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Beyond Average Treatment Effects: Distribution of Child Nutrition Outcomes and Program Placement in India's ICDS

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Summary. — The Indian Integrated Child Development Services (ICDS) aims to improve child nutrition by providing nutritional supplements and pre- and post-natal services to targeted villages. However, previous evaluations find that ICDS fails to reduce malnutrition, and program placement does not uniformly target vulnerable areas. I use new data to reevaluate ICDS on several dimensions; in contrast to previous studies, I find significant treatment effects particularly for the most malnourished children. However, results suggest targeting does not work uniformly well: ICDS effectively targets poor areas, but fails to target areas with low levels of average education or those with unbalanced sex ratios.

Key words — child nutrition, treatment effects, targeting, distributional effects, Asia, India

1. MOTIVATION

"There are people in the world so hungry, that God cannot appear to them except in the form of bread."—Mohandas Karamchand Gandhi

Malnutrition early in a child's life can lower educational attainment and lifetime earnings (Alderman, Hoddinott, & Kinsey, 2006). India's Integrated Child Development Services (ICDS) is one of several programs in the developing world that target long-term nutrition and development of children. This program provides nutritional supplements, vaccinations, health checkups and referral services, and day care. Much of the literature evaluating these programs finds little or no evidence of significant, sizable causal effects on chronic child malnutrition. In this situation, the evaluation of causal impact is complicated by numerous factors. First, causal effects depend on the details of the program and on their context; reductions to long-term child malnutrition need not occur homogeneously with a direct effect. Further, most integrated programs are endogenously placed to target areas of most need, making effective placement of centers crucial to their success. Globally, children from rural and agricultural communities face reduced access to health-care facilities, which in turn renders them particularly vulnerable to the long-term effects of malnutrition. Hence, the impact of ICDS on chronic child malnutrition is relevant not only for Indian policy-makers but also for similar program design in other developing countries.

I evaluate ICDS on two main counts: whether the program has a positive treatment effect on the long-term nutrition of targeted children and whether program placement effectively targets vulnerable segments of the population. I use data from the nationally representative Indian National Family and Health Survey of 2005–06 or NFHS-3 (IIPS & ORC Macro, 2007) and take standardized height-for-age Z-scores (HAZ scores) to reflect long-term child nutritional status. ICDS is the largest program of its kind globally; it has been in place since 1977 and although it cost approximately $1.5 billion in 2008, previous evaluations using data from 1998 to 1999 and earlier showed no evidence in its effectiveness (Gragnolati, Bredenkamp, Das Gupta, Lee, & Shekar, 2006; Lokshin, Dasgupta, Gragnolati, & Ivashenko, 2005). Recently, the World Bank (2007a) recommended that the Indian government redesign the ICDS for a total cost of $9.5 billion. The hefty price tag of redesign, its potential impact on poor households, and the availability of new data motivate this re-evaluation of the impact of the ICDS.

This evaluation of the ICDS contributes to the debate on evaluation of integrated child development program on several counts. First, since ICDS targets children who would otherwise be malnourished, I use Propensity Score Matching to control for endogenous placement. Second, in addition to treatment effects for the entire sample, I also estimate treatment effects for the moderately stunted and severely stunted to determine whether ICDS decreased long-term malnutrition in most-at-risk children. Third, I also estimate these distributional effects for earlier waves of NFHS data to examine whether by focusing on the entire distribution, previous evaluations missed evidence of impact on the most vulnerable. Fourth, although most analyses of program placement (for ICDS, see Lokshin *et al.*, 2005) rely on probit regressions to study targeting the distribution of state-wise ICDS coverage exhibits negative skewness which violates normality required by probit. In this paper, I use beta regression to control for the negative skewness of coverage to determine whether program placement works as intended. Comparison with probit specifications highlights the importance of accounting for skewness. Finally, I use newly available household survey data as well as budget data from the Indian government to evaluate ICDS. These approaches reveal unambiguous evidence that ICDS significantly reduces long-term child malnutrition in India.

I conduct my analysis in two steps: first, Propensity Score Matching (PSM) identifies the effect of ICDS on HAZ scores. Second, probit and beta regression examine the placement of

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ICDS in villages as a function of the observables on which the government bases its placement decision, namely population, average income, district-level sex ratios, and infrastructure. PSM shows ICDS increases average HAZ scores by approximately 6%; this effect size is larger than estimated treatment effects from similar programs in other developing countries. I also find significant treatment effects for the worst-off children, girls in particular. Treatment effect estimates thus suggest ICDS significantly reduces chronic child malnutrition.

Placement results suggest that while ICDS effectively targets poor areas with risky water sources, sex ratios and landholdings do not play a significant role in placement. ICDS targets areas with more educated mothers, which appears regressive because villages with fewer educated people might benefit most from the intervention. I also find that voting patterns correlate with the allocation of national ICDS funds to states while the states' chronic child malnutrition levels do not. In summary, my results show that while ICDS significantly increases HAZ scores, program placement fails to target villages in most need, and political alliances play an important role in budget allocation. This paper contributes by being the first in this literature to estimate distributional treatment effects for HAZ scores due to ICDS. This paper also highlights the importance of accounting for the nature of the data distribution in estimating, say, program placement. Finally, this paper is the first to find evidence of a significant impact of ICDS on chronic child malnutrition.

2. LITERATURE REVIEW

Although real Indian GDP *per capita* doubled in the last 15 years (World Bank, 2007b), child stunting only decreased by 16% over the same period: 69% of children under five were stunted in 1992–93 (NFHS-1), 68% in 1998–99 (NFHS-2), and 58% in 2005–06 (NFHS-3). Further, data from the NFHS-3 show that 45.9% of all Indian children are severely undernourished (three or more standard deviations from the global reference mean for any nutritional indicator). The Indian government takes a two-step approach to reducing child malnutrition: the Public Distribution System makes food available at subsidized prices, and the Integrated Child Development Services (ICDS) provides nutritional supplements, bundled child and maternal services, and day-care facilities to targeted households.

Evaluations of integrated child development programs in most developing countries have yielded little evidence of an impact on HAZ scores. Walker, Grantham-McGregor, Himes, Powell, and Chang (1996) find that early childhood food supplementation does not improve HAZ scores in Jamaica, while Walsh, Dannhauser, and Joubert (2007) report that a nutrition education program in South Africa failed to affect HAZ scores although it had significant positive effects on other measures of nutrition. Similarly, Armecin *et al.* (2006) evaluate a Philippine early child development program to find significant positive effects on short-term nutrition and on cognitive, social, motor, and language development but not on HAZ scores. Stifel and Alderman (2006) study a Peruvian milk subsidy program, *Vaso de Leche* to find that although the intervention is well targeted, it failed to significantly improve child nutrition. In contrast, a few studies find integrated child nutritional programs have a small impact on HAZ scores. Behrman and Hoddinott (2001) find that the Mexican PROGRESA caused a 3% decrease in the probability of a child being stunted. Thus the lack of evidence of a large and statistically significant effect of ICDS on HAZ scores appears to be the norm rather than an exception. Worldwide, chronic malnutrition as measured by HAZ scores appears to be the hardest measure to improve.

A rich literature surrounds the evaluation of other non-integrated child nutrition interventions. This literature tends to find that providing early childhood nutrition intervention significantly improves health and educational attainment, even in adulthood. For instance, Maluccio, Hoddinott, Behrman, Martorell, and Quisumbing (2009) use panel data from Guatemala to evaluate the impact of an intervention that provided protein supplements from 1969 to 1977. The authors use a sub-sample of children younger than seven at the time of the intervention to find participation increased schooling and standardized test scores 25 years after the intervention. Similarly, Gillespie *et al.* (2001) find that a Chinese national salt iodization intervention halved goiter rates. Unconditional cash transfers also appear to significantly improve child nutrition: Agüero, Carter, and Woolard (2006) study the South African unconditional cash transfer program to find it significantly improves child height-for-age, and results in a large earning gain in adulthood. Schady and Paxson (2007) study the Ecuadorean unconditional cash transfer program to find it improves child nutrition, but not other outcomes such as visits to health clinics or parenting practices. In summary, while integrated programs appear to fail to significantly reduce child stunting, cash transfers and focused nutritional supplementation might significantly reduce child malnutrition.

ICDS targets the physical and psychological development of children younger than six in the most vulnerable and economically disadvantaged sections of the population. Village ICDS centers provide food supplements, health care including immunizations and referral services, and information on nutrition and health. Centers also provide early childhood care, daycare and preschool education. The government directs ICDS funds through a two stage targeting process. First, the national government provides each state with an ICDS budget based on state-level development characteristics. Each state then uses its ICDS budget to place centers in villages based on village-level development characteristics. Community-level surveys and the enumeration of families living below the poverty line provide national and state governments information on development characteristics like poverty rates, infrastructure, and health outcomes. The government also hopes to reduce the incidence of female infanticide and feticide by placing ICDS in areas with significantly fewer girls than boys. In addition to providing nutritional support, ICDS centers provide information on the benefits of having (and educating) a girl child.

Evaluations of ICDS tend to concur that implementation issues limit its effectiveness. Gragnolati *et al.* (2006) find that while using all services provided by ICDS centers might result in health and nutritional benefits, most families use only nutritional supplements, immunization services, or day care facilities, which yield insignificant benefits. Other studies have identified similar limitations with smaller samples. Saiyed and Seshadri (2000) study a sample of 610 children under the age of three receiving full, partial, or no services through ICDS over a 1-year period. Although full utilization of ICDS services results in a significant improvement in stunting, wasting, and weight-for-age, partial utilization has a smaller impact.

Researchers have found that ICDS fails to improve parenting practices and is often unable to provide necessary medical referrals. Prinja, Verma, and Lal (2008) study 60 ICDS centers in the northwestern state of Haryana and find that participation in an ICDS center affects neither breastfeeding patterns nor the involvement of the mother in the child's growth