TestMaternal Cash Transfers and Child Nutrition: Evidence from India

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Abstract

The effectiveness of conditional cash transfers (CCTs) on short term nutritional outcomes such as household food intake and dietary diversity is well established globally. However, literature on the effects of CCTs on medium and long term outcomes, which include child wasting and stunting, is ambiguous. Evidence from India, where more than a third of children under the age of 5 are stunted and one-fifth are wasted, is particularly sparse. In 2011, Odisha state in eastern India introduced a CCT scheme named "Mamata". Intended as a partial wage compensation for pregnant and lactating women, the program also aimed at improving health service utilization and infant and young child feeding (IYCF) practices. This paper provides the first causal estimates of the effect of the Mamata scheme on nutritional outcomes of young children in Odisha. Following increases in national budgetary allocations and implementation of conditional maternity benefit schemes throughout India since 2017, it is important to understand program impacts that go beyond uptake and short-term consumption. I use two rounds of the nationally representative India National Family Health Survey (n=8726) to test the effect of the Mamata Scheme on two anthropometric measures of child nutrition: wasting and stunting. Difference-in-difference intention-to-treat (ITT) regression estimates find that being eligible for receiving Mamata benefits improves weight-for-height (WHZ) for children between 0-5 years of age, but has no statistically significant effect on height-for-age (HAZ). Disaggregated analyses show that improvements in WHZ are concentrated amongst male children (compared to female). The findings have the following policy implications. First, cash transfer programs may need to specifically target female children to improve girls' nutritional status in the Indian context. The findings on a lack of reduction in stunting suggest that improvements in nutritional status may attenuate with time, if complementary factors such as maternal education, access to clean water and sanitation, care practices and health care do not improve. Reducing long-term malnutrition in India may require a more comprehensive set of interventions that include CCTs as well as other policies to improve health care, sanitation, and maternal education.

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Section 1: Introduction

Globally, around 144 million children under the age of five are stunted, and an estimated 47 million worldwide suffer from wasting (WHO, 2019). In India, child undernutrition in the form of wasting and stunting persists, despite rapid economic growth following economic liberalization in 1991. In 2015-16 (NFHS-4, 2015), 38% of Indian children under the age of 5 were stunted, and 21% suffered wasting, representing over 70 million children (Global Nutrition Report, 2018). To address this large but solvable problem, Central and state governments in India have adopted various policies to improve child well-being, among which cash transfers (CTs) targeted to pregnant and lactating women have gained prominence in recent years.

Programs that target pregnant and nursing mothers are important, as poor maternal health has adverse consequences on child mortality and nutrition (Black et al., 2013), and women in low and middle-income countries (LMICs) often face barriers to accessing crucial maternity care services (Hunter & Murray, 2017). Further, a large body of evidence in demography, economics, and public health shows that nutritional deficits that both occur in-utero and at the start of life are especially detrimental for human capital outcomes including educational attainment, height and wealth in adulthood (Behrman, 2016; Bleakley, 2010; Case et al., 2005; Currie & Almond, 2011; Glewwe et al., 2001; Cesar G. Victora et al., 2008). Thus, interventions introduced in-utero and during early childhood (first 1000 days of life) are likely to be most effective in reducing cognitive impairments and enhancing economic productivity in adulthood (Hoddinott et al., 2008).

Globally, many CT programs, both conditional and unconditional, target female beneficiaries and/or households with children under 5 years. However, fewer programs specifically target pregnant and nursing mothers and cover only the first two children. Existing work examining CTs and health and nutrition largely focuses on means-tested programs in Latin America and sub-Saharan Africa, most of which do not restrict recipient status to pregnant and nursing mothers. This raises the issue of the extent to which targeting pregnant and nursing women through non means-tested programs affects children's well-being.

Additionally, existing literature on CTs and health and nutrition largely finds improvements in first-order outcomes such as food and health expenditure, and intermediate outcomes such as household dietary diversity and use of health services (see Bastagli et al., 2016 for a review), evidence on third order or "final" outcomes such as child anthropometry is limited and mixed (ibid.). The impact of CTs on children's nutrition is particularly underexplored in the populous Indian context. Also, few studies disaggregate CT program effects on child nutrition by child gender, important for contexts such as India with documented son preference.

My paper examines the long-run effects of a conditional cash transfer (CCT) targeted to pregnant and lactating mothers in India on child nutrition. In 2011, the state government of Odisha launched the "Mamata Scheme", a CCT program that aims to serve as a partial wage compensation for pregnant and nursing mothers, to increase health service utilization, and improve infant & young child feeding practices. Under the Mamata Scheme, all pregnant and lactating women in the state aged 19 or older receive a cash payment for their first two children upon fulfilling health-related conditionalities. The program operates in all districts in the state and is not means-tested, unlike many other CTs. Between 2011 and 2019, more than USD 242 million was disbursed to around 3.9 million pregnant and lactating women in Odisha through the Mamata Scheme (Pragativadi, 2019).

Exploiting exogenous variation in program eligibility, I investigate the long-run effects of the Mamata Scheme on children's nutrition (standardized weight and height measures for children under 5). My paper is one of the few studies examining the impact of a non means-tested CT targeted at pregnant and lactating mothers on children's well-being. Using two repeated cross-sections of nationally representative survey data from the National Family Health Survey (NFHS), I assign each child under the age of 5 to a treatment and comparison group, based on their mother's age and child birth order. I estimate the intent-to-treat program effects on wasting and stunting for children under 5 years of age, controlling for birth year and month fixed effects and unobserved time trends that may vary by a child's birth order. The main source of identification comes from program eligibility criteria which stipulate that a) only mothers aged 19 and above are eligible for the cash benefit and b) cash benefits are limited to first and second-born children.

I find that for children of women exposed to the program, the weight-for-height z-score (WHZ), a measure of wasting, increased by 0.12 standard deviations. However, there was no statistically significant increase in the height-for-age z-score, a measure of stunting. I find evidence of differential program effects by gender, as the effect on WHZ for a girl child is 0.2 standard deviations lower than that for boys. I find no evidence of heterogenous effects by household wealth, significant as the Mamata Scheme is not means-tested. Overall, my findings suggest that conditional cash transfers targeted to pregnant and nursing mothers are an effective policy intervention to reduce wasting, which is a short term response to inadequate calorie intake or illness. However, reductions in stunting, which is a long-term manifestation of undernutrition, may require more sustained interventions.

The rest of my paper is organized as follows. The next section reviews the literature on cash transfers and early-childhood nutrition. Section 3 describes the Mamata Scheme. Section 4 discusses the data. Section 5 and 6 present the identification strategy and results, respectively. Section 7 describes robustness checks, and Section 8 concludes.

Section 2: Nutrition in Early Childhood and Cash Transfer Programs

The first 1000 days from conception to 2 years of age provide a key window of opportunity to shape a child's future health outcomes (Victora et al., 2010; http://www.thousanddays.org). A large body of research in demography, economics and public health shows that nutritional deficits during the first 1000 days negatively affect a range of human capital outcomes in later life, including educational attainment, height, wealth, mental and physical health (Behrman, 2016; Bleakley, 2010; Case et al., 2005; Currie & Almond, 2011; Glewwe et al., 2001; Cesar G. Victora et al., 2008). For nutritional deficits that occur in-utero or at the start of life, the effects on a child's mental (Grantham-McGregor et al., 1999; Pollitt, 1990) and physical growth (Christian & Dillon,

2018) and mortality (Moore et al., 1997) are particularly adverse. Further, these effects may manifest at different stages in the life course, starting from later childhood (Sigman et al., 1991) to adolescence (Mendez & Adair, 1999) and adulthood (Hoddinott et al., 2011). Thus, interventions introduced during pregnancy and the post-natal period are likely to be most effective in reducing cognitive impairments and enhancing economic productivity in adulthood (Dewey, 2016; Hoddinott et al., 2008)

A growing number of low and middle-income countries (LMICs) continue to adopt CTs as part of their social protection strategy to improve children's nutrition and health outcomes. As of 2016 (Bastagli et al., 2016), some 130 LMICs had at least one UCT, and 63 countries had at least one CCT program. CTs may affect children's nutritional outcomes through different pathways. First, by increasing household disposable income, CTs may improve the quality and quantity of household food consumption, either through food purchases and/or investments in food production (Groot et al., 2017). Secondly, additional cash or in the case of CCTs, program conditionalities, may incentivize higher investment in or use of health inputs such as immunization, preventative health care, transportation to health facilities, medicines, safe drinking water and sanitation (ibid.). Cash transfers often target women (The World Bank, 2011), operating under two assumptions: first, that women will spend money differently than men, resulting in better children's outcomes and second, that they will empower women.

Many CTs target women, poor households and/or households with children under 5 years. However, fewer programs specifically target women during pregnancy and the post-natal period. Recent evidence from economics (Chari et al., 2019), and medicine and epidemiology (Cai et al., 2020; Takito et al., 2009) demonstrates that work-related stress during pregnancy is associated with adverse birth outcomes in an LMIC context. Maternal undernutrition is also associated with reduced fetal growth, which increases the risk of neonatal deaths and stunting by 2 years of age (Black et al., 2013). Inadequate breastfeeding increases mortality risk in the first 2 years of life (ibid.). Together, this evidence offers support for providing wage compensation to pregnant and nursing mothers. By means of partial wage compensation, cash transfers targeted to pregnant and nursing mothers may incentivize a reduction in excessive work-related physical activity and exertion during pregnancy, improve diets and incentivize breastfeeding, with implications for children's outcomes.

My paper adds to the literature by providing new evidence on the impact of a maternal cash benefit scheme in India. There is little existing work on how mothers' exposure to cash benefits during pregnancy and the post-natal period affects long-run well-being for their children. A large body of work examines the effect of cash transfers on maternity care services (see Hunter & Murray, 2017 for a review). A few studies also examine the effect of broader programs that include a maternal CT component on health service use (Benedetti et al., 2015) or birthweight (Saville et al., 2018). However, to the best of my knowledge, there is no study that investigates the effect of a non means-tested CT which *only* targets pregnant and nursing mothers on child nutrition. I also make an important contribution to the literature on the impact of CT program design on long-run effects. Unlike many other programs, the Mamata Scheme is not means-tested in any of the treated districts in Odisha. This raises the issue of the extent to which beneficiary selection based on wealth affects children's long-run outcomes.

Recent evidence on Indian CT programs focuses on the "Janani Suraksha Yojana (JSY)", a national CCT program aimed at increasing institutional delivery and use of reproductive and child-health related services. JSY evaluations have demonstrated positive impacts on institutional births and receipt of antenatal care (Lim et al., 2010; Randive et al., 2013), although evidence also points to poor service quality and targeting and unintended consequences on fertility (Nandi & Laxminarayan, 2016; Powell-Jackson et al., 2015). In 2017, the Central Government of India launched the "Pradhan Mantri Matru Vandana Yojana (PMMVY)", a national CCT program targeted to pregnant women and nursing mothers in all districts in the country. As of 2019-2020, the central government allocation to PMMVY is over USD 300 million (Shukla & Kapur, 2019). Against this backdrop of large annual budgetary allocations to the national CCT program, the question whether CCTs targeted to pregnant and lactating women affect children's nutrition remains underexplored.

Section 3: The Mamata Scheme

3.1: Background

Odisha (formerly Orissa) is a state in eastern India. With a population of over 42 million in 2011 and an estimated poverty rate of 32.6% (Thomas et al., 2015), Odisha is one of the poorest states in India. However, over the last 30 years, Odisha has made significant gains in reducing child undernutrition (stunting) and improving health service delivery, compared to many other economically better off states in the country. Political leadership that enabled policy implementation, combined with financial and technical assistance from several international development partners contributed to strong implementation of different national programs (Kohli et al., 2017). These include the Integrated Child Development Scheme (ICDS) which delivers supplementary nutrition, health education, immunization and health check-ups to pregnant women, lactating mothers, adolescent girls and children under 6 years through community health centres; the multi-pronged National Rural Health Mission (NHRM), which included the introduction of Accredited Social Health Activists (ASHAs) as community health educators and a conditional cash transfer (Janani Suraksha Yojana) to incentivize institutional deliveries and the Public Distribution System (PDS), a national food grain subsidy program.

3.2 Program Description

Launched in September 2011, "Mamata" is a CCT program in Odisha. The program aims to serve as a partial wage compensation to pregnant and nursing mothers, to increase health service utilization, and improve infant & young child feeding practices. As of 2016, the scheme consisted of cash transfers of INR 5000 (USD 70) made in four installments[3] to the beneficiary, starting with the end of the second trimester up to 9 months of age for the infant. As of 2020, INR 5000 forms about 5% of annual per capita income in the state (Odisha Economic Survey, 2020). Per Odisha government guidelines, all women over the

[3] Since 2017, the total amount of INR 5000 is disbursed in two installments with accompanying conditionalities (Department of Women & Child Development, Government of Odisha). This change does not affect the present analysis which examines outcomes as of 2015-16.

age of 19 years with up to two live births are eligible for receiving the cash transfer[4], upon fulfilment of several accompanying conditions. These vary by installment stage and include pregnancy and childbirth registration, antenatal check-ups, mother and child immunization, counseling towards Infant and Young Child Feeding (IYCF) practices, children's weight checkups, exclusive breastfeeding for 6 months, introduction of age-appropriate complementary foods and receipt of IFA tablets and Vitamin A dose.

To date, only one paper (Raghunathan et al., 2017) evaluates the effect of the Mamata Scheme on child and household outcomes. This study uses a single cross-sectional survey that is not representative at the state level, and finds a positive association between the Mamata scheme on health utilization outcomes including pregnancy registration, receipt of antenatal services, receipt of iron and folic acid (IFA) tablets, exposure to counseling during pregnancy, exposure to postnatal counseling, exclusive breastfeeding, full immunization, and household food security. While these results are encouraging, it is not surprising that program enrolment has a positive effect on health utilization, given that these are program conditionalities. My study is the first paper to examine the impact of the Mamata Scheme on wasting and stunting.

Analysis of the Mamata Scheme is of particular interest as several of its program design components may be "enabling" towards achieving longer-term nutrition gains. First, the cash transfer forms a significant amount (5%) of average annual household income in Odisha state (Odisha Economic Survey, 2020). Second, the program is targeted at pregnant and lactating mothers, which covers a period within the first 1000 days of life for children, when cash transfers may have larger potential to improve anthropometric measures. Third, conditionalities include behavior change components such as counseling sessions and micronutrient supplements. These program design features align with related evidence on CT design and implementation that highlights the relevance of transfer size (Manley et al., 2015), timing (Bhatia et al., 2013), recipient gender

[4] Starting in 2014, women in Particularly Vulnerable Tribal Groups (PVTG) were exempted from both eligibility criteria, and became universally eligible. While in theory this may bias econometric estimation results downwards, as these women cannot be identified in the data, I do not expect any significant effects given that PVTG women form less than 1% of the sample.

(Yoong et al., 2012) and complementary actions such as nutritional supplements and behavior change training (Bastagli et al., 2016) for positive impacts on child anthropometry. Table 1 outlines the stage wise conditionalities of the Mamata scheme (as of 2016).

Table 1: Mamata Scheme Conditionalities

<table>
<tr>
<td>Instalment 1 (end of second trimester: INR 1500)
• Register pregnancy at AWC
• Receive at least one ANC (optimal 3)
• Receive IFA tablets
• Receive at least one TT vaccination (optimal 2)
• Receive at least one counseling session at the AWC/Village Health and Nutrition Day (VHND)

Verification
• MCP Card
• Scheme Register</td>
<td>Instalment 2 (3 months after delivery: INR 1500)
• Register child's birth
• Child has received BCG vaccination
• Child has received Polio 1 and DPT-1 vaccination
• Child has received Polio 2 and DPT-2 vaccination
• Child has been weighed at least 2 times since birth (optimal 4)
• Mother has attended at least two IYCF counseling sessions at the AWC/ VHND/ Home visit (optimal 3)

Verification
• MCP Card
• Scheme Register</td>
</tr>
<tr>
<td>Instalment 3 (6 months after delivery: INR 1500)
• Child has been exclusively breastfed for first 6 months (self-reported by mother)
• Child has been introduced to complementary foods upon completing 6 months
• Child has received Polio 3 and DPT-3 vaccination
• Child has been weighed at least 2 times between 3 and 6 months (optimal 3)
• Mother has attended at least two IYCF counseling sessions between 3 and 6 months of lactation at the AWC/ VHND/ Home visit (optimal 3)

Verification
• MCP Card
• Scheme Register
• Self-certification on MCP card</td>
<td>Instalment 4 (9 months after delivery: INR 1000)
• Child has received measles vaccine before one year
• Child has received first dose of Vitamin A before one year
• Age appropriate complementary feeding is introduced and continuing
• Child has been weighed at least two times between 6 and 9 months

Verification
• MCP Card
• Scheme Register
• Self-certification on MCP card</td>
</tr>
</table>

Reproduced from (Aswathy et al., 2014)

Notes - MCP: Mother Child Protection; AWC: Anganwadi Center; AWW: Anganwadi Worker; IFA: Iron Folic Acid; ANC: Antenatal Care; TT: Tetanus Toxoid; DPT: Diptheria, Pertusis (Whooping Cough); BCG: Bacillus, Calmette and Guerin; IYCF: Infant and Young Child Feeding

Section 4: Data

4.1: Survey

The data used in this study is from two cross-sections of the National Family Health Survey India (NFHS-3 and NFHS-4). NFHS is a nationally representative, repeated cross-sectional survey of households throughout India conducted in four waves between 1992 and 2016. Following the format of demographic and health surveys conducted worldwide, its main purpose is to provide information on maternal and child health, nutrition, and family welfare in India. The International Institute of Population Studies, Mumbai is the nodal agency coordinating the NFHS, with funding for different rounds provided by the Government of India, USAID, UNICEF, DIFD and the Bill and Melinda Gates Foundation.

The third round of NFHS (NFHS-3), conducted 5-6 years prior to the implementation of the Mamata scheme in Odisha, is considered as the baseline survey in this study. NFHS-3 was carried out in two phases from November 2005 to August 2006 in all 29 Indian states. Nationally, 109,041 households were sampled. The Odisha sample for NFHS-3 consists of 3910 households and is representative at the urban, rural, and state level. 4540 women between 15-49 years and 1592 men aged 15-54 years were interviewed from all the selected households. NFHS-3 includes household-level, women's, and men's questionnaires. The household questionnaire includes details on child anthropometry, the outcome variable of interest in this study. This covers height and weight measurements for all children born after 2001.

NFHS-4, carried out in two phases from January 2015 to December 2016, sampled 601,509 households nationally. Within Odisha state, it covered a representative sample of 30,242 households, interviewing 33,721 women aged 15-49 and 4,634 men aged 15-54.

NFHS-4 includes four questionnaires: household, women, men, and a separate module for biomarker measurements. Conducted 4-5 years after Mamata was implemented in Odisha, NFHS-4 is the endline survey for this paper. Figure 1 depicts the timeline of NFHS data collection vis-à-vis the introduction of the Mamata Scheme.

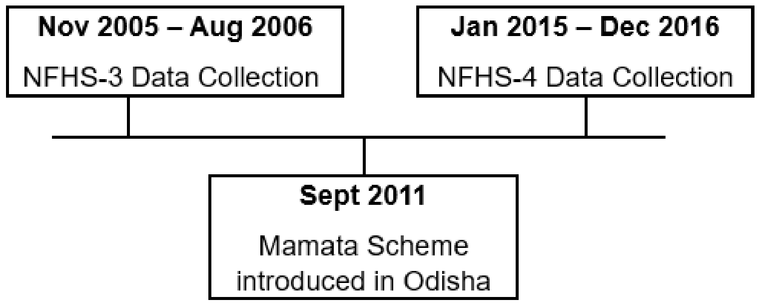

Fig 1: Timeline - Mamata Implementation and NFHS Survey Data Collection

4.2: Sample

The unit of observation in the analysis is an individual child. Mamata eligibility criteria include women who are a) residents of Odisha, b) are 19 years and older and c) have two or fewer children[5,6]. Thus, the treatment group comprises of children with birth order 1 or 2, born to women in Odisha who are 19 and older. This covers children from 0 – 4 years 11 months of age, with the first cohort of eligible children born in January 2012. As the first installment of Mamata benefits was made available to eligible women at the end of 6 months of pregnancy, the earliest cohort of eligible children would be born 3 months after the program started in September 2011. This assumes a typical gestational length of 9 months. The comparison group consists of children in Odisha with birth order higher than 2, or who were born to women younger than 19 years at the time of the child's birth.

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[5] Starting in 2014, women in Particularly Vulnerable Tribal Groups (PVTG) were exempted from both eligibility criteria, and became universally eligible. While in theory this may bias econometric estimation results downwards, as these women cannot be identified in the data, I do not expect any significant effects given that PVTG women form less than 1% of the sample (Census of Odisha, 2001).

[6] Government employees and their wives are not eligible for Mamata cash benefits. However, the survey instrument does not allow for identification of government employees. While in theory this may bias econometric estimation results downwards, I do not expect any significant effects given that government employees form less than 1% of the Odisha's population (Census of Odisha, 2001).

Table 2: Mamata Scheme Eligibility

Treatment Group **Odisha Eligible**	**Comparison Group** **Odisha Ineligible**
Age of mother: 19 – 49 years AND Child's birth order: 1, 2	Age of mother: 15 – 18 years OR Child's birth order: 3 and higher

4.3: Main Variables

The primary outcome of interest in the analysis is child anthropometry. The first indicator of undernutrition is wasting. Per World Health Organization (WHO, 2014) guidelines, a weight-for-height z-score that is two or more standard deviations (S.D) below the WHO Child Growth Standards Median classifies as moderate wasting, while a z-score three or more S.D. below the reference median is considered as severe wasting. The second measure, stunting, is defined as a height-for-age z-score (HAZ) that is two or more S.D below WHO medians for well-nourished populations (ibid.). Both NFHS-3 and NFHS-4 include height and weight measurement for all children under 5 years of age. I calculate child-specific z-scores for both indicators, following WHO's (World Health Organization, 2006) methodology for computation of z-scores. This also includes adjustments for z-scores beyond ± 3 S.D., to better reflect the population distribution.

4.4: Summary Statistics

Table 3 compares average characteristics and nutrition outcomes for the treatment and comparison groups, both in the period before and after the Mamata Scheme was introduced. Mamata eligibility centered around two main criteria, age of mother (>=19yrs) and number of live births (<2). As Table 3 demonstrates, eligible mothers in Odisha were younger than ineligible mothers in both pre and post-periods. While this may seem counterintuitive, ineligible mothers have a higher number of and older children on average, which may explain the age difference. The treatment group has higher z-scores on average for both nutritional outcome measures (WHZ, HAZ) in both periods (All nutritional measures are for children). On average, ineligible mothers were also less educated, belonged to less wealthy households and were more likely to be socially disadvantaged (Scheduled caste/tribe).

I include child, mother, and household level characteristics from the survey as covariates. At the child level, these are age, gender, months of breastfeeding and number of vaccines. While summary statistics for breastfeeding duration and number of vaccines for both women and children are shown below, I do not include these as covariates in the difference-in-difference specifications, as they are likely to be affected by the program (as conditionalities). Mother-level characteristics included in the models are mother's age, education, and number of live children born. Finally, household-level characteristics that I make use of cover household size and wealth, gender, and education of household head, whether the household is rural, household religion and caste. I also include measures of distance to health facilities and access to piped drinking water as these are likely to affect children's nutritional outcomes.

Table 3: Summary Statistics for Treatment and Comparison groups from Odisha in both pre- and post-Mamata periods (sample limited to households with children under 5 years).

	Pre-Mamata (2005-06)		**Post-Mamata (2015-16)**	
	Odisha Eligible mean/sd	**Odisha Ineligible mean/sd**	**Odisha Eligible mean/sd**	**Odisha Ineligible mean/sd**
Child level characteristics				
Gender of child (Girl=1)	0.454	0.486	0.491	0.478
	(0.498)	(0.500)	(0.500)	(0.500)
Child age in years	2.430	2.550	2.419	2.527
	(1.153)	(1.107)	(1.130)	(1.116)
No. of vaccines received	6.134	5.770	7.170	6.830
	(2.872)	(2.861)	(1.999)	(2.373)

Months of breastfeeding	20.927	20.851	18.552	19.047
	(12.229)	(11.941)	(14.023)	(14.395)
Mother level characteristics				
Mother's age in years	26.230	26.837	26.742	28.074
	(3.937)	(6.200)	(3.958)	(6.486)
Mother completed secondary education	0.571	0.210	0.660	0.366
	(0.495)	(0.407)	(0.474)	(0.482)
No. of tetanus injections mother received during pregnancy	2.111	1.871	1.992	1.942
	(0.733)	(0.957)	(0.609)	(0.629)
No. of children born to Mother	1.741	3.454	1.643	3.157
	(0.641)	(1.753)	(0.603)	(1.507)
Household level characteristics				
Household size	6.005	6.240	5.233	5.849
	(2.809)	(2.265)	(2.103)	(1.844)
Wealth Index (1/2/3 Poor/Middle/Rich)	1.900	1.416	1.623	1.268
	(0.875)	(0.702)	(0.808)	(0.579)
Rural	0.705	0.784	0.818	0.870
	(0.456)	(0.412)	(0.386)	(0.336)
Household head is female	0.075	0.080	0.100	0.082
	(0.264)	(0.272)	(0.299)	(0.275)
Household head completed secondary education	0.491	0.274	0.527	0.345
	(0.500)	(0.446)	(0.499)	(0.475)
Scheduled Caste/Tribe	0.598	0.785	0.823	0.913
	(0.491)	(0.418)	(0.382)	(0.311)
Hindu	0.959	0.946	0.936	0.904
	(0.199)	(0.227)	(0.244)	(0.295)
Health facility is too far	0.336	0.437	0.365	0.452
	(0.473)	(0.496)	(0.481)	(0.498)

In-house access to piped drinking	0.098	0.032	0.088	0.040
water	(0.298)	(0.176)	(0.284)	(0.195)
Nutrition Outcomes				
WHZ (weight-for-height, z-score)	-0.913	-1.136	-0.989	-1.287
	(1.263)	(1.218)	(1.353)	(1.302)
HAZ (height-for-age, z-score)	-1.411	-2.001	-1.226	-1.618
	(1.568)	(1.565)	(1.589)	(1.546)
Observations	560	625	4950	2740

4.5: NFHS-2 Data

I also use data from the previous round of the NFHS, which was conducted from 1998-1999 mainly to examine the parallel trends assumption, both in visual and formal tests. NFHS-2 is representative and the national and state levels, and the primary outcome variable of interest from this survey round is child anthropometry, as in consequent rounds.

Section 5: Identification Strategy

Mamata targeted women in Odisha state who were 19 and older and had fewer than 2 live births. Based on these criteria, I estimate the Intent-to-Treat effect of the program on first and second born children of women who are 19 and older. Since program assignment is not strictly "random", merely comparing outcomes for first and second born children of women aged over 19 to first and second born children of women under 19 would not yield accurate estimates of program effects. Given that program eligibility is based on an interaction of mother's age and the child's birth order, I use difference-in-difference, an estimation strategy that exploits variation across two dimensions, namely, across time and across groups. I provide more details for the estimation strategy below.

5.1 Difference-in-difference (DID)

I estimate a difference-in-difference specification as below:

$$Y_{ijt} = \beta_0 + \beta_1 \left(Eligible * 2015 \right)_{jt} + \beta_2 \left(Eligible \right)_{jt} + \beta_3 \left(BirthOrder <= 2 * 2015 \right)_{jt} + \beta_4 (2015) + \gamma \mathbf{X}_{ijt} + \eta_t + \varepsilon_{ijt} \quad (1)$$

Each individual child is indexed by i, Y_{ijt} is the outcome (HAZ, WHZ) for child i, born to woman j at time t. β_1 is the DID estimate that indicates the change in nutritional outcomes for eligible children, between the pre- and post-Mamata periods in Odisha, accounting for changes in nutritional outcomes for the comparison group from Odisha during the same period. $Eligible_{jt}$ indicates whether child *j* belongs to the treatment group (= 1) or the comparison group (= 0) during time *t*. $Post_{jt}$ is a dummy variable which is equal to 1 if child *i* belongs to the dataset after the implementation of the Mamata program (NFHS-4), and zero otherwise. *BirthOrder*<=2 * 2015 is an interaction term which equal to 1 if the child is first or second-born and belongs to the NFHS-4 dataset, and zero otherwise. This controls for time-varying unobservables that may be trending differently between children of different birth orders[7]**.** η_t are birth year x birth month fixed effects, which include a dummy for each month and year of birth for child *i*. These control for time-varying unobservables that are common to treatment and comparison groups. ε_{ijt} is the error term and $\mathbf{X}_{ijt}$ is a vector of arguably exogenous control variables. Standard errors are clustered at birth order of child *i*, as treatment assignment is based on a child's birth order[8]. This will account for correlation between outcomes for children of the same birth order. The primarily underlying assumption of the difference-in-difference strategy is that nutritional outcomes for children in the treatment and comparison groups would have followed the same trend, in the absence of the program. In Section 7, I perform visual and formal tests of this assumption.

[7] I do not add an interaction term for *MotherAge*>=19 * 2015, due to a lack of variation in mother's age for children with birth order>=2. Only 0.2% of all children in the sample (19 out of 8875 obs.) were born to a mother younger than 19 years of age and had a birth order of 3 or more.

[8] Alternatively, standard errors may be clustered on age of woman *j*, the other program eligibility criterion, to account for correlation between outcomes for children born to mothers of similar age.

Section 6: Results

6.1: DID Odisha

Stunting

Table 4 presents results from the DID specification for height-for-age (HAZ). The dependent variable is the z-score of height-for-age, a measure of stunting. Model 1 is the baseline DID specification, which also accounts for unobserved time trends by parity. Model 2 adds an interaction term for poor households (defined as the bottom two quintiles of a national wealth classification). Model 3 adds an interaction term for child gender (female child=1). While Model 1 suggests that being eligible for Mamata is associated with lower height-for-age, the point estimates in Models 2 and 3 are no longer statistically significant. Confidence intervals in all three models do not include substantial positive effects.

Table 4: Mamata and Child Stunting: DID Regression of Eligible vs. Ineligible Groups within Odisha State

Dependent Variable: Height-for-age z-score for children under 5 years of age

VARIABLES	(1) HAZ	(2) HAZ	(3) HAZ
Eligible x Post	-0.19**	-0.12	-0.16
	(0.06)	(0.10)	(0.13)
(Birth Order<=2) x Post	0.19**	0.21**	0.21**
	(0.08)	(0.08)	(0.07)
Eligible	0.23***	0.25***	0.25***
	(0.07)	(0.06)	(0.06)
Post	-1.04	-1.07	-1.08
	(1.26)	(1.24)	(1.24)
Poor x Eligible x Post		-0.13	-0.13
		(0.10)	(0.10)
Female Child x Eligible x Post			0.06
			(0.08)
Gender of child (Girl=1)	0.01	0.01	-0.03
	(0.03)	(0.03)	(0.07)
Child age in years	-1.18***	-1.18***	-1.18***
	(0.27)	(0.27)	(0.27)
Size at birth = Large	0.06	0.06	0.06
	(0.05)	(0.05)	(0.05)

Size at birth = Small	-0.27***	-0.27***	-0.27***
	(0.05)	(0.05)	(0.05)
Mother's age in years	0.01**	0.01**	0.01**
	(0.00)	(0.00)	(0.00)
Mother completed secondary education	0.19***	0.18***	0.18***
	(0.05)	(0.05)	(0.05)
Household size	0.02**	0.02**	0.02**
	(0.01)	(0.01)	(0.01)
Household Wealth Index (1/2/3 Poor/Middle/Rich)	0.29***	0.24***	0.24***
	(0.03)	(0.04)	(0.04)
Household head is female	0.11**	0.11**	0.11**
	(0.05)	(0.05)	(0.05)
Household head completed secondary education	0.07**	0.08**	0.07*
	(0.03)	(0.03)	(0.03)
Rural	0.03	0.02	0.02
	(0.04)	(0.05)	(0.05)
Scheduled Caste/Tribe	-0.31***	-0.32***	-0.31***
	(0.03)	(0.03)	(0.03)
Hindu	0.05	0.05	0.05
	(0.07)	(0.07)	(0.07)
Health facility is too far	-0.05	-0.05	-0.05
	(0.04)	(0.04)	(0.04)
In-house access to piped drinking water	0.04	0.04	0.04
	(0.04)	(0.04)	(0.04)
Constant	2.81**	2.87**	2.88**
	(1.15)	(1.13)	(1.14)
Observations	8,726	8,726	8,726
R-squared	0.21	0.21	0.21

Standard errors clustered at level of child birth order in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Wasting

Table 5 presents results from the DID specification for weight-for-height (WHZ). The dependent variable is the z-score of weight-for-height, a measure of wasting. As before, Model 1 is the baseline DID specification, which also accounts for unobserved time trends by parity. Model 2 adds an interaction term for poor households (defined as the bottom two quintiles of a national wealth classification). Model 3 adds an interaction term for child gender (female child=1). In Models 1 and 2, there is a small positive co-efficient which is not statistically significant. The fully interacted results in Model 3 suggest that there is a significant and positive program effect on wasting. Confidence intervals in all three models include substantial positive effects of a similar magnitude.

Table 5: Mamata and Child Wasting: DID Regression of Eligible vs. Ineligible Groups within Odisha State

Dependent Variable: Weight-for-height z-score for children under 5 years of age			
	(1)	(2)	(3)
VARIABLES	WHZ	WHZ	WHZ
Eligible x Post	0.022	0.024	0.119*
	(0.071)	(0.075)	(0.060)
(Birth Order<=2) x Post	0.196***	0.197***	0.194***
	(0.015)	(0.019)	(0.020)
Poor x Eligible x Post		-0.004	-0.004
		(0.076)	(0.076)
Female Child x Eligible x Post			-0.195***
			(0.040)
Eligible	0.032	0.033	0.033
	(0.089)	(0.091)	(0.089)
Post	-5.260***	-5.261***	-5.238***
	(0.702)	(0.698)	(0.677)
Gender of child (Girl=1)	0.016	0.016	0.126***
	(0.025)	(0.024)	(0.034)
Child age in years	-0.721***	-0.720***	-0.719***
	(0.088)	(0.091)	(0.093)
Size at birth = Large	0.060*	0.060*	0.059*
	(0.029)	(0.029)	(0.029)
Size at birth = Small	-0.233***	-0.233***	-0.234***
	(0.019)	(0.019)	(0.018)
Mother's age in years	0.002	0.002	0.002
	(0.002)	(0.001)	(0.001)
Mother completed secondary education	0.120**	0.120**	0.119**
	(0.049)	(0.050)	(0.050)
Household size	0.018**	0.018**	0.018**
	(0.007)	(0.007)	(0.007)
Household Wealth Index (1/2/3 Poor/Middle/Rich)	0.168***	0.167**	0.166**
	(0.034)	(0.061)	(0.061)
Household head is female	0.077*	0.077*	0.076*
	(0.035)	(0.035)	(0.036)
Household head completed secondary education	0.042	0.042	0.043
	(0.033)	(0.034)	(0.033)

Rural	-0.072	-0.072	-0.072
	(0.043)	(0.042)	(0.041)
Scheduled Caste/Tribe	-0.295***	-0.295***	-0.296***
	(0.044)	(0.043)	(0.043)
Hindu	-0.117**	-0.117*	-0.116*
	(0.052)	(0.053)	(0.053)
Health facility is too far	0.020	0.020	0.018
	(0.044)	(0.045)	(0.044)
In-house access to piped drinking water	0.271**	0.271**	0.271**
	(0.093)	(0.094)	(0.093)
Constant	2.044***	2.046***	1.993***
	(0.575)	(0.553)	(0.553)
Observations	8,726	8,726	8,726
R-squared	0.109	0.109	0.110

Standard errors clustered at level of child birth order in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Household Wealth

Although the Mamata Scheme is not a means-tested program, program participation may be higher among poorer households in the state. Hence, I interact "Poor" with the DID estimate in models for both stunting and wasting. This includes households in the bottom two quintiles of a national level classification of "Poor" or "Poorest", and covers around 64% of all sample households in Odisha in 2015. For both stunting and wasting, I find no significant effects for this group (Tables 4 & 5). This suggests that there may not be substantial wealth heterogeneity for the program's impact, an important finding since Mamata is not means-tested. A data limitation here is that the NFHS does not ask for household income, which may be a better instrument to understand program effects on poor households.

Child Gender

Son preference is well documented in the Indian context. Hence, I also interact child gender with the DID estimates (Tables 4 and 5), to examine whether the reduction in wasting is concentrated by child gender. In the model for wasting, I find a negative and significant co-efficient of 0.2 for girls, suggesting that the program effect on WHZ for a girl child is 0.2 standard deviations lower than that for boys. These findings are in line with other evidence from India that shows female disadvantage in early childhood that is related due to parental underinvestment in girls.

Section 7: Robustness Checks

Given the long time gap between the pre and post survey rounds of NFHS, I conduct several robustness checks to support the validity of the findings.

7.1: Testing Parallel Trends

Figure 2 depicts median nutritional outcome trends for the treatment group and both comparison groups using NFHS-2, 3 and 4. As annual data are not available for nutritional measures, I rely on two previous NFHS rounds to validate this assumption. A visual inspection of these trends supports the parallel trends assumption for the comparison group – Odisha ineligible– in the pre-Mamata period (prior to 2011). Notably, WHZ shows a downward trend between NFHS-3 and 4, in all samples. NFHS-4 has a considerably larger sample size than previous rounds, sampling approximately four times more villages and census enumeration blocks compared to NFHS-3. This may partially explain the downward trend seen in WHZ.

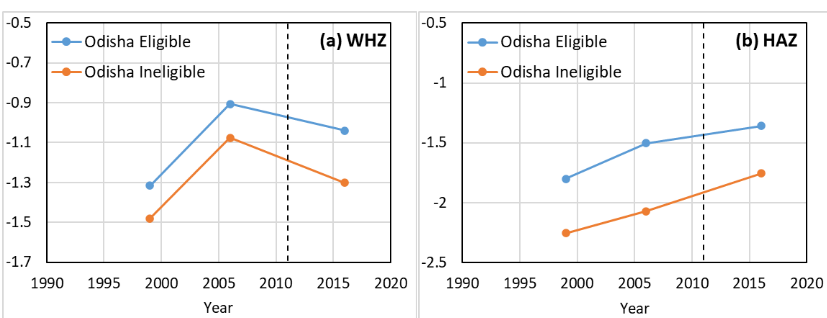

Fig 2: Child nutrition outcomes for Odisha Eligible and Odisha Ineligible groups across NFHS 2, 3 and 4. Dotted black line highlights 2011, the start of Mamata Scheme.

For a formal test of the parallel trends assumption, I estimate leads and lags of program effects, following the methodology in (Chari et al., 2019). NFHS-2 data are used to calculate the lead effects while NFHS-4 serves to estimate the lag effect of Mamata

Scheme on child nutritional outcomes. The DID specification with "Odisha Ineligible" as the comparison group is shown below:

$$Y_{ijt} = \beta_0 + \beta_{+1}\left(Eligible*2015\right)_{jt} + \beta_{-1}\left(Eligible*1998\right)_{jt} + \gamma\mathbf{X}_{ijt} + \eta_t + \varepsilon_{ijt} \qquad (2)$$

where β_{-1} is the lead program effect and β_{+1} is the lag effect. If outcome trends are similar between the treatment and comparison groups in the pre-Mamata period, and there are no changes in the outcome variables that anticipate the program implementation, the lead effect will be small and statistically insignificant. Table 6 shows that the point estimate for the lead program effect (β_{-1}) is small in magnitude and is statistically insignificant for both nutritional outcomes. This result lends support to the parallel trends assumption for the comparison group. The point estimates for the lag program effect (β_{+1}) are statistically significant, as expected.

Table 6: Testing Parallel Trends - DID regression using leads and lags.

VARIABLES	DID (Odisha Eligible vs Odisha Ineligible)	
	WHZ	HAZ
Eligible x 1998	0.123	0.0861
	(0.0794)	(0.0875)
Eligible x 2015	0.179***	0.160***
	(0.0387)	(0.0430)
Observations	9,757	9,757
R-squared	0.113	0.235

Standard errors clustered at level of mother's age in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All regressions include controls for child, mother and household level characteristics and fixed effects for child birth year and month.

7.2: Placebo Program Implementation

As another robustness test for the parallel trends assumption, I run a placebo DID regression using data from the previous NFHS rounds (2 and 3). The placebo regression includes controls for child, mother and household level characteristics, fixed effects for child birth year and month and an interaction term which equal to 1 if the child is first or second-born and belongs to the NFHS-3 dataset, and zero otherwise. This controls for time-varying unobservables that may be trending differently between children of different birth orders. Since Mamata did not exist during these periods, I expect that the point estimates will not be statistically significant if there are no confounding trends that differ between the treatment and comparison groups in the pre-Mamata periods. Although I find that the point estimate for HAZ is positive and significant, this is in the opposite direction of the main specification, lending credence to the empirical strategy.

Table 7: Testing Parallel Trends - Placebo ITT Effects (NFHS-2 and NFHS-3 Data)

VARIABLES	DID (Odisha Eligible vs Odisha Ineligible)	
	WHZ	HAZ
Eligible x 2005	-0.183	0.252***
	(0.109)	(0.069)
Eligible	0.035	0.211***
	(0.097)	(0.046)
2005	-1.695***	1.456**
	(0.413)	(0.630)
Observations	2,204	2,204
R-squared	0.140	0.312

Standard errors clustered at level of mother's age in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Section 8: Discussion

In this paper, I examine the effect of a CCT program intended as partial wage compensation for women during pregnancy and lactation on children's nutrition. Specifically, I analyze the impact of "Mamata Scheme", a conditional cash transfer program in Odisha, India on children's stunting and wasting. I find that being eligible for Mamata is associated with a significant improvement in children's weight-for-height (wasting). However, there is no statistically significant reduction in height-for-age (stunting), and I cannot rule out a negative association. Overall, my findings suggest that a one-time conditional cash transfer targeted to pregnant and nursing mothers may be an effective policy intervention to reduce wasting, which is a short term response to inadequate calorie intake or illness. However, reductions in stunting, which is a long-term manifestation of undernutrition, may require more sustained interventions. My results are in line with previous literature on cash transfers and nutrition (see Bastagli et al. 2016 for a review), which finds mixed evidence for effects on child anthropometry.

In the Mamata Scheme, reductions in wasting are concentrated amongst male children, potentially reflecting intrafamily allocation decisions that favor boys. I find no significant wealth heterogeneity in program effects on both nutritional outcomes. Since Mamata is not a means-tested program, this suggests that from a policy perspective, targeting girl children through non means-tested cash transfers aiming to improve health and nutrition could be very valuable in the Indian context.

Since changes in stunting usually take longer to manifest, studies that examine anthropometry measures for shorter durations often fail to find reduction in stunting. With data that spans a decade, I am able to overcome this limitation and include children upto 5 years of age in my sample. While CCTs gain popularity in India and elsewhere, the results of this paper suggest that policymakers use caution while allocating additional budgets to national or state CCT programs hoping to address stunting. Until the particular pathways for stunting are better understood, CCTs are likely good complements, but not substitutes, to other programs targeting improvements in health, sanitation, women's empowerment, and infrastructure.

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