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IN-KIND TRANSFER AND CHILD DEVELOPMENT: EVIDENCE FROM SUBSIDIZED RICE PROGRAM IN INDONESIA

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Abstract

In the aftermath of the Asian financial crises, the Indonesian government launched a subsidized rice program called RASKIN in 1998 to moderate the shocks of food price inflation and reduced employment to poor households. The program has been continued since then with an objective to provide food security to poor families and is currently the largest in-kind transfer in Indonesia. Using data from five rounds of the Indonesian Family Life Survey (IFLS) covering the period of 1993–2014, this paper examines the impact of RASKIN on children's health status. Using the difference-in-difference estimator, we find that children from the households that are beneficiaries of the RASKIN program show improved health status as measured by various anthropometric measures. We further investigate the long-run gains from RASKIN by tracing the health status of children aged between 0 and 5 years old in 1993 and 1997 respectively until their adolescence/adulthood. We find evidence of improved anthropometric health outcomes for these children in later years. The gains are found to be higher for children who started receiving the subsidized rice in the early years of childhood.

Keywords: in-kind transfers, food consumption, child development, health, long-run impact

JEL Classification: I38, I12, H5, O15, Q18

Contents

1. INTRODUCTION

Indonesia is the fourth most populous country in the world with a predominantly young population. As per the 2010 population census, children (below 18 years old) constitute around 34% of population in Indonesia (Unicef, 2012). Out of this, nearly 44.3 million (or 56% of child population) live in households with earnings of less than $2 purchasing power parity per capita per day, and about 17% of them live below the national poverty line (Unicef, 2012). Substantial evidence has shown that poverty is detrimental to child development. The impact is most remarkable for the children suffering from poverty in their very early periods of life (Brooks-Gunn and Duncan, 1997; Duncan, Brooks-Gunn, and Klebanov, 1994). Childhood deprivation has been linked to behavioral problems, poorer health, lower IQ scores, and inferior academic achievement (Duncan et al., 1994). Moreover, children born in poor households have been found to have worse adolescence and adult outcomes as compared to those born in non-poor households (Ratcliffe and McKernan, 2010).

Although poverty reduction programs have been implemented in an increasing number of countries, we still know little about their impact on child development, especially in the context of developing countries. In this paper, we evaluate the impact of the world's biggest rice subsidy program and Indonesia's largest [1] targeted transfer program, namely RASKIN ("Rice for the poor"), on the health outcomes of children. In the aftermath of the Asian financial crisis, the Indonesian government launched the RASKIN program in 1998 to moderate the shocks of food price inflation and reduced employment on the poor households. Under the RASKIN program, a certain amount of subsidized rice is guaranteed to the eligible households across the entire country. While the amount of subsidized rice eligible per household has varied over time, the program has been implemented in Indonesia for nearly two decades. Government expenditure on RASKIN accounts for more than half of the total household-targeted social assistance in Indonesia.[2] Children are seen to be the primary beneficiaries of food guarantee programs such as RASKIN. Lack of sufficient nutrition can lead to lower health outcomes in young children. Further, to support household incomes, children may be taken out of school and put to work. Despite the massive size of the program and the long period of its implementation, it is surprising that few studies have evaluated the impact of RASKIN program on the welfare of children in Indonesia.

There are a few studies that have qualitatively and quantitatively analyzed certain aspects of the RASKIN program. Djamaluddin et al. (2015) find that the RASKIN program significantly eased the burden of rice expenditure on households, although the magnitude of the effect is relatively small. Using household data, Pangaribowo (2012) shows that RASKIN increased households' consumption of nutrient rice and animal source food. Banerjee et al. (2015) investigate the impact of increased tangible information and citizen empowerment on participation in the RASKIN program. Based on a field experiment of 572 villages in Indonesia, Banerjee et al. (2015) demonstrate that with improved information and citizen empowerment, beneficiaries would receive 26 percent more RASKIN subsidized rice. Another study is qualitative in nature— Arif et al. (2010) analyze the gender dimension of risks and potential of the RASKIN program to qualitatively address gender related vulnerabilities. They find that the program has equal impact on men and women in Indonesia, but that there is no significant impact of RASKIN for reducing specific risks and vulnerabilities facing women.

[1] See World Bank (2012), Banerjee et al. (2015)

[2] Source: National Team for the Acceleration of Poverty Reduction (TPN2K)

The evidence revealed by the existing literature with respect to the impact of in-kind transfers on child welfare remains ambiguous. Hoynes et al.’s (2016) study on the US Food Stamp Program indicates that access to food stamps in childhood leads to a significant reduction in the incidence of metabolic syndrome and an increase in economic self-sufficiency for women. Tarozzi (2005) analyzes the impact of reduction of rice subsidies on child health status in the case of India and does not find any significant relationship. Martorell (1995) analyzes the short- and long-term effects of food transfer program in Guatemalan villages and finds improved nutritional status in early childhood. With respect to school performance, Vermeersch and Kremer (2005) and Ahmed and Ninno (2002) find positive effects of food transfers on school participation in Asian countries like India and Bangladesh, respectively. In the case of the Indonesia’s RASKIN program, however, there seems to be a gap in the literature that connects the policy with child development outcomes.

Our study aims to fill this gap. Using data from five rounds of the Indonesian Family Life Survey (IFLS) covering the period of 1993–2014, our study traces the impact of the RASKIN program on the health outcomes of children below or equal to 15 years old. We gage child health outcomes using multiple anthropometric measures, including weight for age, height for age, weight for height. We classify children into different age groups and use the two-stage difference-in-difference estimator developed by Donald and Lang (2007) and Greenstone and Hanna (2014) to perform our empirical analysis. This approach allows us to assess child-level gains after accounting for the length of the period (number of years) for which the child’s household was enrolled in the program.

As a robustness check, we use the “aggregation” technique developed by Bertrand, Duflo, and Mullainathan (2004). Since in this study the policy variable RASKIN operates at the household level, and since we aim to analyze health outcomes at the individual child level, Bertrand et al. (2004) suggest that the use of such multi-level data can result in distorted inference due to serial correlations. The standard errors may be underestimated due to a correlation between children’s health outcomes within a given household over time. Our “aggregation” technique accounts for this limitation by aggregating the data into two periods: before and after RASKIN; however it yields average household-level gains.

Both the estimations lead us to a common ground. We find that children living in households that participated in the RASKIN program displayed improved anthropometric health outcomes. The estimated gains in height for age range between 0.19 – 0.96 cm per year, weight for age range between 0.08 to 0.21 kg per year and weight for height range between 0.003 to 0.0032 kg per cm for children less than or equal to 15 years of age. We also find that gains are higher for children from relatively poorer households or less-developed regions. Our results are robust to different specifications, placebo tests, and sub-group analysis.

In addition to the above, we examine the long-run impact of the RASKIN program by tracing the health outcomes of two cohorts of children aged between 0 and 5 years (i) in 1993 and (ii) in 1997 until 2014 (the latest round of the survey). We find evidence of positive long-run gains from RASKIN participation. The availability of two rounds of survey prior to the RASKIN introduction in 1998, i.e., IFLS 1 in 1993 and ILFS 2 in 1997 allows us to exploit the impact of timing of the RASKIN program. We examine whether gains differed for children depending on their age when their households enrolled in the program. We find the gains were stronger for the younger cohort (0–5 years old in 1997), who started to receive the RASKIN rice at earlier age in childhood.

The remainder of the paper is organized as follows. Section two briefly introduces the RASKIN program; section three describes the dataset and variable construction; section four presents the econometric methodology; section five analyzes the empirical findings; and section six concludes the paper.

2. BACKGROUND ON THE RASKIN PROGRAM

RASKIN was first introduced in 1997–98 in Indonesia as an emergency food security program for the poor in the aftermath of the Asian financial crises and El Nino. Initially named as Operasi Pasar Khusus (OPK) and renamed as “RASKIN” in 2002, this program constitutes the longest running and the largest permanent social assistance transfer for poor households in Indonesia.

In 2010, the government expenditure on RASKIN accounted for 53% of total household-targeted social assistance in Indonesia. Over the period of 2000 to 2010, the allocated rice has averaged at over 2 million tons per year (World Bank, 2012). The ceilings for the amount of rice provision have varied over time. Between the periods of 2010 to 2013 it was 15 kg of rice per household per month at the rate of IDR 1,600 (or $0.12) per kg, targeting around 15.5 to 17.5 million poor Indonesian households.[3] The price of the RASKIN rice is approximately 75% lower than the market price. In 2012 under the RASKIN program, the government allocated a budget of IDR 15.7 trillion to subsidize 3.41 million tons of rice.[4]

Being the staple food, rice accounts for nearly a quarter of the average monthly expenditures of poor households in Indonesia. In addition, it contributes around 34% and 26% to the calculation of official rural and urban poverty line, respectively (Sumarto and Widyanti, 2008). The program is expected to fulfill 39.5% of poor households’ needs for rice (Djamaluddin et al., 2015).

RASKIN (initially OPK), was launched as a part of an array of social safety net programs (or Program Jaring Pengaman Sosial, JPS) to assist the poor households in the aftermath of the Asian financial crises. Under the RASKIN program, the central government of Indonesia provides subsidized rice to the poor and near-poor households across all provinces. Households eligible for the rice subsidy were selected on the basis of Badan Koordinasi Keluarga Berencana Nasional (BKKBN, or National Family Planning Agency) data. The BKKBN data was collected by Indonesia’s family planning agency to select families for family planning (or population control) programs. However, when the crises struck Indonesia, it was used for implementing the rice subsidy program as it was the only data available to identify poor households. Nonetheless, the authorities were aware that BKKBN classification was not designed to identify food insecure households (Tabor and Sawit, 2001). The BKKBN classified households into five categories, namely Pre-prosperous, Prosperous I, Prosperous II, Prosperous III and Prosperous III+. The first two categories, namely Pre-prosperous and Prosperous I (or very poor and poor), were considered eligible to receive the subsidized rice. Since 2006, the RASKIN program has targeted households classified as “poor” according to the PSE-05 data (Household Socioeconomic Data 2005) collected by BPS-Statistics Indonesia (previously known as Bureau of Statistics, Indonesia).

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[3] Source: National Team for the Acceleration of Poverty Reduction (TPN2K)

[4] See Indonesian Financial Note and Revised Budget for 2012 for greater details.

Delivery of RASKIN rice is a multi-stage process. First, the key policy-making agency "Kemenkokesra" (The Coordinating Ministry of Public Welfare,[5] central government) determines the monthly allotments, coverage, and period of operation for RASKIN. This is further communicated to the execution agency "Bulog" (Bureau of Logistics, Central Government), which is responsible for delivering the agreed amount of rice to various distribution points in the country based on an agreed budget with the Kemenkokesra. Lastly, local governments and the administrative department of the locality identify the eligible households and are responsible for delivery of rice to the households.

While the main rules of the program are the same nationwide, the local implementation of the program, such as decisions on eligibility criteria, distribution system, and co-payment amount varies with local governments across provinces (Tabor and Sawit, 2001). In practice, the RASKIN targeting is unmonitored and the determination of eligibility for receiving the rice subsidy is discretionary and is governed entirely by the local authorities (World Bank, 2012). Table 1 presents the mean and standard deviation of the amount of rice received by the households in years 2007 and 2014 as reported in the IFLS data. We find that on average, the amount of rice received by a household through the RASKIN program was lower than the eligible amount. Further, the standard deviation of the amount of rice received by the households is seen to be large. These numbers suggest that although the eligible amounts have been fixed to be the same across regions and households by the central government, there are considerable differences in the amount of rice actually received by households at the ground level. Table 2 presents the responses of households that could not or did not purchase RASKIN rice. The numbers suggest a significant exclusion error in the program, as about 26% households reported a lack of sufficient money to purchase the subsidized rice. Another 21% reported a lack of rice availability at distribution centers and 26% reported inferior quality of rice as a reason for non-purchase.

Table 1: "RASKIN Rice Received" as Reported by Households in Our Data

	2007			2014		
	Mean	**SD**	**Obs (HHs)**	**Mean**	**SD**	**Obs (HHs)**
No. of times bought Rice	7.3	5.0	5,662	8.0	6.6	6,692
Amount of rice bought last time (in kg) (Eligible: 2007–9 kg; 2014–15kg)	6.8	5.2	5,662	7.3	4.3	6,692

Source: Author's calculations based on IFLS4 and IFLS5 data.

Table 2: HH Response on Why Rice Was Not Bought

Reason not bought RASKIN rice	
No money	25.64%
Poor quality	26.41%
Rice ran out	21.05%
Did not have coupons for the program	6.62%
Others	20.28%
Total HH	**1,435**

Source: Author's calculations based on IFLS5 data.

[5] Renamed as Coordinating Ministry for Human Development and Cultural Affairs in 2014.

In 2010, over 50% of Indonesian households reported to have received RASKIN rice (World Bank, 2012). The RASKIN program has received criticism for inefficiencies in rice delivery and poor targeting. Not all the rice that is allocated for RASKIN reaches the households and there are exclusion errors, as not all poor households are able to receive the subsidized rice. Although the distribution of RASKIN has been found to be marginally pro-poor, the actual beneficiaries seem to look more like "average" rather than poor households due to the high rates of inclusion and exclusion errors in the program (World Bank, 2012). Hence, it has been argued that the actual impact of implicit value of RASKIN transfer may be very low. In the case of RASKIN program no study exists that analyzes the impact of participation in program on health outcomes of children. In this paper, we attempt to infer the causal effect of RASKIN program on child development.

3. DATA AND KEY VARIABLE CONSTRUCTION

The Indonesia Family Life Survey (IFLS) is a longitudinal socioeconomic and health survey conducted by RAND in collaboration with Lembaga Demografi, University of Indonesia, UCLA, Population Research Center, University of Gadjah Mada, Population and Policy Studies (CPPS), and Survey METRE. It represents about 83% of the Indonesian population living in 13 of the nation's 33 provinces.[6] The survey collects data on individual respondents, their family structures, household characteristics, and the communities in which they reside. The first wave (IFLS1) was carried out in 1993 covering 7,224 households and around 22,000 individuals. In the 1997 wave, a total of 7,698 households were interviewed, among which 6,820 were re-contacted IFLS 1 households and 878 split-offs.[7] ILFS 3 and IFLS 4 were fielded in 2000 and 2007 covering 10,574 households and 13,535 households respectively. The latest round of ILFLS 5 was fielded in 2014 and a total of 16,204 households and 50,148 individuals were interviewed.

The IFLS survey contains detailed information on individuals and households, including consumption, income, assets, education, migration, labor market outcomes, marriage, fertility, health status, participation in government programs, etc. In addition to individual- and household-level information, IFLS provides detailed information on the communities in which IFLS households are located and the facilities that serve residents of those communities. These data cover various aspects of the physical and social environment, infrastructure, employment opportunities, prices, access to health, and educational facilities, etc.

Table 3 presents summary statistics of our dataset. We classify households/individuals based on their RASKIN participation status. The policy variable in this study corresponds to a dummy which is equal to one if the child is living in a household which bought rice through the RASKIN program in the interview year, and zero otherwise.[8] Overall we find that the RASKIN-participating households were bigger, poorer, and less educated. The health status of children across various age cohorts reveals that children from RASKIN-participating households have lower heights and weights as

[6] Provinces covered under IFLS-North Sumatra, West Sumatra, South Sumatra, Lampung, DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, Bali, West Nusa Tenggara, South Kalimantan and South Sulawesi.

[7] Household members who separated from the re-interview family to establish separate households, are referred to as "split-offs" and are tracked as new households in our data.

[8] Question asked in the survey (Book 1, section KSR): "During the past year, has the household ever bought rice from the RASKIN program": Responses – Yes/No/Don't know.

compared to the non-participating household children. Their parents were also younger and less educated.

Table 3: Summary Statistics

	Full Sample		RASKIN HH		Non-RASKIN HH	
	Obs	**Mean**	**Obs**	**Mean**	**Obs**	**Mean**
HH characteristics						
HH size	54,680	4.02	15,756	4.05	29,543	3.88
HH income (IDR)	53,262	37,300,000	15,749	10,700,000	37,513	48,500,000
HH head no education	54,710	0.11	15,755	0.12	36,700	0.10
HH head with elementary schooling	54,710	0.40	15,755	0.52	36,700	0.36
HH head with edu. more than elementary less than college	54,710	0.40	15,755	0.45	36,700	0.43
HH head edu college and above	54,710	0.09	15,755	0.03	36,700	0.11
Male headed	50,795	0.83	13,704	0.84	37,091	0.83
Religion						
Islam=1	49,787	0.88	13,437	0.93	36,350	0.86
Protestant=1	49,787	0.04	13,437	0.02	36,350	0.05
Hindu=1	49,787	0.04	13,437	0.03	36,350	0.05
Ethnic group (Race) (two rounds data)						
Javanese=1	27,820	0.44	12,351	0.47	15,469	0.41
Sudanese=1	27,820	0.12	12,351	0.13	15,469	0.13
Bali=1	27,820	0.04	12,351	0.03	15,469	0.05
Batak=1	27,820	0.05	12,351	0.03	15,469	0.06
Bugis=1	27,820	0.03	12,351	0.02	15,469	0.05
Sasak=1	27,820	0.04	12,351	0.04	15,469	0.01
Minang=1	27,820	0.05	12,351	0.07	15,469	0.07
Others=1	27,820	0.23	12,351	0.21	15,469	0.22
Urban=1	55,256	0.47	15,757	0.40	36,702	0.57
HH member characteristics						
Male=1	279,557	0.49	87,212	0.49	192,345	0.48
Married=1	277,138	0.48	86,588	0.51	190,550	0.47
Employed=1	244,072	0.48	86,588	0.51	157,484	0.46
Age (average)	244,056	30.03	86,590	29.39	157,466	30.08
Age<=1	244,056	0.03	86,590	0.03	157,466	0.03
Age<=5	244,056	0.09	86,590	0.10	157,466	0.10
Age<=10	244,056	0.17	86,590	0.17	157,466	0.17
Age<=15	244,056	0.26	86,590	0.26	157,466	0.26
Weight (kg)	178,130	43.16	56,738	42.80	121,392	43.29
Height (cm)	177,772	141.28	56,691	141.10	121,081	141.33
Education						
No school	277,153	0.16	86,588	0.15	190,565	0.16
Elementary	277,153	0.35	86,588	0.40	190,565	0.33
Senior High	277,153	0.25	86,588	0.14	190,565	0.12

continued on next page

Table 3 *continued*

	Full Sample		RASKIN HH		Non-RASKIN HH	
	Obs	Mean	Obs	Mean	Obs	Mean
Child's characteristics						
Male (for <=15 group)	63,233	0.51	19,643	0.50	43,590	0.51
Weight(kg) at age <=1	8,050	8.26	2,512	8.24	5,544	8.37
Weight(kg) at age =2	3,886	11.44	1,251	11.25	2,635	11.53
Weight(kg) at age =3	3,823	13.21	1,203	12.96	2,620	13.32
Weight(kg) at age =4	4,026	14.78	1,296	14.65	2,730	14.84
Weight(kg) at age =5	3,764	16.37	1,149	16.12	2,615	16.48
Weight(kg) at age =10	3,897	27.14	1,200	26.84	2,697	27.27
Weight(kg) at age =15	3,104	45.94	1,025	45.19	2,079	46.31
Height(cm) at age <=1	7,906	69.48	2,489	69.26	5,417	69.58
Height(cm) at age =2	3,756	84.69	1,230	84.67	2,526	84.70
Height(cm) at age =3	3,732	92.25	1,180	92.14	2,552	92.30
Height(cm) at age =4	3,990	98.52	1,291	98.70	2,699	98.43
Height(cm) at age =5	3,757	104.67	1,150	104.45	2,607	104.77
Height(cm) at age =10	3,910	129.60	1,203	129.72	2,707	129.55
Height(cm) at age =15	3,106	154.42	1,025	154.34	2,081	154.45
Parent's characteristics						
Mother's education <=Elementary	59,053	0.46	21,023	0.53	38,060	0.42
Father's education <=Elementary	52,442	0.41	18,677	0.52	35,301	0.36
Mother's age at child birth	59,053	26.93	21,023	26.80	38,060	27.63
Father's age at child birth	53,936	31.68	18,680	31.62	35,301	32.94
Community characteristics			NA		NA	
Population size (persons)	1,550	11,156				
No. of health facilities	1,559	18				
No. of schools	1,562	15				
HHs with electricity access	1,506	0.89				
Sewage system=1	1,555	0.63				
Road =1	1,560	0.86				
Main income						
Agriculture=1	1,560	0.52				
Manufacturing=1	1,560	0.08				
Service=1	1,560	0.40				

3.1 Health Outcome Variables

Child nutritional status is primarily reflected by their heights and weights, as these are directly influenced by food intake in childhood.[9] Nutritional anthropometry, which pertains to the measurement of size, weight, and proportions of the body, is considered as one of the primary indicators of past and present nutritional and health status of children. Poor nutritional status or prevalence of malnutrition in children can be identified by using various anthropometric measurements. Three key indicators in the context of children are stunting (low height for age), wasting (low weight for height) and underweight (low weight for age). Stunting (low height for age) captures early chronic

[9] See DHS comparative reports for detailed discussions http://www.dhsprogram.com/pubs/pdf/CR10/CR10.pdf. Accessed 10 January 2017.

exposure to under-nutrition, wasting (low weight for height) captures acute under-nutrition and underweight (low weight for age) is a composite indicator that includes elements of stunting and wasting (Unicef, 2013). To analyze the impact of the RASKIN program on child nutritional status we use these anthropometric measurements—weight for age, height for age, and weight for height of children for our analysis.

We control for a number of child-specific, parent-specific, household-specific, and community-specific characteristics. Child-level controls in health outcome regressions include child's ethnicity, age, and gender. In addition, since anthropometric measurements such as height and weight are highly correlated with a parent's anthropometric measurements, we also control for parents' height and weight in our regression models. Household-level controls correspond to location of residence (rural or urban), education of the household head, total income, size of the household of which the child is a member of, participation in other government assistance programs. Further, since health outcomes may be affected by external factors, such as the quality of health and other services in the community, we use an array of community level controls along with year fixed effects. These include access to electricity (proportion of households in the community that have access), primary source of income (agriculture, manufacturing, service), presence of road (dummy), and the total number of health facilities in the community.

3.2 Nutrition and Child Growth Linkage

Anthropological literature suggests that overall growth in children from infancy to adulthood follows an S-shaped curve (Scammon, 1930). This implies that growth is the highest in early childhood periods until the age of five; it slows down between the ages of 6–10 years, and picks up again during adolescence. Frisancho et al. (1980) suggest that the influence of environmental factors, such as better nutrition, have the greatest influence on producing difference in anthropometric measurements during early childhood. While growth in children also escalates during adolescence, it is dominated more by genetic factors and less by nutrition. From this background, it would be of interest to understand how RASKIN participation affected children across various age groups in Indonesia. In line with the above literature, we expect the impact of RASKIN (if any) to be the strongest for the youngest cohort of children.[10]

4. METHODOLOGY

A. Two-stage Difference-in-difference

We use a two-stage difference-in-difference approach following Greenstone and Hanna (2014) to analyze the impact of participation in the RASKIN program on the health outcomes of children in Indonesia. The first-stage, event-study-style equation is defined as follows:

$$Y_{ihct} = \alpha + \sum_{\tau} \sigma_{\tau} D_{\tau,it} + \beta_1 X_{ihct} + \beta_2 H_{ht} + \beta_3 V_{ct} + \mu_t + \epsilon_{ihct} \quad (1)$$

where Y_{ihct} is one of the six measures of health outcomes of child i, living in household *h*, community *c,* at time *t*. X_{ihct} is a vector of child-level and parent-level controls, H_{ht} is a vector of the household-level controls and V_{ct} is a vector of the community level

[10] There are two reasons for us to analyze child health until the age of 15 years. First, Scammon's S-shaped curve defines adolescence as 15 years of age. Second, IFLS data defines children as individuals below the age of 15 and collects data on child characteristics for this group of individuals.

controls. μ represents the year fixed effects and ϵ is the error term. $D_{\tau,it}$ is a vector of separate indicator variable for each period before and after the household enrolled in the RASKIN program. We normalize τ so that it equals zero in the year the policy is implemented and ranges between –2 (2 periods before the program) to +2 (2 periods after remaining in the program) in our dataset.[11] For households that never bought RASKIN rice, τ is set equal to zero. The primary coefficient of interest here are the $\sigma_\tau's$ that measure the average outcome level in two period before and two periods after participation in the RASKIN program after controlling for all other child, parent, household, and community characteristics, and time effects. To account for within group correlations, we further cluster the standard errors at the community level.

The second stage of this technique involves another regression analysis to test if the changes in child health outcomes as measured by $\sigma_\tau's$ are associated with a household's participation in the RASKIN program. We use three alternate specifications:

$$\sigma_\tau = \rho_0 + \rho_1(Ras\_Dum) + \epsilon_\tau \tag{2}$$

where $RaskinDummy$=1 if the household to which the child belongs bought rice under the RASKIN program in the given year. The coefficient of interest ρ_1 hence measures the mean shift in outcome level due to participation in the RASKIN program.

To control for any time-specific trends, we include τ in the specification and estimate the following equation:

$$\sigma_\tau = \rho_0 + \rho_1(Ras\_Dum) + \rho_2\tau + \epsilon_\tau \tag{3}$$

The impact of the RASKIN program may change over time as smooth distribution networks get established, participants become familiar with the procedures for procuring rice, etc. To allow for any such time-evolving impact of RASKIN, we also fit the following model.

$$\sigma_\tau = \rho_0 + \rho_1(Ras\_Dum)_\tau + \rho_2\tau + \rho_3(\tau * Ras\_Dum_\tau) + \epsilon_\tau \tag{4}$$

B. Aggregation-based Two-stage Difference-in-difference Technique

The analysis in this study relies on panel data which involve both aggregate (household level) and individual level (e.g. child health) data. The dependent variable in our econometric design pertains to an individual-level health outcome while the covariate of interest, which is the policy variable "RASKIN participation," applies to the household level. Bertrand et al. (2004) *BDM henceforth* and Hansen (2007) note that such a sampling design may give rise to correlations between observations within a group (between children of a given household) over periods. This is termed as "policy autocorrelation problem" in cases of conventional least squares estimation. Hansen (2007) notes that if groups are followed over time and group-level shocks are serially correlated, this will result in correlation between individuals from the same group at different time periods and generate misleading inferences. BDM propose "aggregation" as a plausible solution for overcoming this problem. We implement this aggregation technique for our difference-in-difference analysis. We aggregate the child-level

[11] Two periods before the policy corresponds to the years 1993 and 1997, two periods after the policy correspond to the years 2007 and 2014. τ is set to zero for the year 2000, as it is the first year for which data is available after the RASKIN program was initiated.

health outcome data for each household in our analysis to overcome the issue of serial correlation.

Since the timing of treatment varies across groups as different households enrolled in the RASKIN program at different time periods, we undertake a two-stage regression. In the first stage, we regress aggregated child health outcome variable Y_{st} on household fixed effects, year dummies, and other household and community level controls and obtain the residuals for the households that ever participated in the RASKIN program.

$$Y_{st} = \alpha + \beta_2 H_{st} + \beta_3 V_{ct} + \alpha_s + \alpha_t + \epsilon_{st} \quad (5)$$

Having obtained these residuals, in the second stage we perform a pre- and post-treatment analysis as follows:

$$R_{st} = \alpha + \delta Raskin + \epsilon_{st} \quad (6)$$

If the RASKIN program had a positive impact on child health we expect δ to be positive significant.

Note that although this method is econometrically superior, given the nature of our data, it does not allow us to track each child individually. We track the change in average health outcome of all children in a household. The earlier method (A) allows us to track children individually and hence use many child-level controls, such as gender, parent's characteristics, etc. Method A also allows us to capture the impact of length of participation. Hence, we report results using both the methods in this study.

5. RESULTS

5.1 Two-Stage Difference-in-Difference Estimation Results

Tables 4-6provide the coefficient estimates of equations (2) – (4) for the three child growth indicators, namely, stunting (height for age), wasting (weight for height) and underweight (weight for age). Columns (1), (4), and (7) report the coefficient estimates of Equation 2. Columns (2), (5), and (8) report the coefficient estimates of Equation 3. And, Columns (3), (6), and (9) report the coefficient estimates of Equation 4. A child is defined as a person less than or equal to 15 years old in this study. We divide the children in our dataset into three sub-groups, namely, less than or equal to 5 years, between 5 to 10 years, and greater than 10 but less than or equal to 15 years old.[12]

Results with respect to height for age are displayed in Table 4. We find that across almost all the specifications and for all age groups, ρ_1 is positive and highly significant, indicating that participation in RASKIN led to improved growth outcomes in children in Indonesia. For the youngest cohort, aged 0–5 years, we find that RASKIN led to a rise in height for age by 1.3 cm (Table 4, Column 1). These gains were substantially higher as compared to the gains witnessed by the other age groups (Columns 4–9). For the overall group of children less than equal to 15 years, we find that on average, RASKIN participation led to improvement in height for age of the magnitude 0.19 cm to 0.95 cm (columns 7–9). Overall the analysis suggests that the RASKIN program significantly reduced stunting in young children in Indonesia.[13]

[12] Age groups have been fixed following Aizer et al. (2016).

[13] Results of the first stage regression, i.e. equation 5, are displayed in Appendix Table A1. Coefficient signs are as expected. Family income, education of household head, parent's height, electricity

Table 4: Estimates of Impact of RASKIN Participation on Child Height for Age

	Age<=5			5<Age<=10			Age<=15		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ras_Dum	1.266***	1.744***	2.234***	–0.204***	–0.152***	–0.0931***	0.191***	0.747***	0.955***
	(0.0134)	(0.0180)	(0.0157)	(0.00192)	(0.00253)	(0.00234)	(0.00965)	(0.0128)	(0.0134)
τ		–0.0415***	0.00		–0.00485***	0.000		–0.0503***	–0.0328***
		(0.00109)	(0.00101)		(0.000158)	(0.000153)		(0.000795)	(0.000878)
τ* Ras_Dum			–0.195***			–0.0244***			–0.0830***
			(0.00219)			(0.000343)			(0.00191)
Constant	0.000	–0.272***	0.000	0.000	–0.0306***	0.000	–0.848***	–1.161***	–1.052***
	(0.00827)	(0.0107)	(0.00925)	(0.00112)	(0.00147)	(0.00135)	(0.00582)	(0.00747)	(0.00775)
Observations	15,998	15,998	15,998	15,466	15,466	15,466	46,892	46,892	46,892
R-squared	0.359	0.412	0.608	0.423	0.456	0.591	0.008	0.086	0.121
Equation No.	2	3	4	2	3	4	2	3	4

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Coefficients for weight for age are displayed in Table 5. The results reflect trends similar to height for age. For the 0–5 year olds we find that RASKIN participation led to a rise in weight of children by 0.3 kg (Column 1). ρ_1 is found to be higher for children in the youngest age group (Table 5, Column 1) as compared to the overall cohort (Column 7). This suggests that the RASKIN program significantly improved weight for age of children through the channel of improved nutrition.

Table 5: Estimates of Impact of RASKIN Participation on Child Weight for Age

	Age<=5			5<Age<=10			Age<=15		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ras_Dum	0.300***	0.483***	0.573***	–0.0148***	0.00351***	0.0174***	0.0776***	0.168***	0.207***
	(0.00454)	(0.00603)	(0.00610)	(0.000456)	(0.000580)	(0.000531)	(0.00150)	(0.00197)	(0.00205)
τ		–0.0158***	–0.00817***		–0.00168***	–0.000533***		–0.00818***	–0.00491***
		(0.000367)	(0.000392)		(3.62e-05)	(3.46e-05)		(0.000123)	(0.000134)
τ* Ras_Dum			–0.0361***			–0.00580***			–0.0155***
			(0.000851)			(7.77e-05)			(0.000293)
Constant	–0.192***	–0.296***	–0.245***	–0.0144***	–0.0250***	–0.0177***	–0.127***	–0.178***	–0.158***
	(0.00281)	(0.00359)	(0.00360)	(0.000266)	(0.000337)	(0.000305)	(0.000903)	(0.00115)	(0.00118)
Observations	15,998	15,998	15,998	15,466	15,466	15,466	46,892	46,892	46,892
R-squared	0.215	0.297	0.368	0.064	0.179	0.396	0.054	0.136	0.185
Equation No.	2	3	4	2	3	4	2	3	4

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 6 provides the coefficient estimates of weight for height for the three children cohorts. The coefficient is all positive and highly significant. Since this measure accounts for both the indicators of child growth, namely height and weight, it controls for higher sensitivity at a lower age and is hence seen to be increasing with the age cohort.

availability, and paved roads all contribute positively to children's health. Rural dummy, female gender type, ethnic minority dummy carry a negative coefficient as expected.

Table 6: Estimates of Impact of RASKIN Participation on Child Weight for Height

	Age<=5			5<Age<=10			Age<=15		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ras_Dum	0.00296***	0.00272***	0.00228***	0.00390***	0.00485***	0.00591***	0.00298***	0.00312***	0.00327***
	(2.41e-05)	(3.37e-05)	(3.46e-05)	(2.90e-05)	(3.77e-05)	(3.20e-05)	(5.20e-06)	(7.11e-06)	(7.36e-06)
τ		2.10e-05***	–1.65e-05***		–8.80e-05***	0.000		–1.25e-05***	0.00
		(2.05e-06)	(2.22e-06)		(2.35e-06)	(2.09e-06)		(4.43e-07)	(4.82e-07)
τ* Ras_Dum			0.000177***			–0.000443***			–5.95e-05***
			(4.83e-06)			(4.69e-06)			(1.05e-06)
Constant	–0.000388***	–0.000250***	–0.000496***	0.000	–0.000554***	0.000	0.000	–7.81e-05***	0.00
	(1.49e-05)	(2.01e-05)	(2.04e-05)	(1.69e-05)	(2.19e-05)	(1.84e-05)	(3.14e-06)	(4.16e-06)	(4.25e-06)
Observations	15,998	15,998	15,998	15,466	15,466	15,466	46,892	46,892	46,892
R-squared	0.486	0.489	0.529	0.539	0.577	0.732	0.875	0.877	0.885
Equation No.	2	3	4	2	3	4	2	3	4

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

5.2 Robustness Checks

In this subsection, we implement two robustness checks, the *BDM's Aggregation Estimation* and *Placebo test.*

5.2.1 BDM's Aggregation Estimation Results

The regression results of Equation 6 are displayed in Tables 7 and 8. Table 7 corresponds to results using the RASKIN participation dummy variable. In addition to using the RASKIN dummy, we also use a continuous policy variable, the RASKIN rice ratio (share of rice bought through RASKIN as a proportion of total rice consumption by household) for this analysis. Results displayed in Table 8 are qualitatively similar. We find that across almost all specifications and for all the three health outcomes, the RASKIN coefficient is positive and significant. Overall trend in results remains same using both RASKIN dummy variable and RASKIN rice ratio. Coefficients are found to be higher using the rice ratio variable. In sync with our findings from the earlier method, age-group-wise analysis in this case also suggests that gains were higher for younger cohort. Overall, these results substantiate our earlier findings that the RASKIN program contributed positively to child health outcomes in Indonesia.

Table 7: Coefficient Estimates Using the BDM Technique (Using RASKIN Dummy)

	(1) 0–5 Years	(2) 6–10 Years	(3) 11–15 Years	(4) 0–15 Years
Height for age				
Ras_Dum	1.581***	0.202***	0.0939***	3.180***
	(0.479)	(0.0527)	(0.0255)	(0.266)
Constant	–0.537	–0.138***	–0.116***	–1.326***
	(0.379)	(0.0414)	(0.0201)	(0.193)
Observations	7,094	6,354	6,010	15,211

continued on next page

Table 7 *continued*

	(1) 0–5 Years	(2) 6–10 Years	(3) 11–15 Years	(4) 0–15 Years
Weight for age				
Ras_Dum	0.0377	–0.00521	–0.0715***	0.201***
	(0.0955)	(0.0172)	(0.0166)	(0.0424)
Constant	–0.0696	–0.0679***	–0.0607***	–0.141***
	(0.0754)	(0.0135)	(0.0131)	(0.0308)
Observations	7,214	6,353	6,010	15,263
Weight for height				
Ras_Dum	0.132***	0.0954***	0.105***	0.468***
	(0.045)	(0.0236)	(0.025)	(0.0295)
Constant	0.00433	0.0591***	0.0536***	–0.0977***
	(0.0357)	(0.0185)	(0.0197)	(0.0214)
Observations	7,082	6,348	6,007	15,196

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Coefficient Estimates Using the BDM Technique (Using Rice Ratio)

	(1) 0–5 Years	(2) 6–10 Years	(3) 11–15 Years	(4) 0–15 Years
Height for age				
rice_ratio	1.841**	0.230**	0.128***	4.218***
	(0.822)	(0.0904)	(0.0442)	(0.479)
Constant	–0.301	–0.100***	–0.102***	–0.737***
	(0.341)	(0.0375)	(0.0182)	(0.180)
Observations	5,978	5,367	5,067	13,133
Weight for age				
rice_ratio	0.197	–0.0461	–0.107***	0.303***
	(0.171)	(0.0301)	(0.0289)	(0.0788)
Constant	–0.0825	–0.0573***	–0.0704***	–0.0987***
	(0.0707)	(0.0125)	(0.0119)	(0.0296)
Observations	6,089	5,366	5,067	13,181
Weight for height				
rice_ratio	0.121*	0.194***	0.176***	0.644***
	(0.0767)	(0.0403)	(0.0444)	(0.0531)
Constant	0.0230	0.0562***	0.0647***	–0.0240
	(0.0318)	(0.0167)	(0.0183)	(0.0199)
Observations	5,969	5,361	5,064	13,119

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

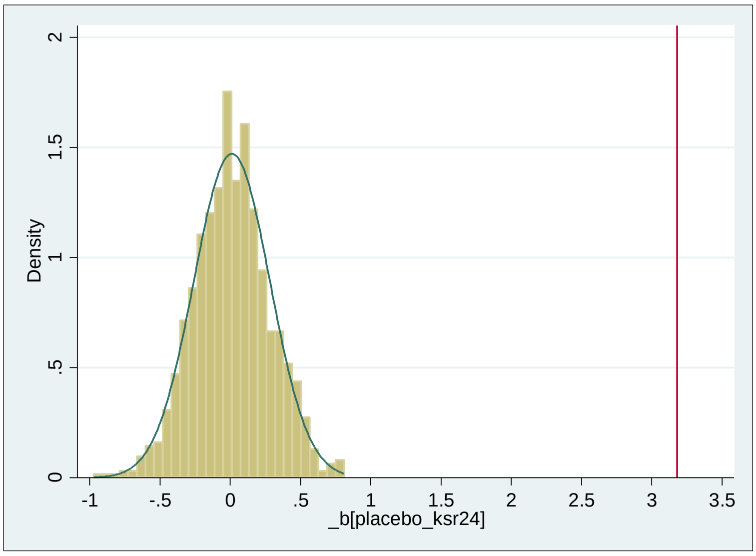
5.2.2 Placebo Tests

A placebo test in econometric analysis is an identification strategy which is applied in the context where no effect of the treatment is expected. Hence if the model has been defined correctly, the results from placebo tests are expected to be insignificant. In our paper, to check for the validity of our model and findings we perform two placebo tests where we use randomization technique and sub-group analysis respectively.

a. **Randomization of RASKIN status:** Our first placebo test uses a randomization technique. We randomly generate a pseudo-RASKIN status for all the households in our data irrespective of their original program status or household characteristics. We then run our baseline BDM regression model as in Table 7 with this pseudo-treatment and control groups. We repeat this procedure 1,000 times and plot the coefficient estimates from these placebo tests in Figures 1–3. If our model correctly captures the effect of RASKIN, we would expect such randomization to yield an insignificant impact of RASKIN. The red line embedded in the graph represents our original sample estimate from Table 7, Column 4. Across all the specifications we find that the pseudo-RASKIN coefficient is a lot smaller than the true coefficient. It is also found to be statistically insignificant in the majority of the simulated cases across groups.

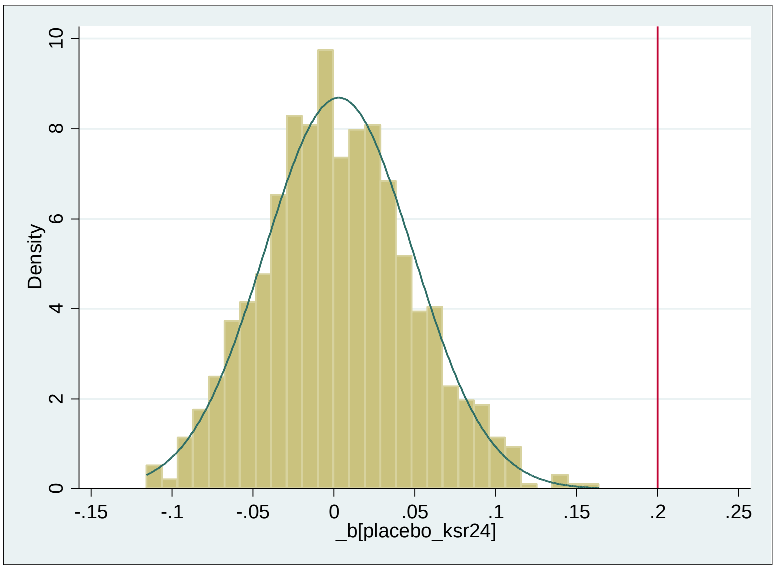
b. **High Income group analysis:** The RASKIN program has attracted criticism in the literature for its poor targeting. The rice subsidy program is expected to support the consumption needs of poor households. However, due to large inclusion errors, RASKIN rice has also been obtained by "not poor" households in Indonesia. This design defect of the program gives us a case to undertake the second validity test of our econometric analysis and results. We analyze the impact of the RASKIN program on the health outcome of children in the sub-group who belonged to the richest 20% households in the data. If our analysis is valid, we expect the impact of RASKIN to be insignificant on these "richer" children in our data. Results of the regression are displayed in Table 9 and, as expected, we find the coefficient to be insignificant and of incorrect sign in the majority of the cases.

Figure 1: Distribution of Coefficients under Placebo: Height for Age
(0–15 years)



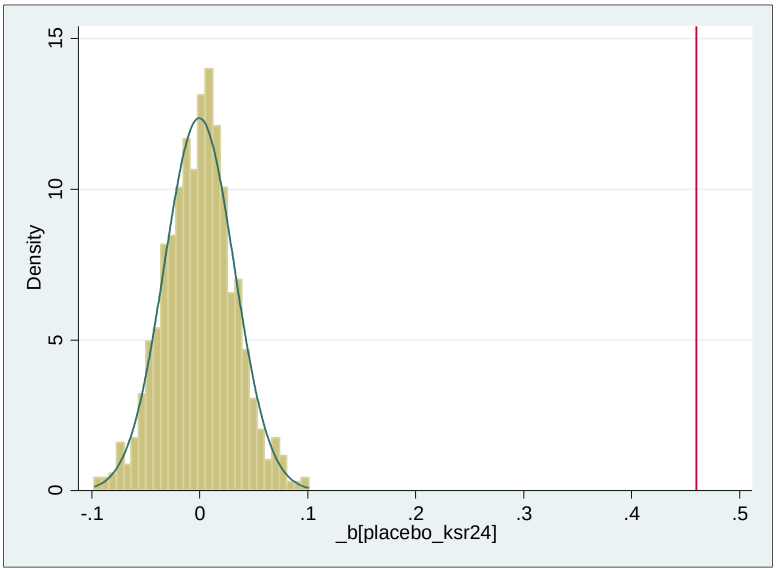
Source: Authors' estimates.

Figure 2: Distribution of Coefficients under Placebo: Weight for Age
(0–15 years)



Source: Authors' estimates.

Figure 3: Distribution of Coefficients under Placebo: Weight for Height
(0–15 years)



Source: Authors' estimates.

Table 9: Robustness Check – High Income Group

	Age<=5	5<Age<=10	10<Age<=15	Age<=15
Height for age				
Ras_Dum	0.408	0.215	–0.222*	1.672
	(2.303)	(0.228)	(0.126)	(1.061)
Observations	463	466	434	1,000
Weight for age				
Ras_Dum	0.0139	–0.126	–0.288***	0.0295
	(0.430)	(0.0923)	(0.0896)	(0.165)
Observations	472	466	433	1,002
Weight for height				
Ras_Dum	0.217	0.208**	0.251***	0.428***
	(0.208)	(0.103)	(0.0923)	(0.115)
Observations	462	466	433	998

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

5.3 Sub-Group Analysis

Using the aggregation estimation, we further perform a sub-group analysis to examine the impact of RASKIN on more vulnerable groups. We classify these sub-groups in a number of ways, as discussed below. The corresponding regression coefficients are displayed in Table 10. To save space, we report the coefficients pertaining to the full group, i.e. 0–15 year olds for all the three outcomes.[14]

a. **Poorest regions:** In this sub-sample, we restrict our analysis to one of the poorest provinces of Indonesia for which data was available in the IFLS. This corresponds to West Nusa Tenggara. This province falls among the top five provinces that had the highest incidence of poverty in Indonesia (Aji, 2015). Since data was only available for this province out of the five top poorest provinces, we choose the same for our analysis. The results are displayed in Row 1 of Table 10. For the full group of 0–15 year olds we find the coefficient to be of a higher magnitude than the full sample results in Table 7, Column 4. Results remain qualitatively similar for both RASKIN dummy as well as RASKIN rice share.

b. **Below poverty line households:** In this sub-group analysis, we restrict our analysis to the households that fell below the poverty line in Indonesia. Poverty line data was obtained from BPS, Indonesia (for 1993, 1997, and 2000) and CEIC province level data (2007 and 2014). The results are displayed in Rows 2–4 of Table 10. We find the gains to be of higher magnitude as compared to the full sample coefficients (Table 7, Column 4) in most cases. Our separate analysis for below poverty line households for rural and urban households (Rows 3 and 4) reveals that gains were higher for rural households as compared to urban ones. This may be due to a higher incidence of malnutrition in rural areas vis-à-vis their urban counterparts.

[14] Age group-wise results follow a similar pattern to that in Table 12 and can be made available on request.

c. **Gender difference:** We run a separate regression for boys and girls in this sub-group. Results are displayed in Rows 5 and 6 of Table 10. Across all groups we find the gains to be higher for boys as compared to girls.

d. **Rural vs. Urban:** For this we segregate households based on whether they were located in rural or urban areas. Results are displayed in Rows 7 and 8 of Table 10. We find that the gains are higher for children in rural households as compared to urban households.

Table 10: Sub-Group Analysis Using RASKIN Dummy

		Height for Age	Weight for Age	Weight for Height
1	Poorest province	5.169***	0.365***	0.645***
		(0.833)	(0.136)	(0.0858)
2	Below poverty line	3.632***	0.228***	0.459***
		(0.336)	(0.0489)	(0.0375)
3	Below poverty line, Urban	3.710***	0.321***	0.497***
		(0.564)	(0.0982)	(0.0619)
4	Below poverty line, Rural	3.870***	0.267***	0.465***
		(0.419)	(0.0559)	(0.0469)
5	Girls	4.274***	0.272***	0.613***
		(0.366)	(0.0542)	(0.0437)
6	Boys	5.605***	0.490***	0.671***
		(0.381)	(0.0585)	(0.0388)
7	Urban	3.595***	0.225***	0.475***
		(0.345)	(0.0509)	(0.0386)
8	Rural	3.632***	0.315***	0.546***
		(0.437)	(0.0674)	(0.0478)

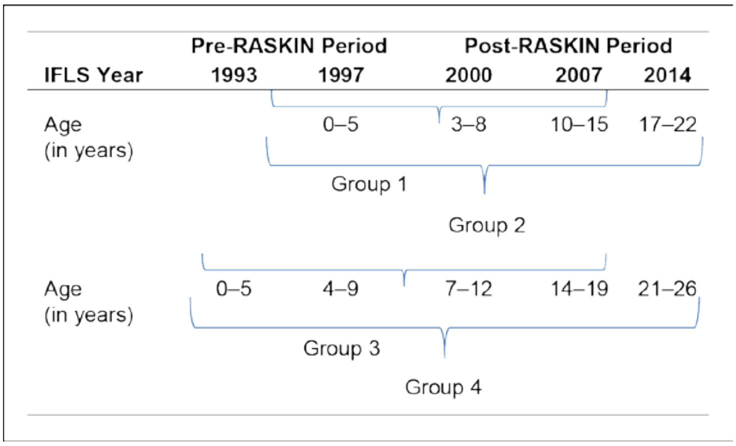
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

5.4 Long-Run Impact

In this part of the paper we trace the health outcomes of two cohorts of children aged (i) 0–5 years old in 1993, and (ii) 0–5 years old in 1997 until 2007 and 2014 (See Figure 4). This exercise enables us to track the health outcomes of same individuals over the entire period from childhood to adolescence/ adulthood and hence analyze the long-run impact of RASKIN. We create four sub-groups for our analysis described in the following diagram:

- Group 1: 1997–2007 (childhood to adolescence): This consists of children aged 0–5 years in 1997. We trace their health outcomes until they reach the age group of 10–15 years old in 2007.
- Group 2: 1997–2014 (childhood to adulthood): This consists of children aged 0–5 years in 1997. We trace their health outcomes until they reach the age group of 17–22 years old in 2014.
- Group 3: 1993–2007 (childhood to adolescence): This consists of children aged 0–5 years in 1993. We trace their health outcomes until they reach the age group of 14–19 years old in 2007.
- Group 4: 1993–2014 (childhood to adulthood): This consists of children aged 0–5 years in 1993. We trace their health outcomes until they reach the age group of 21–26 years old in 2014.

Figure 4: Tracing Health Outcomes of All 0–5 Year Olds over a Period of 10 and More Years



Results of the above analysis using the BDM technique are displayed in Table 11. We find evidence of positive gains in health outcomes of children who received the RASKIN rice until their adolescence/adulthood. For groups 1 and 2, δ is positive and highly significant for two (height for age and weight for height) out of three health outcome variables. Further, comparing the gains between groups 1 and 2, we find that the gains are higher for the younger ages, i.e. for group 1, 10–15 years old in 2007 as compared to group 2, 17–22 years old in 2014.

For groups 3 and 4, δ is found to be significant for the overall growth indicator, namely weight for height. Comparing gains for groups 1 and 2 with that of groups 3 and 4 we find that gains were higher for the former. This implies that benefit from RASKIN was higher for children who started receiving rice at a younger age—group 1 and 2, i.e. 0–5 year olds in 1997 (who first received rice in 2000 at the age of 3–8) as compared to group 3 and 4, i.e. 0–5 year olds in 1993 (who first received rice in 2000 at the age of 7–12).

Table 11: Long-Term Impact of RASKIN

Group 1: Tracing 0–5 year olds in 1997 until 2007

Variables	(1) Height for Age	(2) Weight for Age	(3) Weight for Height
Ras_Dum	0.838**	0.0419	0.124***
	(0.365)	(0.0684)	(0.0472)
Constant	–0.507**	–0.0517	–0.0257
	(0.244)	(0.0456)	(0.0317)
Observations	4,317	4,368	4,315

Group 2: Tracing 0–5 year olds in 1997 until 2014

Variables	(1) Height for Age	(2) Weight for Age	(3) Weight for Height
Ras_Dum	0.658**	0.0429	0.0787**
	(0.293)	(0.0543)	(0.0384)
Constant	–0.367*	–0.0552	0.00346
	(0.203)	(0.0374)	(0.0266)
Observations	5,573	5,628	5,569

continued on next page

Table 11 *continued*

Group 3: Tracing 0–5 year olds in 1993 until 2007

Variables	(1) Height for Age	(2) Weight for Age	(3) Weight for Height
Ras_Dum	0.0277	–0.0217	0.0567*
	(0.233)	(0.0358)	(0.0335)
Constant	–0.268*	–0.0618***	0.0223
	(0.149)	(0.0227)	(0.0214)
Observations	6,489	6,558	6,478

Group 4: Tracing 0–5 year olds in 1993 until 2014

Variables	(1) Height for Age	(2) Weight for Age	(3) Weight for Height
Ras_Dum	0.0809	–0.0194	0.0707*
	(0.277)	(0.0399)	(0.0404)
Constant	–0.393**	–0.0773***	0.0164
	(0.169)	(0.0241)	(0.0246)
Observations	5,277	5,341	5,267

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

6. CONCLUSION

In this paper, we investigate the impact of the RASKIN “rice for poor” program in Indonesia on child health outcomes. We utilize 20-year long panel data for the period of 1993–2014 and adopt two alternate difference-in-difference techniques for the purpose of econometric analysis. We use multiple measures to assess the health status of children, including weight for age, height for age, and weight for height, and we find strong evidence of a positive impact of RASKIN participation on child health status in Indonesia. Further, we analyze the long-run impact of RASKIN for two cohorts of children by tracing their health status from childhood until adolescence/adulthood. We find evidence of positive long-run gains. Furthermore, children who enrolled in the program at a younger age gained more than their older counterparts. Despite the large criticism of the RASKIN program for its inefficiencies and irregularities, we find that overall the program still had a significant positive impact on child welfare in Indonesia. The program’s focus can be improved by better targeting of poor households with greater number of dependents and, unlike the current provision, monthly allotment of rice can be made proportional to the size of the household. RASKIN continues to receive political attention, and it may be important for policymakers to have considerable measures of benefits from the program. Our paper analyzes one aspect of household welfare, that is, child nutrition; however, only a few studies have analyzed its impact on overall household welfare in terms of income, consumption, and well-being. These may constitute important issues for future research.

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APPENDIX

Tables below display stage one regression results for the outcome variable Child Height for Age for age <=15. Stage one results for the other two health outcomes also yield similar coefficient signs and significance.

Table A1: Stage One Regression Results for Child Height for Age: Method A, *Two-stage difference-in-difference*

Variables	Coefficient
Gender (=female)	–0.852***
	(0.172)
tau0	0.730*
	(0.401)
taup1	0.109
	(0.430)
taup2	–0.218
	(0.336)
hh_income	9.39e-09***
	(2.39e-09)
Hh_size	–0.298***
	(0.0553)
HH head Education=High School	0.886**
	(0.383)
HH Head=College and above	2.411***
	(0.515)
Father's height	0.114***
	(0.0153)
Mother's height	0.140***
	(0.0305)
Rural dummy	–1.262***
	(0.319)
Ethnicity1	0.162
	(0.434)
Ethnicity2(minority)	–0.932***
	(0.333)
No. of hospitals	0.00554
	(0.00829)
Electricity	0.0249***
	(0.00678)
Community main income=manu	0.228
	(0.454)
Community main income=service	0.581*
	(0.350)
Road=Paved	–0.0534
	(0.333)
Road=Unpaved	–0.297
	(0.360)
Year dummy	Yes
Constant	32.36***
	(5.128)
Observations	46,892
R-squared	0.899

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A2: Stage One Regression Results for Child Height for Age: Method B,
BDM's Aggregation Technique

Variables	
hhsize	1.602***
	(0.217)
hh_inc	6.73e-09
	(6.69e-09)
Hospital	0.0166
	(0.0326)
Community main income=manu	0.582
	(1.494)
Community main income=service	–0.662
	(1.149)
Rural	–1.704
	(1.504)
Electricity	0.00411
	(0.00589)
other_prg	–1.744
	(1.233)
Year FE	2.553**
HH FE	(1.163)
Observations	13,032
Number of hhno	7,641
R-squared	0.018

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.