservables that may affect contraceptive use. That said, a problem with the estimation of Eq.(1) is that $Everused_i$ could be endogenous on account of multiple unobserved variables that might be correlated with both $Everused_i$ and Y_i. A causal interpretation of β_1 would require that, conditional on our controls, there are no unobserved variables that are correlated with both $Everused_i$ and Y_i. Endogeneity concerns may also arise if the causality runs from child's nutritional outcomes to $Everused_i$, for instance, nutritional status of older children may determine the use of contraceptive measures for subsequent pregnancies. Besides, measurement error in $Everused_i$ given that it is self-reported may also lead endogeneity. These problems would render the OLS estimate of β_1 to be biased and inconsistent. Therefore, we adopt an IV-TSLS approach to estimate the effect of use of contraceptive measures on the anthropometrics measures, HAZ and WAZ.[8]

We utilize information on family planning messages through mass media sources such as radio, television and newspaper to construct our instrument. Firstly, we define a binary variable that takes the value 1 if the woman has heard about family planning either on the radio or TV or newspaper and 0 otherwise. This generates a binary indicator of media exposure for every household in our sample. We then construct a *district average* of media exposure to generate our instrument. We posit that the average exposure of women to family planning information over media is necessarily related with the couple's contraceptive use. This is in line with a large body of evidence that shows the effectiveness of information provided through mass-media programs in increasing family planning use and changing reproductive behaviour(Jah et al., 2014; Agha and Van Rossem, 2002; Gupta et al., 2003; Olenick, 2000). Figure 1 exhibits the correlation between our IV and main variable of interest, $Everused_i$. Note that there is a strong positive correlation between them.

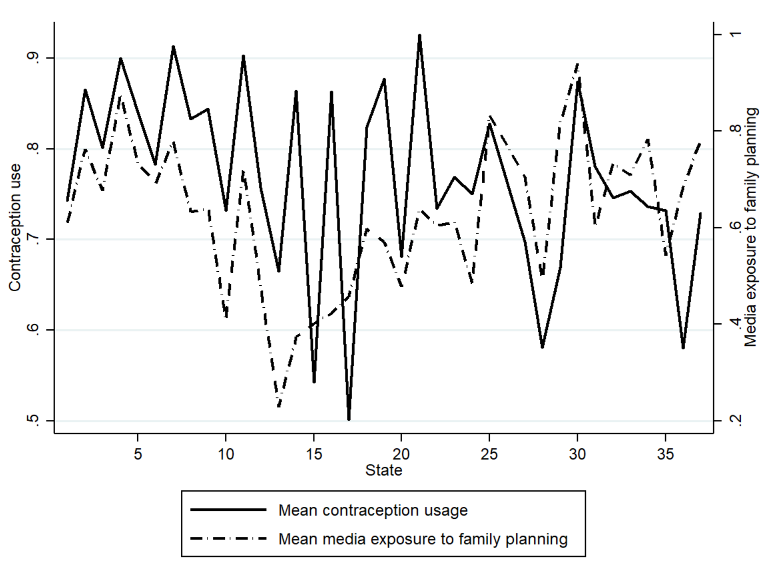


Figure 1: First stage correlation

Notes: The figure illustrates the first stage correlation between the explanatory variable, contraception use and the instrument, average media exposure to family planning messages. For expositional puroposes we illustrate the state-level averages of these variables in the figure.

Besides, the only channel through which district-average media exposure to family planning messages would affect child i's nutritional status is through actual family planning/reproductive practices of the parents. Thus, we assert that our IV is compelling to the extent that it is not only highly correlated with our main variable of interest, $Everused_i$, but also does not have a direct impact on HAZ and WAZ. To address potential concerns about the validity of our IV, we conduct a falsification analysis in Section 6.1.

4 Results

4.1 Baseline results

Table 2 presents the IV-TSLS results of the effect of contraceptive use on HAZ and WAZ. Columns (1) to (3) present the estimates for the effect on HAZ and columns (4) to (6) present the estimates for WAZ respectively. Columns (1) and (4) capture the initial association between a couple's use of contraception on their child's HAZ and WAZ respectively, with no controls. Absent any controls, on average, the effect of contraceptive use increases HAZ (WAZ) of children by 2.2 (1.5) standard deviations (SD). Both these coefficients are statistically significant at 1% level of significance. As we move across to columns (2) and (5), we add the mother's characteristics, child's characteristics as well as household characteristics. Adding comprehensive controls to our specifications reduces the number of observations to a large extent. We continue to find a statistically significant increase in the child's HAZ and WAZ respectively as a result of contraceptive use. Finally, we also include state fixed effects as additional controls in columns (3) and (6). Estimates from columns (3) and (6) capture our most preferred specification. Column (3) shows that the decision to use contraception increases the child's HAZ by 1.3 SD on average. From column (6), we note that child's WAZ increases by 0.46 SD if the couple has ever used any form of contraception. The coefficients are statistically significant at 1% level of significance.[9]

[Table 2 here]

4.2 First stage

We also present the first stage results in Table 3. Columns (1) - (3) present the results with no controls, with comprehensive set of controls and with state fixed effects added sequentially. We note a positive and statistically significant relationship between the couple's use of contraceptives and the district average of women's exposure to family planning through mass-media. More specifically, the probability of the couples using contraception increases by 27.5 pp with rise in the district average of women's exposure. Our model fairs remarkably well in terms of diagnostic tests that assess the efficiency and reliability of the IV. The weak identification and under identification test statistics have been reported in Table 2. The first stage F-statistic is 310.1 and 307.1 in our preferred specifications for HAZ and WAZ reported in Columns (3) and (6) respectively. the F-statistic is also well above 10 across all our specifications, implying that our instrument is strong. The Kleibergen Paap rk-LM statistic allows us to reject the null that the instrument is uncorrelated with the endogenous regressor. This indicates that our instrument is relevant and correlated with the endogenous regressor.

[Table 3 here]

5 Extensions

5.1 Other measures of nutritional deficiencies: Stunting and Underweight

Further, we measure the effect of contraceptive use on other measures of child nutritional statuses. Specifically, we focus on stunting and underweight indicators. Stunting, based on a child's height and age, is considered a measure of *chronic nutritional deficiency*. Underweight, on the other hand, is based on a child's weight and age and is considered a composite measure of both *acute* and *chronic nutritional statuses* (Croft et al., 2018). Stunting typically results from long-term deprivation of nutrition and leads to delayed mental development and reduced intellectual capacity, while being underweight significantly increases the mortality risk.

We consider both stunting and underweight as binary variables for our analysis. *Stunted* takes the value 1 if the child is moderately or severely stunted and 0 if the child is not stunted. Our measure of *underweight* similarly takes the value 1 if the child is moderately or acutely underweight and 0 otherwise.[10] More specifically,

$$Stunted_i = \begin{cases} 0(\text{not stunted}), & \text{if } \; HAZ > -2 \\ 1(\text{moderately/acutely stunted}), & \text{if } \; HAZ <= -2 \end{cases}$$

$$Underweight_i = \begin{cases} 0(\text{not underweight}), & \text{if } \; WAZ \in (-2, 2] \\ 1(\text{moderately/acutely underweight}), & \text{if } \; WAZ < -2 \end{cases}$$

Given that our outcomes here, *stunted* or *underweight*, are binary in nature as well as our variable of interest *everused*, we utilize Roodman (2011)'s conditional mixed-processes (CMP) framework as our IV estimation approach. We present the results in Table 4. Columns (1) - (3) present the marginal effects for *Stunted* and columns (4) - (7) present the same for *Underweight* without controls, with controls and with fixed effects added subsequently.

We start by looking at our most preferred specification including comprehensive controls and fixed effects for $Stunted_i$ in column (3). We note that if a couple uses contraception, the probability that the child is stunted decreases statistically significantly by 15.2 percentage points (pp). As we move to $Underweight_i$, we note a negative and statistically significant effect of contraceptive use on the probability of the child being underweight (see column (6)); the likelihood being underweight decreases by 11.8 pp.

In summary, our results for the measures of chronic and acute nutritional deficiencies confirm our baseline results on HAZ and WAZ. The negative effects of a couple's contraceptive use on a child being stunted or underweight corroborate the effects we find on the anthropometric measures.

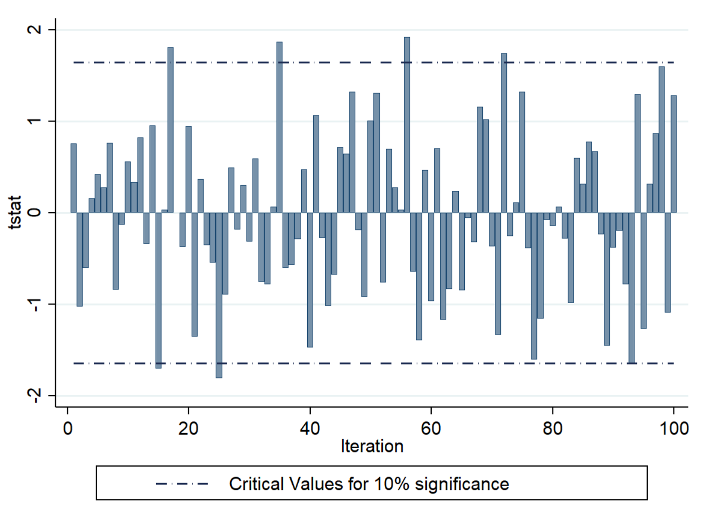
[Table 4 here]

6 Robustness

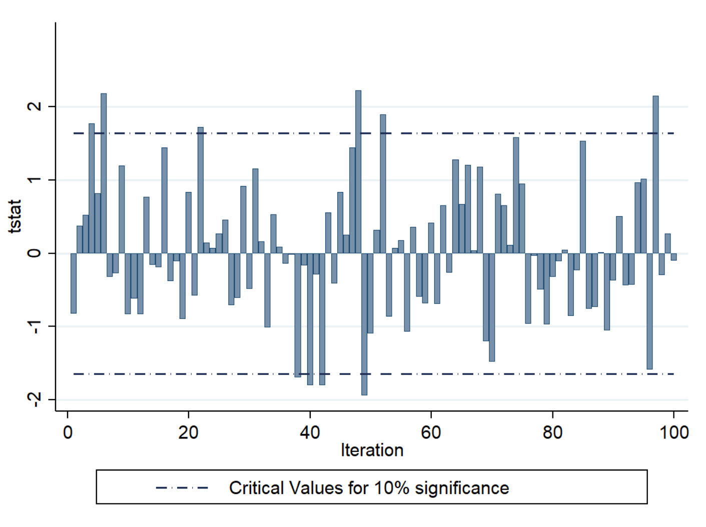
6.1 Falsification analysis

Thus far, our results point to a positive and statistically significant effect of a couple's use of contraception on their child's anthropometric measures for nutrition surveillance. Here, we attempt to show that such a result is not obtained if we consider any randomly assigned HAZ and WAZ outcomes. To do so, we keep the first stage relationship between our endogenous regressor and our instrument intact and randomly shuffle our outcome variables. In other words, we associate a random child j's HAZ and WAZ scores to the use of contraception by child i's parents instrumented by the district average of women's exposure to contraceptive methods through mass-media. Ceteris paribus, this makes the association between our dependent variables and the regressors in our estimation random.

We replicate this analysis 100 times and show that 93% (90%) of the times there is no significant impact of use of contraceptives on the randomly assigned HAZ (WAZ) measure. To be precise, we are unable to reject the null that the effect of use of contraceptives is equal to zero 7 (10) out of 100 times for HAZ (WAZ). Figure 2 plots the t-statistics obtained corresponding to the coefficients of contraceptive use on both HAZ and WAZ in each of the 100 replications. This falsification test reveals that repeated estimations with random assignments of contraception choice do not produce significant results on children's anthropometric measures and thus we are unable to falsify our baseline estimates.



(a) HAZ



(b) WAZ

Figure 2: Falsification test

Notes: Panel (a) presents the t-statistics of the effect of a couple's contraception use on their child's height-for-age z-score (HAZ). Panel (b) presents the same for the child's weight-for-age z-score (WAZ). These test statistics are obtained from 100 iterations of our preferred two-stage least squares estimation, but using randomly assigned nutritional outcomes of kids.

6.2 Household level sample

We estimate our preferred baseline specifications using data at the individual child level, where we consider multiple children per couple and household. A possible worry with this level of analysis is that given our data limitations, we only know if the couple has ever used any contraception method. We are unable to determine *when* the couple may have used contracepives or *which* pregnancy did it delay or affect. In addition, since the number of children per couple can vary, households with more children repeat themselves in the data more than households with one or fewer children in the analysis at the child level. To address these potential concerns and check the sensitivity of our baseline results, we also estimate our desired impacts using aggregated household level data. For every household we look at the average child characteristics[11] and continue to control for our preferred set of mother's and household characteristics.

Table 5 presents our preferred baseline estimates for HAZ and WAZ using the household level data. From columns (1) and (2) , we note that a couple's use of contraceptives increases the average HAZ of their children by 1.22 SD and the average WAZ by 0.33 SD respectively. Comparing these magnitudes to our baselines estimates reported in columns (3) and (6) in Table 2 we find that our results are substantially robust. The impacts are statistically significant at the aggregated household level as well and the magnitudes comparable. Our instrument continues to perform well at the household level, with the weak and under identification F statistics still being much above 10.

[Table 5 here]

6.3 NFHS - 4 sample

Considering that child malnourishment has continued to be an unrelenting and critical issue for the country, we add to the richness of our analysis by also utilizing data from the NFHS - 4 survey wave and test whether family planning practices have remained important for child health. We run our baseline regressions for HAZ and WAZ as well as for the outcomes denoting chronic nutritional status of children i.e. stunting and underweight for the years 2015 - 16.

Table 6 presents the baseline results for HAZ and WAZ using NFHS 4. We present the results in the same progression as our baseline. We find that in 2015-16 as well we find important and positive effects of contraceptive use on child health. In particular the results are robust for HAZ for all specifications. From our preferred specification in column (3), we note that HAZ increases by 0.26 SD if the couple uses contraceptives. The effect is statistically significant. We find a similar trend for WAZ as well. From column (2), once we add the same set of comprehensive controls in our regressions, we find that use of contraception leads to a statistically significant rise of 0.24 SD in the child's WAZ. The effect loses significance once state fixed effects are included. Overall, contraceptive use persistently emerges as a key predictor of children's nutritional outcomes as evidenced by the results for the years 2019-21 (our baseline) but also for 2015-16.

Table 7 reports the estimates for the probability of stunting and underweight. From columns

(1) to (3), it is evident that use of contraceptives by the parents leads to a statistically significant decline in the likelihood of the child being stunted. More specifically, the probability of stunting declines by 13.9 pp as seen from the marginal effect reported in column (3). Results are similar for the probability of being underweight. The marginal effects suggest a negative effect of contraceptive use on the likelihood of being underweight. Looking at column (2) with the comprehensive controls, the reduction is of the order of 4.2 pp in the probability of being underweight as a result of limiting fertility through contraceptives. While we find that in both Tables 6 and 7, the effect loses statistical significance in Column (6) once state fixed effects are included, we believe this is driven by some degree of measurement error or imprecision in the data.

By estimating the impact using an earlier round of data, we provide evidence that nutritional deficiency is a chronic problem for the country that has not shown much improvement. This may be a serious challenge for India in view of the COVID-19 crisis which has deteriorated an already critical situation India faced in terms of malnourishment.

[Table 6 here]

[Table 7 here]

7 Hetergeneity analysis

To examine whether our main results vary across different subsamples, we dissect our analytical sample in different ways and estimate the effect of contraception use on HAZ and WAZ for the sub samples. We examine 4 different sub-samples based on - *(i) sex of the child, (ii) caste, (iii) by area of residence, and (iv) wealth.* We present the results in Table 8. Panel (a) presents the results for HAZ and Panel (b) for WAZ. The following findings are noticeable from this heterogeneity analysis.

By sex of the child: From both panels, the estimates in columns (1) and (2) show the effect of contraception use on child's anthropometric measures. We find a much larger statistically significant impact on a girl's HAZ score compared to boys. A couple's use of contraception increases a girl's HAZ score by 2 SD whereas a boy's HAZ score increases by 0.74 SD. Also, we find a statistically significant effect for girls but not boys when we consider their WAZ scores. Specifically, we note that use of contraceptives increases a female child's WAZ by 0.65 SD.

By caste: We find statistically significant effect of contraceptive use on child's anthropometric measures for the backward caste. Contraceptive use increases the child's HAZ and WAZ by 1.5 SD and 0.47 SD respectively. No such effect is noted for the upper caste. That said, a word of caution warranted here is that the sample size reduces by a large extent for the upper caste sample.

By area of residence: Looking at the heterogenous effects of contraceptive use on child's health measure by rural or urban areas, we find statistically significant effect for rural areas for both HAZ and WAZ. A child's HAZ increases by 1.5 SD and WAZ by 0.57 SD in rural areas. We do not find a statistically significant effect of limiting fertility through use of contraceptives on the nutritional outcomes of children in the urban areas.

By wealth: We divide our sample into poor and rich households and find statistically significant positive effects of contraceptive use on child's HAZ for both poor as well as rich households. Whereas, when we consider WAZ as our outcome, we only find an effect for the sub-sample of poor households. Looking at the estimates for HAZ form column (8), the effect is larger for the poor households and is of the order of 1.75 SD for HAZ for the poor households and 0.86 SD for the rich households. The effect of limiting fertility through contraceptives in the poor households shows a 0.55 SD rise in WAZ of children.

[Table 8 here]

8 Potential mechanism - Quantity-Quality trade-off

Here, we attempt to study a potential mechanism that may explain the positive effects of contraceptive use on child health that is in line with the Becker and Lewis (1973); Becker and Tomes (1976) model of quantity-quality trade-off of children. Parent's choice to use contraceptive measures to limit the number of children born may have important implications on resource allocation per child, the quality of children's outcomes and thus, their nutritional status. To assess if this is a channel that explains our effects, we first study the effect of couple's use of contraceptives on household size. Further, we analyze the impact of household size on a child's HAZ and WAZ scores. Tables 9 and 10 reports these set of results.

Table 9 presents the results where the outcome is household size and the variable of interest is couple's use of contraceptives. In column (1) we estimate the impact of contraceptive use on household size using our baseline child-level data and our preferred set of comprehensive controls as well as state fixed effects. We find that a couple's use of contraception leads to a 6.9 percent decrease in household size. To alleviate concerns regarding disproportionate sample representation of households and the fact that we cannot deduce *when* or *for which pregnancy* the couple used contraception, we repeat the same analysis at the household level. We collapse our dataset at the household level where we estimate our impact on *average* child characteristics in that household. We find a similar result suggesting that contraceptive usage by the couples leads to a 12 percent decline in the household size.

To further provide evidence for the channels running from quantity to quality, in Table 10 we present our estimates of the impact of household size on the HAZ and WAZ of children. Besides, we acknowledge that household size in itself is also likely endogenous. As such, we examine its effect on child nutrition using our IV approach, the IV being the district average of women's exposure to family planning messages through mass-media. In Columns (1) and (3), we estimate this impact using our baseline child-level data and find that a unit increase in household size leads to a 1.25 SD decrease in a child's HAZ score and a 0.45 SD decrease in her WAZ score respectively. Similarly, in Columns (2) and (4), we re-run our analysis using household level data and find that a unit increase in household size leads to a 0.97 SD decrease in the average child's HAZ score and a 0.26 SD decrease in her WAZ score. Together, our estimates in Tables 9 and 10 provide support to substantiate the quantity-quality trade-off and resource dilution hypothesis as a plausible mechanism driving our main results.

[Table 9 here]

[Table 10 here]

9 Conclusion

Child malnutrition is currently one of the most critical public health issues in India with an alarmingly high proportion of children wasted, stunted and/or underweight. Media reports and researchers suggest that India is slipping into a vicious cycle of malnourishment (Singh and Pandey, 2013). Despite several efforts by the government under the umbrella of the National Food Security Act, which aims to target and significantly reduce child malnutrition through Integrated Child Development Services (ICDS) and Mid Day Meal Scheme (MDMS), India continues to grapple with poor child health. In light of this, we assert that it is important to understand other causes and channels that affect child health. In this paper, we examine one such determinant of children's nutritional status. Specifically, utilizing the latest round of the NFHS, we study the *causal* effects of parents' family planning practices, that is, their contraceptives on children's anthropometric measures of nutritional surveillance.

By exploring the exogenous variation in the district average exposure of women to family planning messages through mass-media, we find a positive impact of a couple's choice to use contraception on children's nutritional statuses. Having controlled for a comprehensive set of controls as well as state fixed effects, we provide robust evidence that contraceptive use leads to a 1.3 SD increase in a child's HAZ and a 0.46 SD increase in her WAZ. We also document interesting heterogeneous effect, in that, we find larger effects on a female child's HAZ and WAZ scores compared to boys. In addition, we find significant effects of contraceptive use for the poor families, and those residing in rural areas for both HAZ and WAZ. Beyond this, we also note some noteworthy effects of contraceptive use on the measures of children's stunting and underweight indicators. We find that the probability of being moderately or acutely stunted reduces by 15.2 pp as a result of parent's reproductive practices. Similarly, we find that contraceptive use decreases the likelihood of the child being moderately or acutely underweight by 11.8 pp. Our results hold across individual child-level data as well as for the analysis conducted at the household level. We also document that couple's reproductive practices have a causal effect on child nutrition using data from the previous survey wave of NFHS. This result ought to be of importance for development practitioners and policymakers given that the use of contraceptives by the parents consistently appears important in determining children's health outcomes.

We also examine a probable channel through which we could be capturing the effect of contraceptive use on child's nutritional indicators. We provide evidence in support of the quantity-quality trade-off indicating that with family planning measures and consequently fewer children, parents are more effectively able to invest resources towards existing children. We not only document that there is a negative effect of contraceptive use on household size, we also note that increase in household size does indeed lead to a decline in the nutritional indicators of children.

Considering that better nutritional outcomes for children eventually lead to better human capital accumulation, improved productivity and reduced healthcare costs, we underline the importance of family planning measures in tackling child ill-health. We assert that this has important implications from a policy viewpoint. While better sanitation, food security, maternal healthcare have been examined as important determinants of child health in the literature, our paper calls for greater focus on family planning measures specifically through encouragement of contraceptive use for improved child nutritional status in a country riddled with both high population as well as triple burden of child malnutrition. Our findings also indicate that, if anything, these family planning measures have greater positive effects on children from the backward castes, poorer households and residing in rural areas. Therefore, it may be important to channel greater efforts towards these groups to reap sizeable benefits for children's health outcomes.

Notes

[1]The government has established the Integrated Child Development Services (ICDS), aimed to provide comprehensive health and nutrition services to children under six as well as pregnant and lactating mothers.

[2]India was the first nation in the world to launch a National Programme for Family Planning.

[3]The DHS surveys for all countries are available at https://dhsprogram.com/.

[4]See IIPS and ICF for more details on the survey methodology.

[5]The assignment of the z-scores based on the WHO Child Growth Standards is done through a complicated interpolation function that takes into account sex, age (measured by difference in date of birth and date of interview, both precise to day of month), height in centimeters, and weight in kilograms (precise to 100 grams). The z-scores are calculated using software based on the WHO Anthro program and the macros for statistical packages at http://www.who.int/childgrowth/software/en/. As per De Onis et al. (1997), the z-score is the best system for analysis and demonstration of anthropometric data.

[6]Oster (2019) also suggests that if a coefficient is stable after the inclusion of the observed controls, this can be taken as a sign that the omitted variable bias is limited.

[7]Our measure of wealth is based on the wealth index provided by DHS which is a standardised measure of economic status for households in a given survey. The households are divided into poorest, poor, middle, richer and richest households by the DHS.

[8]We also utilize the OLS estimation technique to examine the effect of contraceptive use on child health. For brevity, we do not include those results in the paper. The results are available upon request.

[9]The results from a simple OLS estimation point to similar effects of contraceptive use on both HAZ and WAZ scores. We do not report the OLS results for brevity and they are available upon request.

[10]Children whose weight-for-age z-score (WAZ) is more than 2 SD above the mean as per WHO Child Growth standards are categorized as *overweight* for age. Since we are looking at nutritional deficiency we only consider whether or not a child is underweight/stunted as our main outcome variables. We have run the analysis for the overweight category also and find that contraceptive use can lead to a small increase in likelihood of being overweight. Results can be made available upon request.

[11]Instead of controlling for birth order and multiple births, we now control for the total number of sons and total number of daughters in the household

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Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Height for Age (haz)	195323	-1.307	1.839	-6	6
Weight for Age (waz)	199394	-1.398	1.347	-6	5
Ever used contraception(Everused)	219254	0.77	0.421	0	1
Media exposure to family planning	219254	0.596	0.491	0	1
Media exposure to family planning (dist avg)	219254	0.596	0.171	0.08	0.98
Stunted	195323	0.356	0.479	0	1
Underweight	197009	0.316	0.465	0	1
Mother's characteristics					
Age (years)	219254	27.267	5.005	15	49
Education level	219254	1.569	0.977	0	3
Body Mass Index category	214280	1.317	0.977	0	3
Health insurance coverage	219254	0.27	0.444	0	1
Had iron supplements during pregnancy	165463	0.875	0.33	0	1
Number of antenatal visits	165869	5.004	5.467	0	95
Child's characteristics					
Birth order	219254	2.145	1.335	1	16
Multiple birth	219254	0.025	0.202	0	3
Heamoglobin level (g/dl)	178625	103.04	15.283	20	238
Birth size	215998	0.898	0.302	0	1
Age (months)	208026	29.625	17.482	0	59
Sex	219254	0.482	0.5	0	1
Completed Polio vaccine	102846	0.831	0.375	0	1
Completed BCG vaccine	124157	0.94	0.238	0	1
Completed DPT vaccine	107917	0.851	0.356	0	1
Completed Measles vaccine	123450	0.532	0.499	0	1
Household characeristics					
Wealth index	219254	2.65	1.376	1	5
Household size	219254	6.249	2.608	1	35
Backward caste	207776	0.835	0.371	0	1
Geographic location: rural/urban	219254	0.8	0.4	0	1
Hindu	219254	0.74	0.439	0	1
Muslim	219254	0.143	0.35	0	1
Christian	219254	0.078	0.268	0	1

Notes: The sample is restricted to a unique couple per household. We consider couples where the woman is married only once. The data provides information on all children, aged below 5 years, born to surveyed women. Mother's BMI is a categorical variable ranging from 0 for underweight to 3 for obese. The HH wealth index is a composite measure of a household's cumulative living standard and ranges from 1 (poorest) to 5 (richest). "Backward" is a binary indicator of whether the household belongs to the scheduled caste, scheduled tribe or other backward classes or not.

Table 2: Effect of Contraception use on child's anthropometric measures

Outcome variables:	**Height for age (HAZ)**			**Weight for age (WAZ)**		
	(1)	(2)	(3)	(4)	(5)	(6)
Ever used contraception	2.213***	0.739**	1.309***	1.572***	0.537**	0.464***
	(0.145)	(0.324)	(0.265)	(0.111)	(0.219)	(0.178)
Observations	202,145	69,105	69,105	206,563	70,722	70,722
Mother's Characteristics	No	Yes	Yes	No	Yes	Yes
Kid's Characteristics	No	Yes	Yes	No	Yes	Yes
HH Characteristics	No	Yes	Yes	No	Yes	Yes
State FE	No	No	Yes	No	No	Yes
First Stage F Statistic (Weak ID)	743.1	173.1	310.1	729.8	174.5	307.1
Kleibergen-Paap rK-LM Statistic (Under ID)	651.3	168.2	294.2	640.9	169.5	292.1
Endogeneity Test P-Value	0.00	0.03	0.00	0.00	0.03	0.01

Notes: Outcome variable in Columns (1)-(3) is a child's height-for-age z-score whereas in Columns (4)-(6) it is the child's weight-for-age z-score. These are standardized anthropometric measures based on the WHO Child Growth Standards and range from -6 SD to +6 SD. The main explanatory variable is a binary indicator taking the value 1 if the couple has ever used any kind of contraceptive method and 0 otherwise. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. All specifications correspond to a linear two-staged least squares estimation. Results pertain to children aged below 5 years. We have sequentially added individual mother's and child's characteristics, household controls and finally state fixed effects. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 3: First Stage estimates: Effect of media exposure on contraception use

Outcome:	**Ever used contraception**		
	(1)	(2)	(3)
Media exposure to family planning	0.290***	0.174***	0.275***
	(0.010)	(0.013)	(0.016)
Observations	228,414	71,487	71,487
Mother's Characteristics	No	Yes	Yes
Kid's Characteristics	No	Yes	Yes
HH Characteristics	No	Yes	Yes
State FE	No	No	Yes

Notes: Col (1)-(3) present the first stage estimates corresponding to our preferred instrumental variable estimates reported in Table 2. Our instrument is the district average media exposure of women to family planning information. This is created by taking a district-wide average of a binary indicator that takes the value 1 if woman i has been exposed to family planning related information on the TV, radio or newspaper and 0 otherwise. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 4: Effect on contraception use on nutritional deficiency indices- stunting and underweight

Outcome variables:	**Stunted**			**Underweight**		
	(1)	(2)	(3)	(4)	(5)	(6)
Ever used contraception	-1.392***	0.007	-0.435***	-1.343***	-0.739***	-0.368**
	(0.053)	-0.209	(0.161)	(0.058)	(0.193)	(0.167)
Average Marginal effects on:						
Probability of being malnourished	-0.449***	0.003	-0.152***	-0.421***	-0.235***	-0.118**
(haz/waz < -2)	(0.012)	(0.074)	(0.055)	(0.014)	(0.059)	(0.053)
Observations	202,145	69,105	69,105	202,145	69,105	69,105
Mother's Characteristics	No	Yes	Yes	No	Yes	Yes
Kid's Characteristics	No	Yes	Yes	No	Yes	Yes
HH Characteristics	No	Yes	Yes	No	Yes	Yes
State FE	No	No	Yes	No	No	Yes

Notes: Outcome variable in Columns (1)-(3) is a binary variable taking the value 0 if a child is not stunted and 1 if moderately/acutely stunted. Outcome variable in Columns (4)-(6) is a binary variable taking the value 0 if a child is not underweight and 1 if moderately/acutely underweight. These categorizations are based on the child's underlying HAZ and WAZ scores as defined by the WHO. With binary outcome variables, all specifications have been estimated using the conditional mixed processes estimation and the resulting marginal effects of contraception use have been reported. Individual characteristics of the mother and child, household characteristics and state fixed effects have been added sequentially. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 5: Robustness- Household level analysis

Outcome variables:	**Height-for-age (HAZ)**	**Weight-for-age (WAZ)**
	(1)	**(2)**
Ever used contraception	1.229***	0.334**
	(0.216)	(0.145)
Observations	76,781	77,893
Mother's Characteristics	Yes	Yes
Kid's Characteristics	Yes	Yes
HH Characteristics	Yes	Yes
State FE	Yes	Yes
First Stage F Statistic (Weak ID)	376.6	373.5
Kleibergen-Paap rK-LM Statistic (Under ID)	352.6	350.2
Endogeneity Test P-Value	0.000	0.027

Notes: Outcome variable in Columns (1) is a child's height-for-age z-score whereas in Columns (2) it is the child's weight-for-age z-score. These are standardized anthropometric measures based on the WHO Child Growth Standards and range from -6 SD to +6 SD. The main explanatory variable is a binary indicator taking the value 1 if the couple has ever used any kind of contraceptive method and 0 otherwise. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. All specifications correspond to a linear two-staged least squares estimation. Results are based on average child characteristics at the household level for children aged below 5 years. We have sequentially added individual mother's and average child's characteristics, household controls and finally state fixed effects. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 6: Robustness- Main estimates using NFHS-4 sample

Outcome variables:	**Height for age (HAZ)**			**Weight for age (WAZ)**		
	(1)	(2)	(3)	(4)	(5)	(6)
Ever used contraception	1.420***	0.539***	0.260**	0.910***	0.242***	-0.005
	(0.050)	(0.090)	(0.121)	(0.039)	(0.064)	(0.075)
Observations	221,008	101,125	101,125	221,008	101,125	101,125
Mother's Characteristics	No	Yes	Yes	No	Yes	Yes
Kid's Characteristics	No	Yes	Yes	No	Yes	Yes
HH Characteristics	No	Yes	Yes	No	Yes	Yes
State FE	No	No	Yes	No	No	Yes
First Stage F Statistic (Weak ID)	4029	1169	723	4029	1169	723.0
Kleibergen-Paap rK-LM Statistic (Under ID)	2574	1032	629.2	2574	1032	629.2
Endogeneity Test P-Value	0.000	0.000	0.0450	0.000	0.003	0.762

Notes: Outcome variable in Columns (1)-(3) is a child's height-for-age z-score whereas in Columns (4)-(6) it is the child's weight-for-age z-score. These are standardized anthropometric measures based on the WHO Child Growth Standards and range from -6 SD to +6 SD. The main explanatory variable is a binary indicator taking the value 1 if the couple has ever used any kind of contraceptive method and 0 otherwise. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. All specifications correspond to a linear two-staged least squares estimation. Results pertain to children aged below 5 years. We have sequentially added individual mother's and child's characteristics, household controls and finally state fixed effects. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 7: Robustness- Nutritional deficiency estimates using NFHS-4 sample

Outcome variables:	**Stunted**			**Underweight**		
	(1)	(2)	(3)	(4)	(5)	(6)
Ever used contraception	-1.005***	-0.423***	-0.395***	-0.768***	-0.125*	0.035
	(0.024)	(0.066)	(0.092)	(0.029)	(0.069)	(0.095)
Average Marginal effects on:						
Probability of being malnourished	-0.344***	-0.149***	-0.139***	-0.268***	-0.042*	0.012
(haz/waz < -2)	(0.006)	(0.023)	(0.032)	(0.009)	(0.023)	(0.032)
Observations	221,008	101,125	101,125	221,008	101,125	101,125
Mother's Characteristics	No	Yes	Yes	No	Yes	Yes
Kid's Characteristics	No	Yes	Yes	No	Yes	Yes
HH Characteristics	No	Yes	Yes	No	Yes	Yes
State FE	No	No	Yes	No	No	Yes

Notes: Outcome variable in Columns (1)-(3) is a binary variable taking the value 0 if a child is not stunted and 1 if moderately/acutely stunted. Outcome variable in Columns (4)-(6) is a binary variable taking the value 0 if a child is not underweight and 1 if moderately/acutely underweight. These categorizations are based on the child's underlying HAZ and WAZ scores as defined by the WHO. With binary outcome variables, all specifications have been estimated using the conditional mixed processes estimation and the resulting marginal effects of contraception use have been reported. Individual characteristics of the mother and child, household characteristics and state fixed effects have been added sequentially. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 8: Heterogeneity Analysis

	Male Child	Female Child	Upper caste	Backward caste	Urban	Rural	Rich	Poor
	Panel (a): Height for age (HAZ)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ever used contraception	0.741**	2.007***	0.309	1.516***	0.584	1.512***	0.862***	1.752***
	(0.320)	(0.402)	(0.667)	(0.283)	(0.569)	(0.304)	(0.333)	(0.409)
Observations	36,412	32,693	12,056	57,049	14,294	54,811	36,872	32,233
First Stage F Statistic	224.2	147.6	52.55	275.2	73.13	237.1	194.2	141.8
Kleibergen-Paap rK-LM Statistic	213.7	142.4	50.63	262.5	70.12	225	183.9	136.4
Endogeneity Test P-Value	0.023	0.000	0.661	0.000	0.295	0.000	0.009	0.000
	Panel (b): Weight for age (WAZ)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ever used contraception	0.295	0.656**	0.483	0.473**	0.062	0.577***	0.350	0.555**
	(0.222)	(0.256)	(0.500)	(0.185)	(0.438)	(0.196)	(0.237)	(0.260)
Observations	37,350	33,372	12,338	58,384	14,627	56,095	37,695	33,027
Mother's Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Kid's Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HH Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First Stage F Statistic	222.2	146.8	53.66	271.1	64.55	242.6	193	140.4
Kleibergen-Paap rK-LM Statistic	211.9	141.9	51.73	259.2	62.70	230.3	183.1	135.4
Endogeneity Test P-Value	0.196	0.01	0.338	0.012	0.883	0.004	0.163	0.033

Notes: This table illustrates the heterogeneity of our estimates by sex of the child, household caste, geographic location and wealth status. In Panel (a) the outcome variable is a child's height-for-age z-score whereas in Panel (b) it is a child's weight-for-age z-score. Columns (1)-(8) correspond to our preferred IV-TSLS estimation with the full set of controls and state fixed effects. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 9: Potential mechanism- Impact of contraception use on household size

Outcome variable:	**Household size**	
	Child-level	**HH level**
	(1)	(2)
Ever used contraception	-0.069***	-0.120***
	(0.024)	(0.020)
Observations	71,487	78,441
Mother's Characteristics	Yes	Yes
Kid's Characteristics	Yes	Yes
HH Characteristics	Yes	Yes
State FE	Yes	Yes

Notes: Outcome variable in both specifications is the household size. The main explanatory variable is a binary indicator taking the value 1 if the couple has ever used any kind of contraceptive method and 0 otherwise. In Column (1) we estimate the impact using individual child-level data and controls. In Column (2) we estimate the impact using household level data and average child characteristics for every household. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. All specifications correspond to a linear two-staged least squares estimation. We have included mother's and child's characteristics, household controls and finally state fixed effects. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.

Table 10: Potential mechanism- Impact of household size on child health

Outcome variables:	**HAZ**		**WAZ**	
	Child-level (1)	HH-level (2)	Child-level (3)	HH-level (4)
Household size	-1.253***	-0.974***	-0.448**	-0.262**
	(0.459)	(0.256)	(0.222)	(0.125)
Observations	69,105	76,781	70,722	77,893
Mother's Characteristics	Yes		Yes	
Kid's Characteristics	Yes		Yes	
HH Characteristics	Yes		Yes	
State FE	Yes		Yes	

Notes: Outcome variable in columns (1)-(2) is a child's height-for-age z-score whereas in columns (3)-(4) it is a child's weight-for-age z-score. The main explanatory variable is the size of a household. In Column (1) and (3) we estimate the impact using individual child-level data and controls. In Column (2) and (4) we estimate the impact using household level data and average child characteristics for every household. The sample is restricted to a unique couple per household. We only consider couples where the woman is married once. All specifications correspond to a linear two-staged least squares estimation. We have included mother's and child's characteristics, household controls and finally state fixed effects. Standard errors (in parentheses) are clustered at the cluster level. ***, **, and * represent significance at 1%, 5% and 10%, respectively.