Effect of National Immunizations Days on Immunization Coverage, Child Morbidity and Mortality: Evidence from Regression Discontinuity Design

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EXTENDED ABSTRACT

Background

National Immunization Days (NIDs), days set aside to provide vaccines or combination of vaccines to children of specified age-group nationally or sub-nationally, have become an integral component of global strategy to reduce vaccine-preventable deaths. These campaigns are seen as low-cost way of supplementing routine immunization by providing a first dose for children missed by the routine system and providing additional doses for those with a single dose. In spite of the widespread popularity of NIDs, there is limited rigorous empirical evaluation of their impact on health of children partly due to the difficulty of identifying a suitable control group for a robust counterfactual analysis since NIDs tend to be conducted nationwide. Much of the existing evidence on the health impact of NIDs comes from national reports on campaigns documenting trends in NIDS and trends in mortality. Such time-series correlations cannot be interpreted causally since improvements in delivery of health services over time confound correlation between NIDs and health outcomes.

This paper seeks to address two important questions about NIDs: 1) Does participation in NIDs affect routine immunization coverage, 2) Does participation affect improve child mortality and morbidity?

Methods

Data Sources

The data analyzed in this study come from the demographic and health surveys (DHS) and the multiple indicators cluster survey (MICS), two programs of nationally-representative surveys conducted periodically in sub-Saharan countries and other regions of the world. In both the DHS and the MICS surveys, women of reproductive age (women aged 15-49) in sampled households are asked to provide (among other topics) information on immunization of surviving children. Childhood immunization histories are obtained in similar fashion in the DHS and the MICS. In both the MICS and the DHS, mothers are also frequently asked about each child's participation in recent SIAs against polio. In some surveys, respondents are asked whether their child has participated in any SIA in recent years. In other surveys, participation in specific SIAs is elicited from mothers. In the DHS, mothers are asked: "At which national immunization day campaign did (NAME [of child]) receive vaccinations?" with options such as A: Measles campaign of November 2007; B: Polio campaign of June 2003, among others. In the MICS, the question is "Please tell me if (NAME) has benefited from any of the following campaigns, national immunization in the last year and/or vitamin or child health week". Respondents then answer 'Yes' 'No' or "Don't Know" to date-specific campaigns. The study uses data for all countries for which questions about date-specific campaigns: Bangladesh (2007), Benin (2006, 2005, 1999), Burkina Faso (2005), Cote d'Ivoire (2006, 2005), Gambia (2005, 2004), Guinea (2004), Indonesia (2002), Iraq (2005), Kenya (2008), Lesotho(2004), Malawi (1999), Mali(2000), Namibia (2006, 2005), Nepal (2011, 2010), Niger (2005), Rwanda (2000), Senegal (2004), Swaziland (2004), Togo (2005) and Uganda(2001).

We obtained dates of SIAs either directly from the survey questionnaire or indirectly from the WHO registers of SIAs (online at: http://apps.who.int/immunization_monitoring/en/globalsummary/siacalendar/padvancedsia.cfm).

Empirical procedure

We employ a Regression Discontinuity Design in our estimation. The discontinuity stems from the fact that children born on or immediately after one round of NID may not have opportunity to receive vaccines from an NID at the prescribed age. We estimate the causal impact of participation in an NID at date T_j on outcomes, y_{ij}, by from estimating the following system:

$$y_{ij} = \beta Z_{ij} + f(a_{ij}) + X'\gamma + \varepsilon_{ij} \qquad (1)$$

$$Z_{ij} = \alpha W_{ij} + g(a_{ij}) + X'\theta + \mu_{ij} \qquad (2)$$

Where W_{ij} is an indicator that child i is born after NID taking place on date j, Z_{ij} is indicator variable that takes a value 1 if child i, participated in NID at date T_j and zero otherwise, a_{ij} is the age of child i at NID date T, f(·) and g(·) are flexible functions of a_{iTj}, X is a vector of child, mother and household characteristics and ε_{ij} and μ_{ij} are child-specific error terms. Eligibility is not strictly enforced and some eligible children to not participate in NID so the design is a fuzzy regression discontinuity design. Under the assumption that a_{iTj} is continuous at the eligibility cut-off, the causal effect of measles NID on childhood morbidity and mortality is identified by the parameter β. The identifying assumption will be violated if mothers strategically time their births to take an advantage of NID. Although we believe this is unlikely, we provide evidence that this is not the case.

Our outcome variables for immunization coverage are i) indicator for receiving all three DPT vaccines by age 12 months, and ii) indicator for receiving all vaccines receiving all DPT vaccines at the prescribe ages (6th, 10th and 14th week of life for DPT 1, 2 and 3 respectively). For child mortality we use under-five, infant and neonatal deaths. For morbidity, we consider indicators for having diarrhea, fever and cough.

Results to date

Preliminary results shows that being before immediately after an NID significantly reduced the probability of participating in NIDs. The first-stage results are very strong for all the countries and campaign considered. Preliminary results shows that participation in NIDs strongly increases the probability of completing all DPT vaccines and also completing them on time. On-going analysis is focusing on the mortality and morbidity outcomes. Results for selected countries are shown in the Figure 1 and Table 1 below.

Figure 1: first-stage

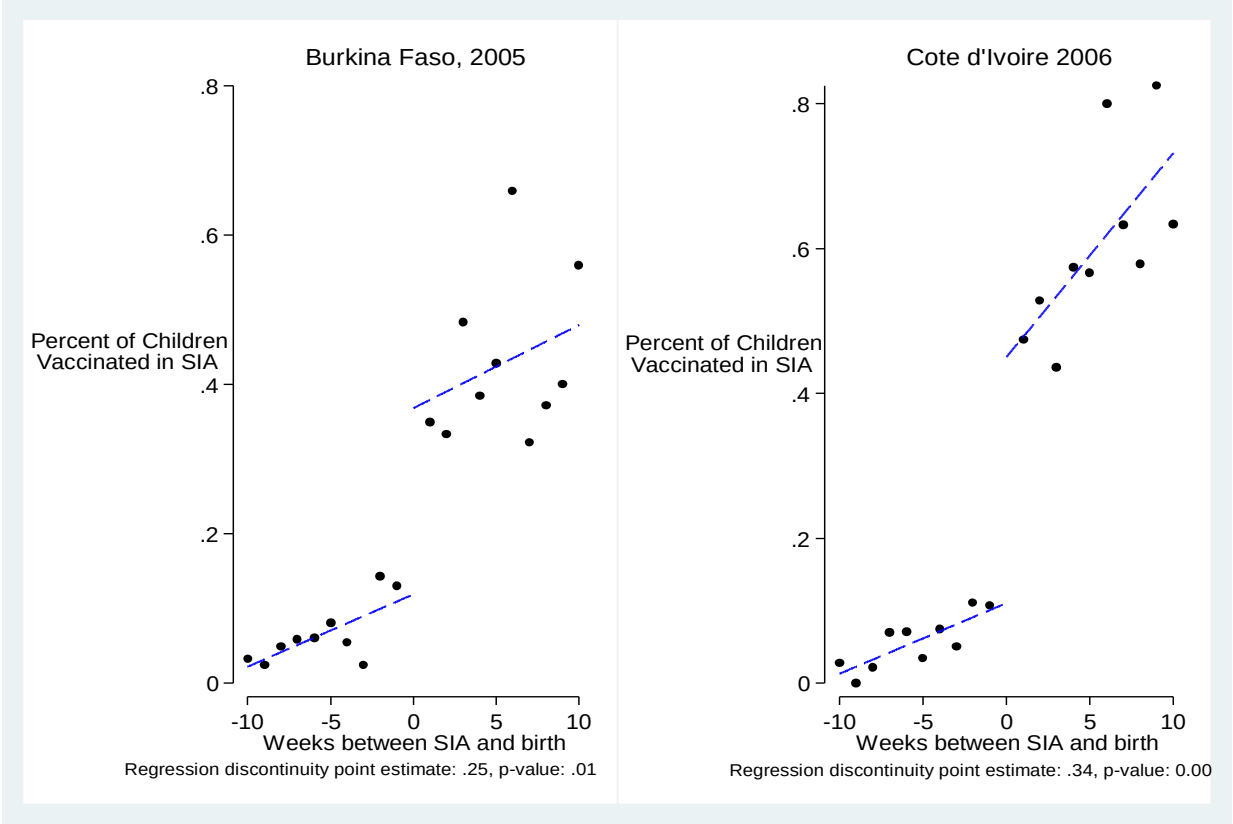

Table 1: Regression results for two countries/ NID campaigns

Panel A: First-stage regressions

Outcome variable: Indicator for receiving polio vaccines during an NID campaign

	Cote d'Ivoire 2006		**Burkina Faso 2005**	
Was born after NID campaign	-0.397***	-0.391***	-0.246***	-0.202***
	(0.048)	(0.050)	(0.031)	(0.047)
Month and year dummies	No	Yes	No	Yes
Observations	6725	6725	6685	6685
Wald chi^2 (14)	498.78	537.70	1341.36	1203.32
Pseudo R^2	0.0968	0.1026	0.2619	0.2667

Panel B: IV regressions

Outcome variable: Indicator for received all three doses of DPT vaccine

Received vaccine at NID	0.943***	0.826***	0.839**	0.673**
	(0.341)	(0.259)	(0.324)	(0.375)
Month and year dummies	No	Yes	No	Yes
Observations	6725	6725	6685	6685
Wald chi^2 (14)	359.29	415.96	359.29	415.96

Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% levels respectively. All reported regressions are from probit models. Regressions in columns 1 and 2 do not include month and year dummies. Sample for regressions in column 2 is restricted born after the last NID campaign before the campaign under analysis.