The Determinants of Women's Health Preferences and Behavior: Evaluating the Impact of Cash Incentive Programs on Safe Childbirth on Child Vaccinations in Nepal

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Background

- Worldwide, approximately 1.4 million children die annually due to incomplete vaccination. In Nepal, approximately 17% of children do not get the World Health Organization (WHO) recommended vaccine doses on time (Pandey & Lee, 2012).

- Mothers' knowledge and awareness of health issues are critically important in determining the likelihood that they would vaccinate their children (Pandey & Lee, 2012)
- Cash incentives conditioned on antenatal care, institutional deliveries, and postnatal care play pivotal roles in:
  1) Pursuit and awareness of health information
  2) Adoption of behaviors that lead to improved children's health, well-being, and survival (Witter, Khadka, Nath, & Tiwari, 2011; Upreti et al, 2012)

Background (Cont.)

- In 2005, the Nepali government launched a maternity incentive program, known as the Safe Delivery Incentive Program (SDIP), which provided cash to women who:
  1) "completed the four sessions of antenatal care",
  2) "gave birth in an institutional setting", and
  3) "attended first postnatal care" (Upreti et al, 2012).

- This study examined the impact of SDIP on the likelihood of child vaccinations.

- The expectation is that women who received cash incentive (SDIP) will have stronger preference for child vaccination because of the awareness and exposure to health information.

Research Question and Hypotheses

- **Research Question:** Does the SDIP program influence the likelihood that women will vaccinate their children?

Hypothesis_1: Women who participate in the SDIP are more likely to comply with the recommended 8-dose child vaccinations.

Hypothesis_2: Women who participate in the SDIP are more likely to comply with the recommended 1-dose BCG child vaccination.

Hypothesis_3: Women who participate in the SDIP are more likely to comply with the recommended 3-dose DPT child vaccination.

Hypothesis_4: Women who participate in the SDIP are more likely to comply with the recommended 3-dose polio child vaccination.

Hypothesis_5: Women who participate in the SDIP are more likely to comply with the recommended 1-dose measles child vaccination.

Data

- The study used data from the sixth wave of the 2012 Nepali Demographic and Health Survey (DHS).

- The DHS, funded by the U.S. Agency for International Development, has earned a worldwide reputation for collecting and disseminating accurate, nationally representative data on fertility, family planning, maternal and child health, gender, HIV/AIDS, malaria, and nutrition (Demographic and Health Survey, 2012).

- **Sample**
  - The sample consists of 1,000 women who were selected because the target population was mothers with children between 12 months and 23 months of age, as WHO recommends that each child receive eight vaccines—1 dose for BCG, 3 doses for DPT, 3 doses for Polio, and 1 dose for Measles—during the first 12-23 months of life.

Measurement

- **Dependent variables.** There are five dependent variables—all 8 recommended vaccines; the 1 dose for BCG; the 3 doses for DPT; the 3 doses for Polio; and the 1 dose for Measles. Children's vaccination is a dichotomous measurement, which is coded as 0 for not receiving and 1 for receiving.

- **Independent variable.** The independent variable is whether women completed all 4 sessions of antenatal care (4ANC), institutional delivery (ID), and a first postnatal visit. Complying with the set of conditions is a dichotomous measurement, which is coded as 0 for non-completion and 1 for completion of the program.

- **Confounding variables.** The confounding covariates are individual, household, and regional characteristics related to delivery service and children's vaccination, which should influence the treatment condition but not in reverse. See Table 2 for details.

Estimands

- Average treatment effect (ATE) is chosen to compare difference in means between the treated and control group. The ATE is equal to:

$$\tau = E[Y(1) - Y(0)]$$
$$= E[E[Y|Z = 1, X] - E\big[Y[Z = 0, X]\big]$$

Where Y(1) is defined as the potential outcome under exposure to the treatment, and Y(0) is defined as outcome under no exposure to the treatment. Z =1 refers to exposure to the treatment, whereas Z =0 indicates no exposure to the treatment. X indexes a vector of confounding covariates.

- In theory, the ATE is identical to average treatment effect for treated (ATT) if adjusting for differences in the distribution of *X* between treated and control removes all confounding. Therefore, the estimand is measured by the ATT. The ATT is as follows:

$$\tau_t = E[Y(1) - Y(0)|Z = 1]$$
$$= E[E[Y|Z = 1, X] - E[Y|[Z = 0, X]|Z = 1]$$

Where all definitions are identical to the above ones, except for the given condition, |Z=1, which indicates that we can use the matched groups to estimate each mean. Thus, the treatment effect of the SDIP on the child's vaccination is estimated with the ATT.

Data Analysis Strategies

- First, descriptive statistics were used to summarize the sample of this study.
- In addition, based on an assumption that data from non-experimental design may incur a selection bias on estimating the effectiveness of the program, this study used propensity score matching (PSM) to provide a robust method of comparison between a treatment and a control group.
- Throughout analyses, the study uses a *p*-value of .10 to test for significance.

Propensity Scores

- Propensity scores are created by logistic regression, which predicts each participant's probability of being assigned to the treatment group based on the characteristics of covariates listed in Table 2.
- In an observational study, propensity scores are unknown and must be estimated based on confounding covariates in the sample. In order to obtain an estimate $\hat{\pi}_i$ of each individual's true propensity score π_i, logistic regression model of the conditional probability of receiving treatment (i.e., women who comply with the required conditions) is as follows:

$$\hat{\pi}_i = \frac{e^{\hat{\eta}_i}}{1 + e^{\hat{\eta}_i}} = \frac{1}{1 + e^{-\hat{\eta}_i}}$$

Where

$$\hat{\eta}_i = \hat{\beta}_0 + \sum_{j=1}^{J} \hat{\beta}_j X_{ij}$$

Where $X_i$is the vector of covariates for individual i, β is a vector of regression coefficients that are estimated by maximum likelihood, and j indexes the covariates included in the model.

Assumptions

- The most important assumptions required for propensity score matching are ignorability, sufficient overlap, appropriate specification of the propensity score model/ balance achieved, and stable unit treatment values assumption (SUTVA).

  - First, the ignorability assumption holds because important confounding variables were included in this model, which assumes that the covariates in *X* are the only confounding covariates.
  - Second, Figure 1 and Figure 2 show that there are slightly sufficient overlap so that the sufficient overlap assumption holds, even though the Figures do not show the perfectly sufficient overlap between treatment group and control group.
  - Third, Table 1 indicates that balance was achieved.
  - Finally, SUTVA holds because units do not interfere with each other and have the same potential outcome for the same treatment.

Diagnostics

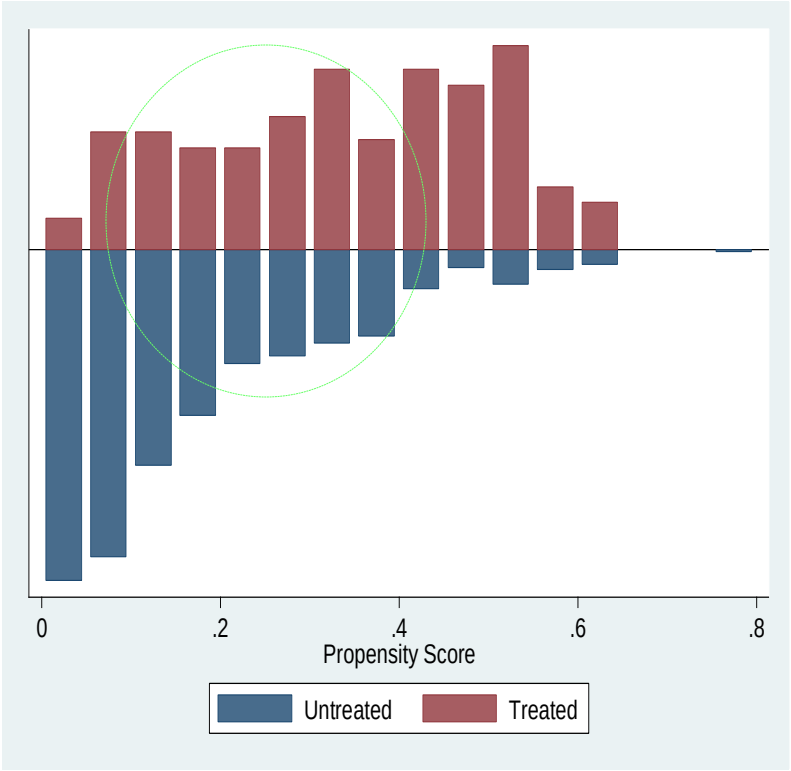

Figure 1. Checking balance with overlap between the treatment group and the control group.

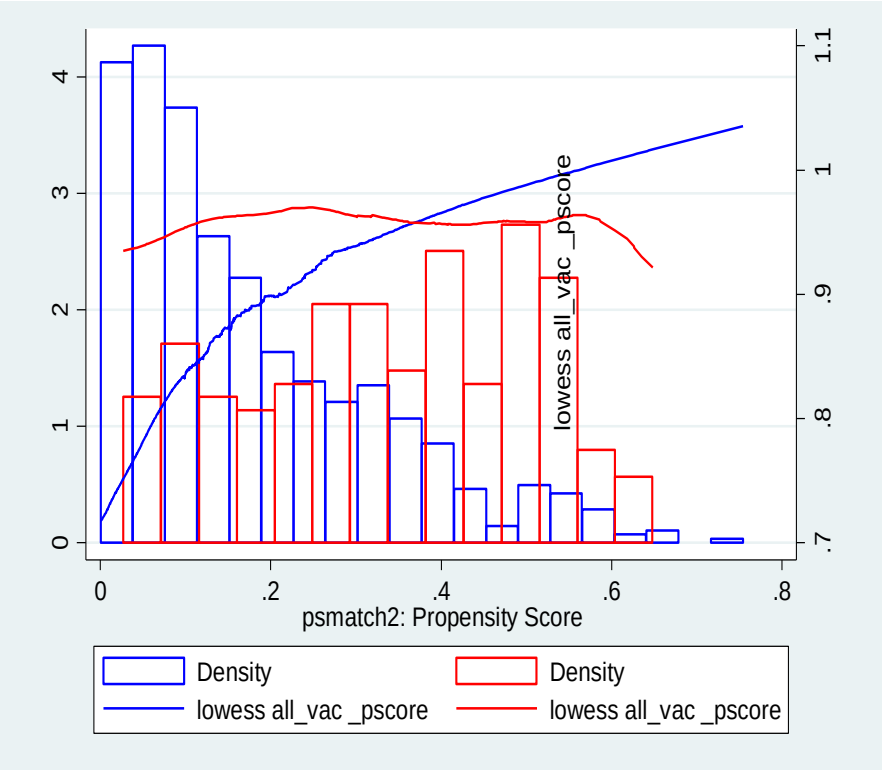

Figure 2. Histogram/response surface plot, showing heterogeneity, which indicates that ATE, ATT, and ATC are different.

Results: Descriptive Statistics

Table 2.
Summary of Variables

Variables	Frequencies (%) Mean (*S.D.*)
Dependent Variables	
Child received all 8 recommended vaccinations	86.6
Child received 1 dose for BCG	96.5
Child received 3 doses for DPT	91.7
Child received 3 doses for polio	92.5
Child received 1 dose for measles	88.3
Independent Variable	
Completed SDIP, 4ANC, and postnatal	20.4
Covariates	
Mother's education	
No education	45.2
Primary (1-5th grades)	20.0
Secondary and higher (6th grade and above)	34.8
Health knowledge (heard about STD or AIDS) (1=Yes)	80.0
Makes financial, healthcare, mobility, and purchase decisions	69.6
Mother's paid work (1=Yes)	15.8
Household head (1=Female)	24.1

Caste (1=privileged caste)	26.7
Religion (1=Hindu)	79.2
Ecological region	
Hill	40.2
Mountain	7.5
Terai	52.3
Development region	
Central	34.5
Eastern	22.9
Western	18.7
Mid-western	13.8
Far-western	10.1
Wealth index (1=middle and upper class)	52.6
Is distance to health facility a problem? (1=Big problem)	57.2
Is money of health care a problem? (1=Big problem)	56.0
Exposure to media (1=non-exposure to newspaper, radio, or TV)	14.5
Age	25.8 (5.70)
Number of members in household	6.2 (3.01)
Number of less than 5 years old in household	1.6 (0 .88)
Sample Size (N)	1,000

Source: Data from the Demographic and Health Surveys in Nepal, 2011.

Note: Frequencies are used for categorical/binary variables and mean (S.D.) is used for continuous variables. Weight is applied.

Results (Cont.): Treatment Effects

Table 3.

Comparison of Treatment Effect Between Treatment Group with Complete SDIP and Control Group with incomplete SDIP

Dependent Variables	Complete case regression[a]		Propensity score: One-to-one M[b]		Propensity score: Caliper M[c]		Propensity score: FM[d]	
	TE	*SE*	TE	*SE*	TE	*SE*	TE	*SE*
All 8 vaccinations	1.05*	1.02	1.04+	1.02	1.04*	1.02	1.01	1.01
1 dose for BCG	1.02	1.01	1.02+	1.01	1.02**	1.00	1.00	1.00
3 doses for DPT	1.04*	1.02	1.06*	1.02	1.05**	1.01	1.02***	1.00
3 doses for polio	1.03	1.02	1.03+	1.01	1.02***	1.00	1.02**	1.00
1 dose for measles	1.03	1.02	1.00	1.01	1.01	1.01	1.00	1.01

Notes: p+ < 0.1; p* < 0.05; p** < 0.01; p*** < 0.001. Covariates are composed of mother's education, decision making, household head, caste, religion, ecological region, development region, wealth index, the problems of distance and money to health care, exposure to media, age, numbers of member in household, and number of children younger than 5 years old in household.

a n= 1,000. Weight is applied.

b n =332; One-to-one M = one-to-one matching with replacement.

c n =437

d n =945; FM = full matching.

Discussion

Findings

- Compared to what would happen if women had not completed the 4ANC, ID, and postnatal visits, women who completed all of the 4ANC, ID, and postnatal visits increased their children's vaccinations by 4% of likelihood, controlling for all other factors.

- The results indicate that the cash incentive program has positive effects on increases in children's vaccinations.

- Findings suggest that encouraging women to use institutional delivery and antenatal care services are a desirable policy strategy to keep them engaged with health facilities and continue to use its services for their child's vaccinations.

Discussion (Cont.)

Limitations

- First, the study pays attention to only the effects of the demand side of the SDIP on women's institutional deliveries rather than on the supply side, such as health providers. Further studies should include the supply side effects.
- Second, this study does not consider health care quality, which influences women's preference and decision for birth delivery service at public health facilities.
- Third, this study does not take the size of the financial package offered by the program into account when examining the effectiveness of the SDIP, due to data limitations.

Conclusion

- The results suggest that focusing on increases in women's knowledge of health and encouraging women to visit public health facilities and to use antenatal and postnatal care may be a desirable policy strategy to help improve children's health.