The Impact of the Mexican Conditional Cash Transfer on Immunization Rates

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1 Introduction

Every year more than 2 million children die from diseases that could have been prevented by inexpensive vaccines (UNICEF, 2005). While many countries have increased immunization rates over time, coverage is still low in many regions. In 2003, coverage for measles and diphtheria, pertussis and tetanus toxoids (DPT) vaccines was below 90 percent in Latin American and middle- income countries and below 80 percent for low-income countries (The World Bank, 2003). Vaccination coverage is even lower for traditionally under-used vaccines such as haemophilus influenzae type b, at one in five children worldwide, despite the dramatic reductions in the cost of this vaccine in late 1990s (WHO, 2002). The current challenge is two fold: 1) to understand the impediments that limit the demand and supply of vaccines, and 2) to evaluate policies and program that may increase vaccine coverage. A better understanding of these issues will not only provide insights into how to improve immunization rates today, but may be instrumental in successful rapid dissemination of future life saving vaccines for diseases such as malaria or HIV/AIDS. In this paper, we focus on the latter question and evaluate the impact of randomized conditional cash transfer program in Mexico, Progresa, on children's vaccination coverage for TB and measles.

Conditional cash transfers (CCT) are a policy tool that has recently been used to reduce poverty by building the human capital of children. They are a departure from pure income transfer programs since cash transfers are provided conditional on the beneficiary household engaging in a set of behaviors designed to improve their health, nutrition and education status. While improving vaccination coverage is not an explicit goal of CCT programs, meeting a regular schedule of vaccinations may be part of the conditionalies. For this reason they may prove to be an effective way to improve immunization rates.

Our analysis takes advantage of a randomized experiment designed to investigate the impact of Progresa on vaccination coverage of measles and TB for children under the age of 36 months.[1] As a way to rigorously evaluate the program, the Mexican government randomized 506 Progresa villages into treatment and control villages. Eligible households in treatment communities received the conditional transfers starting in the spring of 1998, and control villages were brought on approximately a year and a half later. We utilize data from the May 1998, October 1998 and May 1999 evaluation surveys to determine the impact of the program 6 and 12 months post baseline (PBL) using a double difference estimator.

Past research on the Nicaraguan CCT program did not reveal significant impacts of CCTs on full vaccination coverage of children aged 12-23 months (Maluccio and Flores, 2004). Children of this age group were considered to be fully vaccinated if they received 3 doses of polio and DPT, and one dose of the measles and tuberculosis (TB) vaccines. We examine the effect of the Mexican CCT program on child immunization rates to determine if the results are similar in a different context. We also provide a more in-depth analysis than Maluccio and Flores (2004) by presenting results by investigating the impact of age groups and type of vaccine. Since the recommended age for vaccination varies by type of vaccine (Table 1)[2], disaggregating by age and vaccine type is important. Including the older age groups allows us to determine if Progresa encouraged children, who were not vaccinated at the recommended age, to catch-up with their vaccinations. Unfortunately, vaccination rates were too high for these children prior to the program that analysis on catch-up is not possible. Lastly, since some groups of people may have been affected differentially by the program, we examine the heterogeneity of

[1] While data was collected on DPT and polio vaccinations, data inconsistencies strongly imply that these data were improperly recorded making the data unreliable for these vaccines.
[2] For example, following the Mexican schedule of vaccination (Table 3.1) children should receive their TB inoculation at birth and measles at 12 months of age.

the impact with respect to gender of the child, mother's education, household head's ethnicity and health supply characteristics.

2 The Progresa Intervention

2.1 Background

Adopted in 1997, Progresa aims to break the intergenerational transmission of poverty by improving the human capital of poor children in Mexico. The program targets the rural poor, reaching nearly 2.5 million rural households by 2000. The Progresa model is extremely popular throughout the Latin American region and has been adopted by Argentina, Colombia, Honduras, Jamaica, and Nicaragua.

Progresa differs from other poverty reduction programs in that it combines two traditional methods of poverty alleviation: cash transfers and free provision of health and education services. These elements are linked by conditioning the cash transfers on children attending school and family members obtaining sufficient preventative health care. Therefore, the income transfer not only relaxes the household budget constraint, but also provides an incentive to increase utilization of health and education services. The program was first introduced in rural areas; it was later expanded into urban areas however this study focuses on the rural program.

Eligible households in each community were identified on the basis of a welfare index. The welfare index was developed using data from a census taken of all households in each Progresa community (Encaseh*)*. The census collected information on household income and other socio-economic characteristics that capture the multidimensional nature of poverty. Using these data, the welfare index was established and households were classified as poor or non-

poor.[3] Only poor households became eligible for benefits. Households did not have to apply, but were informed of their eligibility either at community meetings or in household visits. Enrollment in Progresa was high at 94% (Gertler, 2000).

The health component of Progresa was designed to promote family health and nutrition. However, the majority of the conditionalities focused on infant, children, and pregnant and lactating women in an effort to ensure a healthier start to life. While not the only health conditionality, children must receive the regular schedule of vaccinations to participate in the program (Table 1). Other health conditionalities included:

1. growth monitoring from conception to age 5;
2. regular preventative health check-ups for all family members, including prenatal care, and well baby care;
3. mother's attendance at health, hygiene and nutrition education programs; and
4. children ages 0-2 and pregnant and lactating women taking nutritional supplements.

Anticipating the need to evaluate the impact of Progresa, the Mexican government designed a randomized experiment. In 1998, 506 of the approximately 50,000 eligible villages were chosen to participate in the experiment. The government randomly assigned 320 communities into treatment areas and 186 into control areas. These communities were located in 7 states within Mexico (Guerrero, Hidalgo, Michoacan, Puebla, Queretero, San Luis Potosi, and Veracruz). [4]

Eligible households in treatment communities received benefits starting in the spring of 1998 while household in control areas were incorporated in November 1999 or later. The delay in implementation of the program in control villages was justified since the government lacked

[3] See Skoufias, Davis and Behrman (1999) for more details.
[4] See Skoufias, Davis and Behrman (1999) for a detailed description of the targeting procedures for choosing Progresa village.

sufficient funds to provide the program nationally from the outset. The transfers were fairly large and estimated to be on average 20 percent household expenditures (Skoukias, 2001).

2.2 Vaccination Coverage in Mexico and Possible Impediments to Program Success

The Mexican Universal Vaccination Program (UVP) was established by presidential decree in January of 1991. This program was given 20 months in which to show measurable results. It was successful, and by October 1992 coverage rates for DPT, TB and measles were 91%, 95% and 90% respectively (see Figure 1 for trends in DPT and measles). Polio coverage was already high before the UVP was introduced at 95 percent. Despite an economic crisis in 1994, the Mexican government sustained its support for the program and vaccination rates remained above 90 percent throughout the 1990s (Rossetti and Gauri, 2004).

These high rates of vaccination in Mexico achieved prior to Progresa make increasing rates further a challenging goal. Furthermore, since Progresa is a demand-side program, success in raising coverage also hinges on there being demand-side factors that hinder children from receiving their vaccinations. Immunization coverage, however, is the result of a complex interaction between supply- and demand-side factors.[5] So, Progresa's effectiveness in raising vaccination rates also relies on adequate supply in vaccines to meet the potential increases in demand. Unfortunately, data on vaccine supply in Mexico could not be obtained.

[5] Factors that affect vaccination coverage vary by country, but may include among others: capabilities of the national immunization organizations, political support, health care supply and quality, mother's education, local beliefs, mother's empowerment, and socio-economic level (Garui and Khaleghain, 2002). Free-riding in response to positive externalities associated with other children receiving vaccinations may also affect coverage.

3 The Data

The Progresa evaluation dataset comprises a panel of approximately 24,000 households covering the period October 1997 to October 2000. Baseline surveys were taken in October 1997 and May 1998, and five follow-up surveys were implemented at approximately 6 month intervals. Community surveys were also taken during the Progresa evaluation and are used as a source of health clinic data for this study. Owing to limited availability of vaccine utilization data, our sample covers the time period May 1998 to May 1999 and includes 22,809 observations. An unbalanced panel is used as children may move in and out of the sample due to births or age changes. Table 2 provides the exact number of observations by the number of surveys in which a child participates.

3.1 Dependent Variables

Immunization information on TB, DPT (diphtheria, pertussis, and tetanus), polio and measles is provided at the child level in the May 1998, October 1998 and May 1999 surveys. Due to issues of data accuracy, this study focuses on TB and measles. We use the Mexican Schedule of Vaccinations (Table 1), to determine if a child's vaccinations are up-to-date. A binary dependent variable is created that takes on the value 1 if a child received all the recommended doses of a vaccine and zero otherwise. This variable is made for each child at the time of each survey. Since both the measles and TB vaccines only require one dose, there is no need to investigate partial coverage.

As shown in the vaccination schedule in Table 1, it is recommended that TB be provided at birth. If Progresa is effective, increases in vaccination rates for TB should be experienced for children less than 12 months of age. We also examine 12-23 and 23-25 month olds to determine

if the program helped children make-up missed vaccinations. Unlike TB, the measles vaccine should be given to a child at 12 months of age. Program effects are mostly likely occur at between the ages of 12 and 23 months. Again, catch-up is measured by examining older age groups (children aged 24-25 months).

The vaccination data was collected differently in each of the surveys. The May 1998 baseline survey provides information by vaccine type on the total number of doses ever received by children age five and under. The October 1998 survey was taken approximately 6 months post baseline (PBL). In this survey, respondents are asked to provide information on the number of doses of each vaccine the child received in the past 6 months (i.e. in the period between surveys) for all children in their household under the age of six. The May 1999 survey provides data on immunizations 12 months PBL. Similar to the October 1998 survey, data is collected on the number of doses of each vaccine that the child received in the prior 6 months. However, immunization information in the May 1999 survey is only provided for those children aged two and under. We therefore limit our analysis to this age group.

To determine whether a child is up-to-date with vaccinations, the total number of doses of each vaccine received by each survey date must be calculated. This is calculated in October 1998 by adding the number of doses received by baseline (provided in the May 1998 survey), to the number of doses received in the last six months (recorded in the October 1998 survey). A similar process is used to calculate the cumulative number of doses received by May 1999.

Careful examination of the data reveals that the surveyors may not have collected the data correctly. Table 3 displays the total number of vaccinations for TB and polio for each child if calculated according to the procedure described above. In May 1998 either children were not vaccinated or they received the recommended dose. By the time of the second survey, a 60

percent of children appear to have received 2 doses – more than recommended number. This percent reached 87 percent by the third survey. It is highly unlikely that such a high proportion of children received more vaccinations than is necessary in the October 1998 and May 1999 surveys, but not in the baseline survey. It is especially surprising since the TB vaccine leaves a scar indicating the child received this vaccine. The pattern is similar for polio and the other vaccine types that are not presented in Table 4 (measles and DPT). Thus, we believe that some surveyors collected data on the cumulative number of doses received in the October 1998 and May 1999 surveys, rather than the number of doses received only in the past six months.

This problem does not affect the calculations of the up-to-date vaccinations for TB and measles. Since both of these vaccinations only require one dose to be fully covered, a child reported to have received one, two or three vaccinations all indicate full coverage. However, data for those vaccinations that require more than one dose, namely DPT and measles, are unusable. Consider a child that is not fully vaccinated for Polio by the October 1998 survey. Suppose they received one dose of the Polio vaccine before May 1998 and another dose in the 6 months prior to October 1998. If a surveyor recorded the cumulative number of doses received prior to both surveys, the data would indicate that the child had received three doses of Polio and was fully vaccinated. Since it is not possible to determine whether the data was collected in accordance with the survey instructions,[6] the DPT and Polio data are not examined in this analysis.

Another issue with the data occurs because the survey instrument asks for the number of doses received in the previous six months in the October 1998 and May 1999 surveys. Each survey is taken approximately six months apart, so if all new entrants in these surveys are

[6] Examination of the surveyor's manual did not clarify the issue.

children under the age of 6 months, the total number of doses ever received can be calculated in the manner we describe above. As shown in Table 4, approximately 40 percent of the children who join the sample after May 1998 are 12 months old or greater. If these children have received one dose of TB or measles, one can be certain that they are fully vaccinated. However, if the child received no doses, it is unclear if this is because the child was not vaccinated and the zero is correct, or if the child was vaccinated more than six months ago. If the surveyors had recorded the data correctly, these observations should be coded as missing as we are unsure of the value. With the coding change, the number and percent of missing observations and the percent of observations is almost the same between the treatment and controls for all surveys (Table.5, rows 2 and 3) Due to the missing observations, there will be fewer children who have received zero doses in the last two surveys and vaccination rates may be artificially high.

Since is appears that a large percent of the surveyors actually recorded total vaccinations received in the last two surveys, we also create a variable that changes the missing observations back to zeros for new entrants in last two surveys. Table 5 column 4 shows the number of children who vaccinations value is recoded to zero. The percent reset is higher for measles because children should receive this vaccination at a later age than for TB (12 months instead of at birth) leading to a larger percent of zeros in the sample as a whole (Table 5, column 5). This assumption may lead to an under-estimate of vaccination levels for the sample. Fortunately, the percent of missing observations and ones that were filled with zeros is similar between the treatment and control groups.

While the two methods of creating the dependent variable lead to different levels of vaccinations, the finding remain the same. For this reason, we only present the results for the variable that was recoded back to zero.

4 Methods and Empirical Model

The objective of this research is to identify the average effect of Progresa on vaccination coverage. Specifically, we would like to compare immunization rates when Progresa was available with the counterfactual—i.e., when Progresa is not available in the treatment areas at the same point in time. Since the counterfactual is never observed, we must estimate it. The Progresa evaluation employed the most rigorous methods to choose a counterfactual possible—random assignment. When randomization is done well, the treated and untreated have on average the same observed and unobserved characteristic removing selection bias and causality concerns regarding the choice of the counterfactual group.

Tables 6 and 7 compare the difference in means between treatment and control groups at baseline for vaccination rates by age group, and for other individual, household, and community characteristics respectively. They reveal that the randomization was successful for the covariates, but that the vaccination rates are statistically different between the treated and untreated for some age groups.[7] In order to take these baseline differences in immunization coverage between treatment and control into account, we use a double difference estimator to measure the impact of the program.

4.1 Double Difference Estimator

The double difference estimator compares the change in outcomes in the treatment group before and after the intervention to the change in outcomes in the control group. By comparing changes, the estimator controls for characteristics that do not change over time within treatment

[7] This finding matches Behrman and Todd (1999).

and control groups, as well as characteristics that change over time in the same way between the two groups. The change in the control group is an estimate of the true counterfactual, that is, what would have happened to the treatment group if Progresa had not been implemented.

The first difference is achieved by comparing the treatment and control group at baseline, thereby accounting for any inherent differences in means between the groups. The second difference measures the change over time between the treatment and control. This can be represented by the following equations, where $I_{i,t}$ is the mean immunization rate for group i at time t.

First Difference:
$D1 = (I_{1,0} - I_{2,0})$ 1= Progresa (treatment village), 2=control village;
0= Baseline;

Second Difference:
$D2 = (I_{1,t} - I_{2,t})$ 1= Progresa (treatment village), 2=control village;
t= 6, or 12 months PBL;

Double Difference Estimation:
$D2 - D1 = (I_{1,t} - I_{2,t}) - (I_{1,0} - I_{2,0})$, measures the impact of Progresa 6 or 12 months PBL.

Note, this estimator assumes that the variation between groups accounted for at the baseline does not change over time. While it is never possible to test such an assumption, data limitations do not allow us to verify if the change in mean vaccination rates over time is the same for both groups prior to Progresa. This assumption seems reasonable since the time period between the baseline and the final survey is short. However, is does rely on vaccination supply being constant or changing in the same way between treatment and control groups.

4.2 Empirical Specification

We estimate the intent to treat separately for measles and TB and each age group using an OLS model.[8,9] While the survey includes information on DPT and polio, these variables are not analyzed for reasons discussed earlier. The regression equation is:

$$V_{ihvt} = \alpha_t + \beta_1 T_v + \gamma_1 (T_v * PBL6_t) + \gamma_2 (T_v * PBL12_t) + X'\lambda + \varepsilon_{ihvt} \quad (3.1)$$

where:

V_{ihvt} = 1 if child i in household h from village v in time period t is vaccinated and zero otherwise;
α_t = time fixed effects;
T_v = 1 if child i is from a treatment village and zero otherwise;
$PBL6_t$ = 1 if 6 months PBL and zero otherwise;
$PBL12_t$ = 1 if 12 months PBL and zero otherwise;
X = baseline socio-economic characteristics of child, households, and health clinic and personnel characteristics; and
ε_{ihvt} = error term.

The coefficients, γ_1 and γ_2, are the double difference estimates of the average impact of the program on vaccinations rates 6 and 12 months PBL respectively. We include time fixed effects, α_t , to control for time varying factors that are common to both control and treatment areas and a program dummy, T_v, to account for differences in mean vaccination rates between the treatment and control groups at baseline. Since heteroskedasticity is present in a linear probability model and there is possible spatial and temporal correlation among the errors terms, standard errors are robust and clustered at the village level.[10]

[8] While a village fixed effect model is feasible, lack of within village variation results in low levels of significance. This is a consequence of high pre-program vaccination rates and there being too few children of the appropriate age in each village; forty-five percent of villages had less than three children age one at baseline, and 76 percent of the villages had vaccination rates of 100 percent for the same age group.
[9] Non-linear models such as probits or logits that use maximum likelihood methods are often employed when the dependent variable is binary. Since vaccination rates are close to or equal to one for certain groups, these models provide unreliable estimates because the probability is perfectly or almost perfectly predicted.
[10] Spatially- and temporally- correlated errors may be present due to the nature of the panel data.

It is important to examine whether Progresa helps some groups increase their vaccination coverage more than others. We examine the heterogeneity of the impact with respect to six different binary variables: if the child is female; if the child's mother finished primary school; if the household head only speaks an indigenous language; if the village has a permanent health care clinic; if the village has a mobile health clinic; and, if the nearest health care clinic is more than 5.5 kilometers away.[11] We estimate these effects using a modification of equation 3.1 in which all the program variables are interacted with the binary heterogeneity variable of interest, *H*. The subscript on *H* will differ depending on which of the six variables it represents. The regression equation is specified as:

$$V_{ihvt} = \alpha_t + \beta_1 T_v + \beta_2 H_i + \beta_3 T_v * H_i + \gamma_1 (T_v * PBL6_t) + \lambda_1 (T_v * PBL6_t * H_i) + \gamma_2 (T_v * PBL12_t) + \lambda_2 (T_v * PBL12_t * H_i) + X'\lambda + \varepsilon_{ihvt} \quad (3.2)$$

If H_i is one for a female child, and λ_1 and λ_2 are the difference in the impact of the program between girls and boys 6 and 12 months PBL, respectively.

While establishing a relationship between vaccination coverage and the amount of the transfer could be of interest to policy makers, it is not possible using the Progresa experiment. This is because receipt of vaccinations at the scheduled time is a conditionality of the program for all children and does not vary by transfer amount.

4.3 Non-Random Attrition and Additions to the Sample

The double difference estimator will be biased if there is non-random attrition or introduction of new children into the sample between surveys. A non-random change in the sample would lead the treatment and control groups to be incomparable over time. Such a change

[11] We choose the distance 5.5 kilometers because it is the mean distance to the nearest permanent health care clinic.

might occur if the program had an impact on outcomes such as infant mortality, migration or fertility. Past research shows that the program had little or not effect on fertility and out-migration patterns (Skoufias, 2001; Raymond, 2002). The program did lead to a decrease in infant mortality rates of 2 deaths per 1000 live births among the treated (Barham, 2005). Fortunately, with less than 1600 treated children under the age of one in the sample, infant mortality has a negligible impact on attrition.

We test for non-random changes over time in the sample by comparing differences in the baseline characteristics between treatment and control groups in each of the surveys. As discussed previously, non-vaccination characteristics do not significantly differ at the five percent level between the treated and untreated at baseline (May 1998). If attrition is a problem, we may find differences in later surveys between these same groups. With the exception of one variable in the October 1998 survey, baseline characteristics between the treated and untreated do not differ in the October 1998 or May 1999 surveys (Tables 8, and 9). At a significance level of 5 percent, it is expected that one variable is significantly different by chance.

5 Results

5.1 Summary Statistics

Table 10 presents the differences in the percent of children inoculated against TB and measles between the treatment and control groups at baseline and each post baseline survey by age group. Because the TB vaccine is scheduled to be given at birth, one would expect the program to have the highest impact among children less than 12 months of age. Baseline data for this group indicate that differences in vaccination rates exist between treatment and control groups prior to program interventions. Coverage for the treated is 3 percentage points lower than

the control group (88 percent as compared to 91 percent). At six months PBL, vaccination rates rose slightly to 89 percent for the treated but declined to 87 percent among the controls.[12] Using the double difference estimator, this drop in coverage in the control group resulted in a five percent point increase in coverage due to the program. This impact disappears by 12 months PBL as the control group recovers from the decline in vaccination coverage.

The high vaccination rates prior for TB to Progresa make it difficult to demonstrate program effectiveness. To address this issue, we examine vaccination coverage in villages with vaccination rates lower than 90 percent for children aged 0-11 months at baseline (Table 11). We refer to these villages as the low coverage villages.[13] The previous findings remain; there is no impact of the program on TB 12 months PBL.

We further disaggregate TB coverage rates with respect to the sex of the child, mother's education,[14] ethnicity of the household head, presence of a permanent or mobile clinic, and distance to a permanent clinic. We do no present these results since we find no evidence that Progresa improves vaccination coverage for TB.

The program could have affected TB coverage among older children who were not inoculated before the age of one. For children aged 12-23 months and 24-35 months, vaccination rates are so close to 100 percent prior to the program for both the full sample and lower coverage villages that there is no room for Progresa to have an effect. In fact, the double difference

[12] It is unknown what led to the decline in immunization coverage in the control group. It is possible that a shortage of vaccines during this year led to a shift in supply to Progresa areas from control areas. An alternative explanation is that there was a free rider problem and controls decreased their coverage in response to the positive externalities accrued from immunization in treatment areas. This reason seems unlikely, however, given that coverage rates only increased by one percent in the treatment areas. Unfortunately we are unable to determine the reason for the decline in immunization with the present data.

[13] For measles, a low coverage village is one that has less the 90 percent coverage for children aged one at baseline.

[14] We are unable to identify who is the mother of the child for children who entered the sample after baseline. Since we would like to keep these children in the sample, we proxy for mother's education with the education of the head or spouse of the head house, depending on which one is female.

estimator may be misleading because coverage rates reach their maximum of 100 percent and simply reflect differences at baseline between the treated and untreated. For this reason, the estimates for the double difference are not reported for these two groups in Table 10 and 11. These high coverage rates may mask differences among certain groups of children. Disaggregating vaccination rates reveals that there is little heterogeneity in the data with respect to TB (Tables 12 and 13), and coverage rates are still too high to accurately measure a double difference impact. As a result, regression results will not be provided for these age groups.

Vaccination against measles should take place at 12 months of age. The analysis therefore focuses on children 12-23 and 24-35 months of age. At baseline, 92 percent of treated children aged 12-23 months were vaccinated as compared to 95 percent of control children in the same age group (Table 10). By six months PBL, the immunization rate increased four percentage points to 96 percent for the treated, equalizing the coverage rates between the two groups and leading to a program impact of three percentage points. The program impact is sustained through 12 months PBL. Immunization levels among treatment and control areas remain the same, though levels decline to 91 percent in this period.

Restricting the sample to low coverage villages, (villages with coverage rates lower than 90 percent for children aged 12-23 months) reveals an almost doubling of the program impact to six percent at 12 months PBL (Table 11). Similar to the full sample, this finding mainly reflects the treatment group catching-up from lower immunization level at baseline rather than an increase relative to the control group.

Examining the heterogeneity of the results reveals that the program effects on measles are experienced among children whose mother had less the primary school education and children that reside in localities that do not have a permanent heath care clinic and the clinic at least 5.5

kilometers away (Table 14).[15] For both these groups the findings mimic the full sample; the program equalizes vaccination rates and is approximately equal to differences in means at baselines between the treated and the untreated.

Similar to TB, measles coverage is too high to calculate a reliable double difference estimate for the 24-26 month olds (Tables 10, 11, 15, and 16). Again, the double difference estimator is not reported for this age group and will not be included in the regression analysis.

5.2 Regression Results

Controlling for baseline levels of health care supply and parents' and household characteristics, the findings presented in the summary statistics are confirmed (Table 17). While the impact of the program is not significant for TB if results are pooled for 6 and 12 months PBL (Table 17, columns 1and 2), they are significant once the impact is separated by survey year. Among children 12-23 months old, Progresa leads to a five percentage point increase in TB coverage for the full sample by 6 months PBL. The impact is the same in villages with low vaccination coverage at baseline, but is not significant due to the reduced sample size (Table 18). Recalling the findings in the summary statistics, this effect is primarily due to a reduction in vaccination rates in the control group rather than an increase in the treatment group. After the control group recovered from the drop in vaccination coverage, there is no longer a significant impact of the program on TB 12 months PBL.

For measles, the program has a statistically significant impact of 3 percentage point for 12-23 month olds at 6 and 12 months PBL for the full sample (Table 17, column 8). When the

[15] We do not perform this analysis on villages with low vaccination coverage since sample sizes are too small. We also do not present results for gender and health supply since they are not significant. Results for all the heterogeneity tests are provided in the regression results.

sample is restricted to villages with low vaccination coverage, the program effect is no longer statistically significant at 6 month PBL. At 12 months PBL, the impact is twice as large at 6 percentage points and is statistically significant. The program impact at 12 months PBL represents a 3 and 6 percent increase in vaccination coverage for the full sample and the restricted sample respectively. Such small effects are not surprising given the high levels of vaccination coverage in Mexico prior to Progresa. An alternative view, however, is that the program led to a 50 percent reduction in the coverage gap of children who are not vaccinated and approximately equalized the coverage rates between the treatment and the control groups.

5.3 Heterogeneity of the Treatment Effect

The heterogeneity of the treatment effect is presented in Tables 19 and 20. The estimate of the program impact amongst subgroups is similar whether or not the sample was limited to low vaccination villages, but results are not significant for the latter group due to a smaller sample size. We therefore only present results for the full sample.

The findings do not statistically differ for TB at 12 months PBL (Tables 19 and 3.20, columns 1-3). As discussed in the summary statistics, by 12 months PBL intent to treat effect for measles is higher for children whose mother has less than primary school education and who live further away from a permanent health care clinic (Tables 19 and 3.20, columns 4-6). These results are encouraging as they indicate that Progresa aided disadvantaged groups who had lower vaccination rates at baseline in treated communities relative to the controls catch-up.

6 Discussion

A year after its' introduction, the Mexican CCT program, Progresa, had no impact on TB immunization rates, but led to a significant three percent increase in coverage for measles among 12-23 months olds on a base of 93 percent. While this is a significant impact, it is unclear how this small increase in coverage will affect the incidence of measles in Mexico. The improvements in immunization rates were experienced among children who lived on average at least 5.5 kilometers from a permanent health care clinic and whose mother had not completed primary school. In all cases, the program effect resulted in an equalization of vaccination rates between the treatment and control from baseline levels which were lower for the treated.

The limited impact of Progresa on immunization coverage is not surprising since vaccination levels were already in the 90s for both TB and measles in Mexico prior to the program.[16] While a difficult context in which to be successful, it is encouraging that Progresa helped groups whose immunization levels lagged behind for reasons of access and lack of education reach levels experience by other groups. This is an important finding as it shows that, at least in Mexico, CCT programs may be able to help those who have traditionally lower coverage rates. In analysis of CCT programs in other countries, it will be important to investigate if this result is robust to a change in context.

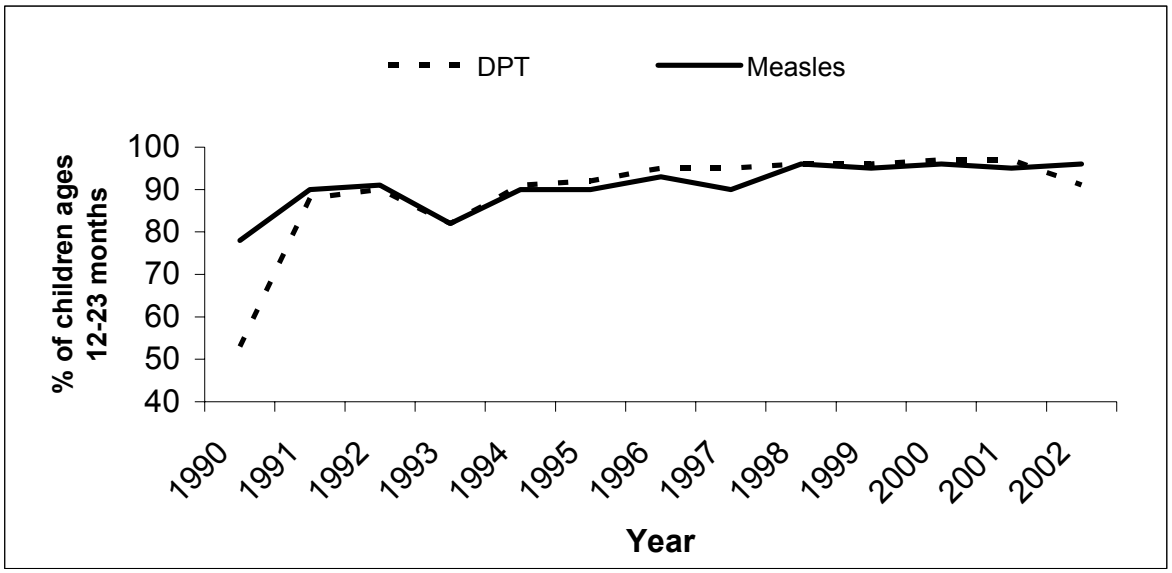
We faced a number of data quality issues which gives some concern regarding the reliability of the results. Many of these issues are a consequence of the post baseline surveys collecting data on number of doses received since last survey. To address these concerns we split the sample a number of different ways and use alternative measures of the dependent variable and reach consistent conclusions. To avoid the problems of data accuracy experienced in this

[16] Due to these high vaccination rates in the before Progresa, we are unable to examine the success of Progresa in encouraging older children who missed receiving their vaccinations at the normal age, catch-up.

study, it is recommended that future panel data questionnaires gather total doses ever received in each of the surveys.

1. Figures and Tables

Figure 1: Trends in DPT and Measles Coverage in Mexico.



Source: World Bank Development Indicators, The World Bank 2003.

Table 1: Basic Vaccination Schedule for Mexico.

Type of Vaccine	Required Doses	Recommended Age for Vaccine
Tuberculosis (TB)	1	At birth
Polio	1	2 months
	2	4 months
	3	6 months
Diphtheria, pertussis and tetanus toxoids (DPT)	1	2 months
	2	4 months
	3	6 months
	Booster 1	2 years
	Booster 2	4 years
Measles	1	12 months

Source: Provided by The Mexican National Institute of Public Health

Table 2: Observations by Number of Surveys a Child is Present.

	May-98	Oct-98	Nov-99
Children in 3 surveys	3,115	3,115	3,115
Children in 2 surveys	2,360	2,360	
	131		131
		2,293	2,293
Children in 1 survey	874		
		1333	
			1689
Total Observed	6,480	9,101	7,228

Table 3: Number of Observations by Total Number of Doses for Children 12-23 Months.

Total Doses	TB			Polio		
	May-98	Oct-98	May-99	May-98	Oct-98	May-99
0	59	31	7	41	11	12
1	2,188	722	115	590	129	51
2		1,146	420	498	377	125
3			410	526	464	184
4				287	378	174
5				184	235	147
6				0	122	85
7				0	59	58
8				0	19	34
9				0	5	16
10				0	1	4
11				0	0	1
13				0	0	1
14				0	0	1
Total Observations	2247	1899	952	2126	1800	893

Table 4: Age Distribution of Children New to the Sample After May 1998.

Age	Frequency	Percent
< 12 months	3,177	59.77
12-23 months	1,229	23.12
24-36 months	909	17.1
Total	5,315	100

Table 5: Observations for Alternative Handling of the Dependent Variable, by Vaccine Type.

	Total			Treatment Group			Control Group		
	May-98	**Oct-98**	**Nov-99**	**May-98**	**Oct-98**	**Nov-99**	**May-98**	**Oct-98**	**Nov-99**
TB									
Total observations	6480	9101	7228	3999	5659	4468	2481	3442	2760
Number of missing observations	54	665	360	34	398	221	20	267	139
% missing	1	7	5	1	7	5	1	8	5
Number of missing reset to zero	0	296	152	0	173	94	0	123	58
% not changed	0	45	34	0	43	35	0	46	32
Number of missing after change	54	369	208	34	225	127	20	114	81
% missing after change	1	4	3	1	4	3	1	4	3
Measles									
Total observations	6480	9101	7228	3999	5659	4468	2481	3442	2760
Number of missing obervations	195	1937	1665	122	393	246	73	250	154
% missing	3	21	23	3	7	6	3	7	6
Number of missing reset to zero	0	1294	1265	0	798	772	0	496	493
% changed	0	67	69	0	67	68	0	66	70
Number of missing after change	195	643	400	122	393	246	73	250	154
% missing after change	3	7	6	3	7	6	3	7	6

Table 6: Baseline Vaccination Rates.

	Treatment			Control			Difference	
	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
< 12 months								
TB	0.88	(0.013)	1320	0.91	(0.013)	788	-0.03	-1.71
12-23 months								
TB	0.97	(0.005)	1397	0.98	(0.006)	850	-0.01	-1.05
Measles	0.92	(0.009)	1383	0.95	(0.009)	841	-0.03	-2.27
23-35 months								
TB	0.98	(0.006)	758	0.97	(0.008)	484	0.01	0.72
Measles	0.96	(0.009)	751	0.95	(0.012)	481	0.01	0.72

Table 7: Difference in Means Between Treatment and Control Groups, May 1998.

	Treatment			Control			Difference	
	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
Female (=1)	0.49	(0.009)	3507	0.50	(0.009)	2140	-0.01	-0.85
Age of father	36.81	(0.270)	3507	36.96	(0.432)	2140	-0.14	-0.28
Age of mother	32.98	(0.280)	3507	32.89	(0.381)	2140	0.09	0.18
Years of father's education	3.53	(0.090)	3507	3.42	(0.104)	2140	0.11	0.80
Years of mother's education	3.13	(0.098)	3507	3.18	(0.110)	2140	-0.05	-0.34
Household head speaks an indigenous language (=1)	0.40	(0.034)	3504	0.39	(0.046)	2139	0.01	0.10
Health center (=1)	0.10	(0.025)	3507	0.06	(0.019)	2140	0.04	1.15
Mobile health clinic (=1)	0.72	(0.033)	3507	0.68	(0.043)	2140	0.04	0.81
Any clinic (=1)	0.79	(0.030)	3507	0.71	(0.043)	2140	0.08	1.45
Health worker in village (=1)	0.74	(0.030)	3507	0.79	(0.038)	2140	-0.05	-1.06
Distant to health center (km)	6.85	(0.419)	3507	6.51	(0.567)	2140	0.34	0.48
Cost to reach clinic (pesos)	9.42	(1.208)	3507	11.78	(1.978)	2140	-2.36	-1.02
Size of household (=1)	6.47	(0.069)	3507	6.45	(0.107)	2140	0.02	0.16
Number of hectars of land	1.71	(0.112)	3506	1.72	(0.125)	2139	-0.01	-0.09
Number of draft animals	1.66	(0.028)	3499	1.64	(0.042)	2132	0.02	0.40
Number or rooms in house	0.56	(0.015)	3498	0.58	(0.018)	2136	-0.02	-1.03
Household has:								
Radio (=1)	0.37	(0.019)	3502	0.41	(0.024)	2135	-0.04	-1.38
TV (=1)	0.02	(0.004)	3502	0.02	(0.007)	2136	0.00	-0.05
Vehicle (=1)	0.34	(0.016)	3507	0.31	(0.018)	2140	0.03	1.03
Dirt floor (=1)	0.67	(0.019)	3493	0.68	(0.025)	2132	-0.01	-0.35
water_land97	0.36	(0.027)	3500	0.29	(0.033)	2135	0.07	1.70
Water piped to home (=1)	0.06	(0.007)	3501	0.04	(0.007)	2129	0.01	1.34
Bathroom (=1)	0.53	(0.023)	3499	0.53	(0.026)	2125	0.00	0.02
Water piped to bathroom (=1)	0.03	(0.004)	3493	0.03	(0.004)	2129	0.00	-0.47
Electricity (=1)	0.66	(0.027)	3501	0.69	(0.029)	2137	-0.03	-0.86
Fridge (=1)	0.07	(0.007)	3502	0.09	(0.011)	2135	-0.01	-1.04
Gas heater (=1)	0.21	(0.017)	3502	0.23	(0.027)	2136	-0.02	-0.51

Table 8: Difference in Means Taken at Baseline Between Treatment and Controls, October 1998.

	Treatment			Control			Difference	
	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
Female (=1)	0.49	(0.008)	4891	0.50	(0.008)	2930	-0.02	-1.60
Age of father	37.65	(0.260)	4899	38.02	(0.401)	2936	-0.37	-0.78
Age of mother	34.06	(0.288)	4899	34.23	(0.388)	2936	-0.17	-0.35
Years of father's education	3.41	(0.091)	4899	3.29	(0.104)	2936	0.12	0.86
Years of mother's education	3.01	(0.092)	4899	3.05	(0.107)	2936	-0.04	-0.32
Household head speaks an indigenous language (=1)	0.41	(0.034)	4600	0.40	(0.046)	2754	0.00	0.05
Health center (=1)	0.09	(0.026)	4899	0.06	(0.018)	2936	0.04	1.16
Mobile health clinic (=1)	0.74	(0.031)	4899	0.67	(0.045)	2936	0.07	1.27
Any clinic (=1)	0.79	(0.028)	4899	0.70	(0.044)	2936	0.09	1.79
Health worker in village (=1)	0.74	(0.030)	4899	0.77	(0.040)	2936	-0.03	-0.56
Distant to health center (km)	7.02	(0.479)	4899	6.83	(0.613)	2936	0.18	0.24
Cost to reach clinic (pesos)	10.07	(1.361)	4899	11.46	(1.918)	2936	-1.38	-0.59
Size of household (=1)	6.43	(0.065)	4605	6.47	(0.108)	2755	-0.05	-0.36
Number of hectars of land	1.70	(0.115)	4604	1.85	(0.137)	2755	-0.16	-0.87
Number of draft animals	0.35	(0.016)	4605	0.33	(0.018)	2755	0.02	0.67
Number or rooms in house	1.64	(0.027)	4595	1.64	(0.041)	2746	0.00	-0.08
Household has:								
Radio (=1)	0.56	(0.015)	4595	0.58	(0.020)	2753	-0.03	-1.16
TV (=1)	0.36	(0.019)	4599	0.41	(0.024)	2752	-0.06	-1.83
Vehicle (=1)	0.02	(0.004)	4599	0.02	(0.006)	2753	0.00	0.00
Dirt floor (=1)	0.68	(0.019)	4589	0.69	(0.026)	2746	-0.01	-0.29
water_land97	0.36	(0.027)	4595	0.28	(0.032)	2751	0.08	1.79
Water piped to home (=1)	0.06	(0.007)	4597	0.04	(0.007)	2742	0.01	1.45
Bathroom (=1)	0.52	(0.024)	4593	0.52	(0.027)	2744	0.01	0.16
Water piped to bathroom (=1)	0.03	(0.003)	4586	0.02	(0.004)	2746	0.00	0.38
Electricity (=1)	0.65	(0.027)	4598	0.69	(0.031)	2753	-0.04	-0.87
Fridge (=1)	0.07	(0.007)	4599	0.08	(0.010)	2752	-0.01	-1.06
Gas heater (=1)	0.20	(0.017)	4598	0.23	(0.027)	2753	-0.03	-0.82

Table 9: Difference in Means at Baseline Between Treatment and Control Groups, May 1999.

	Treatment			Control			Difference	
	Mean	SE	Obs	Mean	SE	Obs	Diff.	T-stat
Female (=1)	0.49	(0.009)	3826	0.50	(0.009)	2308	-0.02	-1.47
Age of father	37.55	(0.296)	3854	38.50	(0.476)	2327	-0.95	-1.70
Age of mother	34.13	(0.329)	3854	34.72	(0.445)	2327	-0.59	-1.06
Years of father's education	3.47	(0.096)	3854	3.25	(0.107)	2327	0.22	1.51
Years of mother's education	3.10	(0.102)	3854	3.04	(0.108)	2327	0.06	0.41
Household head speaks an indigenous language (=1)	0.40	(0.035)	3630	0.42	(0.048)	2183	-0.02	-0.39
Health center (=1)	0.10	(0.026)	3854	0.06	(0.018)	2327	0.04	1.26
Mobile health clinic (=1)	0.74	(0.032)	3854	0.65	(0.047)	2327	0.09	1.55
Any clinic (=1)	0.80	(0.029)	3854	0.68	(0.047)	2327	0.12	2.20
Health worker in village (=1)	0.75	(0.029)	3854	0.79	(0.039)	2327	-0.04	-0.77
Distant to health center (km)	6.88	(0.462)	3854	6.57	(0.616)	2327	0.31	0.40
Cost to reach clinic (pesos)	8.85	(1.009)	3854	11.41	(2.036)	2327	-2.56	-1.13
Size of household (=1)	6.14	(0.063)	3634	6.32	(0.123)	2184	-0.18	-1.27
Number of hectars of land	1.65	(0.118)	3634	1.80	(0.143)	2182	-0.15	-0.82
Number of draft animals	0.34	(0.016)	3634	0.33	(0.019)	2184	0.01	0.40
Number or rooms in house	1.60	(0.029)	3628	1.60	(0.036)	2176	-0.01	-0.18
Household has:								
Radio (=1)	0.56	(0.015)	3627	0.59	(0.020)	2180	-0.03	-1.03
TV (=1)	0.36	(0.019)	3629	0.39	(0.024)	2180	-0.03	-1.07
Vehicle (=1)	0.02	(0.003)	3629	0.02	(0.004)	2180	0.00	0.51
Dirt floor (=1)	0.67	(0.019)	3622	0.71	(0.025)	2176	-0.03	-1.08
water_land97	0.36	(0.027)	3626	0.28	(0.033)	2179	0.08	1.77
Water piped to home (=1)	0.06	(0.007)	3628	0.04	(0.007)	2177	0.01	1.30
Bathroom (=1)	0.53	(0.025)	3627	0.52	(0.026)	2175	0.01	0.29
Water piped to bathroom (=1)	0.03	(0.003)	3618	0.02	(0.004)	2173	0.00	0.05
Electricity (=1)	0.67	(0.028)	3629	0.67	(0.033)	2181	0.00	-0.03
Fridge (=1)	0.07	(0.007)	3629	0.08	(0.011)	2179	-0.01	-0.72
Gas heater (=1)	0.20	(0.017)	3628	0.20	(0.025)	2180	0.01	0.18

Table 10: Summary Statistics for Vaccination Rates, Full Sample.

	Treatment			Control			Simple Difference		Double Difference	
	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat	Difference	T-Stat
Tuberculosis										
< 12 months										
Baseline	0.88	(0.013)	1320	0.91	(0.013)	788	-0.03	-1.71		
6 months PBL	0.89	(0.010)	1312	0.87	(0.015)	737	0.02	1.16	0.052	2.07
12 months PBL	0.92	(0.010)	952	0.93	(0.013)	592	-0.02	-0.94	0.016	0.66
12-23 months										
Baseline	0.97	(0.005)	1397	0.98	(0.006)	850	-0.01	-1.05		
6 months PBL	1.00	(0.001)	1615	0.99	(0.002)	981	0.00	1.02	--	
12 months PBL	0.98	(0.003)	1354	0.98	(0.004)	821	0.00	0.18	--	
23-35 months										
Baseline	0.98	(0.006)	758	0.97	(0.008)	484	0.01	0.72		
6 months PBL	1.00	(0.001)	1790	1.00	(0.001)	1096	0.00	-1.50	--	
12 months PBL	1.00	(0.001)	1440	1.00	(0.000)	848	0.00	-1.42	--	
Measles										
12-23 months										
Baseline	0.92	(0.009)	1383	0.95	(0.009)	841	-0.03	-2.27		
6 months PBL	0.96	(0.005)	1543	0.96	(0.007)	935	0.00	0.17	0.030	2.03
12 months PBL	0.91	(0.009)	1299	0.91	(0.010)	790	0.00	-0.07	0.028	1.00
23-35 months										
Baseline	0.96	(0.009)	751	0.95	(0.012)	481	0.01	0.72		
6 months PBL	0.99	(0.003)	1753	0.99	(0.002)	1078	-0.01	-1.61	--	
12 months PBL	1.00	(0.002)	1425	1.00	(0.002)	840	0.00	-0.96	--	

Table 11: Summary Statistics for Vaccination Rates, Low Coverage Villages.

	Treatment			Control			Simple Difference		Double Difference	
	Mean	SE	Obs	Mean	SE	Obs	Mean	T-Stat	Difference	T-Stat
Tuberculosis										
< 12 months										
Baseline	0.71	(0.023)	539	0.74	(0.026)	265	-0.03	0.94		
6 months PBL	0.89	(0.015)	551	0.87	(0.025)	243	0.02	0.60	0.05	1.13
12 months PBL	0.90	(0.017)	402	0.94	(0.020)	200	-0.04	-1.60	-0.01	0.22
12-23 months										
Baseline	0.96	(0.010)	555	0.95	(0.016)	251	0.01	0.62		
6 months PBL	1.00	(0.003)	636	0.99	(0.007)	286	0.01	1.26	--	
12 months PBL	0.98	(0.006)	559	0.98	(0.007)	254	-0.01	-0.61	--	
23-35 months										
Baseline	0.98	(0.012)	293	0.95	(0.018)	123	0.03	1.32		
6 months PBL	0.99	(0.003)	705	1.00	(0.003)	322	0.00	-0.61	--	
12 months PBL	1.00	(0.002)	589	1.00	(0.000)	259	0.00	-1.41	--	
Measles										
12-23 months										
Baseline	0.75	(0.021)	423	0.80	(0.019)	205	-0.05	-1.59		
6 months PBL	0.96	(0.009)	425	0.96	(0.015)	253	0.00	0.06	0.05	1.51
12 months PBL	0.92	(0.018)	330	0.90	(0.020)	199	0.01	0.51	0.06	1.90
23-35 months										
Baseline	0.91	(0.027)	202	0.91	(0.032)	123	0.00	-0.11		
6 months PBL	0.96	(0.011)	505	0.98	(0.008)	271	-0.02	-1.50	--	
12 months PBL	0.99	(0.006)	425	1.00	(0.000)	210	-0.01	-2.27	--	

Table 12: Difference in Means for TB by Individual and Household Characteristics, Children Aged 12-23 Months.

	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
		Female			*Male*			
Treatment								
Baseline	0.97	(0.007)	687	0.97	(0.008)	710	0.00	-0.24
6 months PBL	1.00	(0.002)	779	1.00	(0.001)	832	0.00	-1.05
12 months PBL	0.98	(0.005)	605	0.98	(0.005)	746	0.00	-0.34
Control								
Baseline	0.97	(0.007)	438	0.98	(0.006)	412	-0.01	-1.01
6 months PBL	0.99	(0.003)	498	1.00	(0.003)	481	0.00	-0.41
12 months PBL	0.98	(0.007)	410	0.98	(0.006)	411	0.00	-0.50
		HH Head Speaks an Indigenous Language			***Doesn't Speak an Indigenous Language***			
Treatment								
Baseline	0.96	(0.010)	549	0.98	(0.007)	846	-0.01	-1.00
6 months PBL	1.00	(0.003)	625	1.00	(0.001)	911	0.00	-1.26
12 months PBL	0.99	(0.004)	514	0.98	(0.005)	764	0.01	1.86
Control								
Baseline	0.97	(0.010)	337	0.98	(0.007)	513	-0.01	-1.18
6 months PBL	1.00	(0.004)	400	0.99	(0.003)	533	0.00	0.13
12 months PBL	0.97	(0.008)	323	0.99	(0.005)	460	-0.01	-1.50
		Mother Has Primary Education or Greater			***Mother Has Less Than Primary Education***			
Treatment								
Baseline	0.99	(0.004)	396	0.96	(0.007)	1001	0.03	3.56
6 months PBL	1.00	(0.003)	425	1.00	(0.001)	1190	0.00	-0.87
12 months PBL	0.99	(0.006)	350	0.98	(0.004)	1004	0.01	1.34
Control								
Baseline	0.97	(0.010)	255	0.98	(0.006)	595	-0.01	-1.24
6 months PBL	0.99	(0.005)	257	1.00	(0.002)	724	0.00	-0.61
12 months PBL	1.00	(0.005)	223	0.97	(0.006)	598	0.02	2.74

Table 13: Difference in Means for TB by Health Supply, Children Aged 12-23 Months.

	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
	Permanent Clinic			***No Permanent Clinic***				
Treatment								
Baseline	0.97	(0.013)	139	0.97	(0.006)	1258	0.00	0.04
6 months PBL	1.00	(0.000)	166	1.00	(0.001)	1449	0.00	2.04
12 months PBL	0.97	(0.011)	130	0.98	(0.004)	1224	-0.01	-1.14
Control								
Baseline	0.95	(0.044)	41	0.98	(0.005)	809	-0.03	-0.66
6 months PBL	0.98	(0.015)	58	1.00	(0.002)	923	-0.01	-0.83
12 months PBL	0.98	(0.017)	57	0.98	(0.005)	764	0.00	0.12
	Mobile Clinic			***No Mobile Clinic***				
Treatment								
Baseline	0.97	(0.008)	721	0.97	(0.008)	676	0.00	-0.22
6 months PBL	1.00	(0.002)	823	1.00	(0.002)	792	0.00	0.04
12 months PBL	0.98	(0.005)	715	0.98	(0.005)	639	0.00	0.51
Control								
Baseline	0.98	(0.008)	420	0.98	(0.008)	430	0.00	-0.04
6 months PBL	0.99	(0.004)	477	1.00	(0.003)	504	0.00	-0.51
12 months PBL	0.98	(0.007)	371	0.98	(0.006)	450	0.00	0.13
	More than 5.5 km to a			***< 5.5 km to a Permanent***				
Treatment								
Baseline	0.97	(0.006)	998	0.96	(0.011)	399	0.01	0.64
6 months PBL	1.00	(0.002)	1185	1.00	(0.000)	430	0.00	-2.05
12 months PBL	0.98	(0.004)	1001	0.98	(0.007)	353	0.01	0.68
Control								
Baseline	0.98	(0.007)	571	0.99	(0.009)	279	-0.01	-0.91
6 months PBL	1.00	(0.003)	667	0.99	(0.004)	314	0.00	0.37
12 months PBL	0.98	(0.006)	532	0.98	(0.007)	289	0.00	-0.36

Table 14: Summary Results for Measles by Mother's Education and Distance to Clinic, Full Sample.

	Treatment			Control			Simple Difference		Double Difference	
	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat	Difference	T-Stat
Mother has less Than Primary School Education										
Baseline	0.91	(0.012)	989	0.95	(0.011)	588	-0.04	-2.30		
6 months PBL	0.96	(0.007)	1123	0.96	(0.007)	685	-0.01	-0.89	0.028	1.48
12 months PBL	0.91	(0.010)	957	0.90	(0.012)	574	0.02	0.95	0.052	2.41
Mother Completed Primary School Education										
Baseline	0.94	(0.012)	394	0.95	(0.013)	253	-0.01	-0.55		
6 months PBL	0.97	(0.008)	420	0.94	(0.015)	250	0.03	1.68	0.039	1.60
12 months PBL	0.90	(0.016)	342	0.94	(0.016)	216	-0.04	-1.97	-0.034	1.20
Distance to Permanent Health Clinic is Less than 5.5 km										
Baseline	0.93	(0.013)	672	0.94	(0.013)	426	-0.01	-0.45		
6 months PBL	0.96	(0.008)	763	0.96	(0.009)	491	0.00	0.17	0.010	1.48
12 months PBL	0.91	(0.013)	610	0.92	(0.012)	426	-0.01	-0.59	-0.002	2.41
Distance to Permanent Health Clinic is 5.5 km or Greater										
Baseline	0.90	(0.013)	711	0.95	(0.011)	415	-0.05	-2.86		
6 months PBL	0.96	(0.008)	780	0.95	(0.011)	444	0.00	0.11	0.050	1.48
12 months PBL	0.91	(0.012)	689	0.90	(0.018)	364	0.01	0.47	0.059	2.41

Table 15: Difference in Means of Measles by Individual and Household Characteristics. Children Aged 24-35 Months.

	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
		Female			*Male*			
Treatment								
Baseline	0.93	(0.020)	298	0.98	(0.007)	453	-0.04	-2.02
6 months PBL	0.98	(0.008)	668	0.99	(0.003)	1005	-0.01	-1.21
12 months PBL	0.99	(0.004)	546	1.00	(0.002)	828	0.00	-0.77
Control								
Baseline	0.94	(0.024)	173	0.96	(0.011)	307	-0.02	-0.81
6 months PBL	0.99	(0.004)	404	0.99	(0.003)	639	0.00	-0.69
12 months PBL	1.00	(0.003)	347	1.00	(0.002)	450	0.00	-0.18
	HH Head Speaks an Indigenous Language			***HH Head Doesn't Speak an Indigenous Language***				
Treatment								
Baseline	0.97	(0.010)	373	0.95	(0.013)	378	0.02	1.34
6 months PBL	0.98	(0.005)	860	0.99	(0.004)	893	0.00	-0.75
12 months PBL	0.99	(0.003)	711	1.00	(0.002)	708	0.00	-1.35
Control								
Baseline	0.95	(0.014)	237	0.95	(0.016)	244	0.00	0.14
6 months PBL	0.99	(0.004)	551	0.99	(0.003)	526	0.00	-0.65
12 months PBL	1.00	(0.003)	417	1.00	(0.000)	419	0.00	-1.42
	Primary Education or Greater			***Less Than Primary Education***				
Treatment								
Baseline	0.99	(0.007)	193	0.95	(0.012)	558	0.04	2.96
6 months PBL	0.99	(0.005)	436	0.98	(0.004)	1317	0.01	1.08
12 months PBL	1.00	(0.000)	389	0.99	(0.003)	1036	0.01	2.42
Control								
Baseline	0.98	(0.013)	128	0.94	(0.014)	353	0.04	2.16
6 months PBL	1.00	(0.004)	280	0.99	(0.003)	798	0.01	1.05
12 months PBL	0.99	(0.007)	214	1.00	(0.000)	626	-0.01	-1.43

Table 16: Difference in Means of Measles by Health Supply, Children Aged 24-35 Months.

	Mean	SE	Obs	Mean	SE	Obs	Difference	T-Stat
	Permanent Clinic			***No Permanent Clinic***				
Treatment								
Baseline	0.97	(0.020)	67	0.96	(0.010)	684	0.01	0.56
6 months PBL	0.99	(0.006)	161	0.98	(0.004)	1592	0.01	1.21
12 months PBL	1.00	(0.000)	143	0.99	(0.002)	1282	0.01	2.40
Control								
Baseline	0.97	(0.029)	33	0.95	(0.012)	448	0.02	0.74
6 months PBL	1.00	(0.000)	64	0.99	(0.003)	1014	0.01	3.06
12 months PBL	1.00	(0.000)	41	1.00	(0.002)	799	0.00	1.42
	Mobile Clinic			***No Mobile Clinic***				
Treatment								
Baseline	0.96	(0.011)	377	0.96	(0.015)	374	0.00	0.16
6 months PBL	0.98	(0.005)	914	0.99	(0.005)	839	-0.01	-0.97
12 months PBL	0.99	(0.003)	737	1.00	(0.002)	688	0.00	-0.26
Control								
Baseline	0.95	(0.017)	222	0.95	(0.017)	259	0.00	0.19
6 months PBL	0.99	(0.004)	531	0.99	(0.003)	547	0.00	-0.05
12 months PBL	1.00	(0.002)	410	1.00	(0.002)	430	0.00	-0.03
	More than 5.4 km to a			***< 5.5 km to a Permanent Clinic***				
Treatment								
Baseline	0.96	(0.011)	530	0.95	(0.016)	221	0.01	0.29
6 months PBL	0.98	(0.004)	1266	0.99	(0.005)	487	0.00	-0.41
12 months PBL	1.00	(0.002)	1049	0.99	(0.004)	376	0.00	0.12
Control								
Baseline	0.95	(0.011)	336	0.94	(0.028)	145	0.01	0.48
6 months PBL	1.00	(0.002)	729	0.99	(0.006)	349	0.01	1.60
12 months PBL	1.00	(0.002)	568	1.00	(0.000)	272	0.00	-1.43

Table 17: OLS Results of the Impact of Progresa on TB and Measles Coverage.

	TB (12-23 month olds)				Measles (24-35 month olds)			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Program (=1)	-0.031*	-0.029	-0.031*	-0.029	-0.029**	-0.030**	-0.029**	-0.030**
	[0.018]	[0.018]	[0.018]	[0.018]	[0.013]	[0.013]	[0.013]	[0.013]
Program * PBL (=1)	0.036	0.035			0.029**	0.032**		
	[0.022]	[0.023]			[0.015]	[0.015]		
Program * 6 months PBL (=1)			0.052**	0.050*			0.030**	0.033**
			[0.025]	[0.026]			[0.015]	[0.016]
Program * 12 month PBL (=1)			0.016	0.015			0.028	0.031*
			[0.024]	[0.025]			[0.018]	[0.018]
Controls	N	Y	N	Y	N	Y	N	Y
Observations	5701	5290	5701	5290	6791	6490	6791	6490
Adjusted R-square	0	0	0	0	0.01	0.01	0.01	0
Mean of Dependent Variable	0.9	0.89	0.9	0.89	0.93	0.93	0.93	0.93

Notes:

1. Standard errors are in brackets and clustered at the village level.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Controls include sex of child, and parent and health supply characteristics.

Table 18: OLS Results of the Impact of Progresa on TB and Measles Coverage, Low Coverage Villages.

	TB (12-23 month olds)				Measles (24-35 month olds)			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Program (=1)	-0.033	-0.028	-0.033	-0.028	-0.046	-0.032	-0.046	-0.032
	[0.035]	[0.034]	[0.035]	[0.034]	[0.029]	[0.031]	[0.029]	[0.031]
Program * PBL (=1)	0.024	0.019			0.052*	0.051*		
	[0.039]	[0.038]			[0.028]	[0.030]		
Program * 6 months PBL (=1)			0.05	0.044			0.047	0.043
			[0.044]	[0.043]			[0.030]	[0.032]
Program * 12 month PBL (=1)			-0.009	-0.012			0.059*	0.061*
			[0.043]	[0.042]			[0.031]	[0.034]
Controls	N	Y	N	Y	N	Y	N	Y
Observations	2200	2063	2200	2063	1835	1763	1835	1763
Adjusted R-square	0.05	0.05	0.05	0.05	0.07	0.07	0.07	0.07
Mean of Dependent Variable	0.83	0.83	0.83	0.83	0.88	0.88	0.88	0.88

Notes:

1. Low coverage villages are villages where vaccination rates are lower than 90 % at baseline for children age 0-11 months for TB and 12-23 months for measles.
2. Standard errors are in brackets and clustered at the village level.
3. * significant at 10%; ** significant at 5%; *** significant at 1%.
4. Controls include sex of child, and parent and health supply characteristics.

Table 19: Heterogeneity of the Impact by Individual and Household Characteristics.

	TB (<12 Month Olds)			Measles (12-23 Month Olds)		
	[1]	[2]	[3]	[4]	[5]	[6]
Program	-0.023	-0.064**	-0.038*	-0.038**	-0.004	-0.036**
	[0.021]	[0.030]	[0.022]	[0.017]	[0.023]	[0.016]
*Female	-0.014			0.02		
	[0.025]			[0.022]		
*Indigenous language, HH head		0.057			-0.039	
		[0.037]			[0.027]	
*Primary education, mother			0.03			
			[0.030]			0.026
						[0.023]
Program * 6 months PBL (=1)	0.047	0.095**	0.066**	0.046**	0.003	0.029
	[0.034]	[0.040]	[0.031]	[0.022]	[0.027]	[0.019]
*Female	0.011			-0.028		
	[0.041]			[0.029]	0.049	
*HH head only speaks Spanish		-0.073			[0.032]	
		[0.054]				0.011
*Primary education, mother			-0.049			[0.031]
			[0.045]			
Program * 12 months PBL (=1)	0.011	0.018	0.023	0.048*	0.037	0.053**
	[0.028]	[0.035]	[0.027]	[0.025]	[0.028]	[0.021]
*Female	0.011			-0.04		
	[0.038]			[0.032]		
*HH head only speaks Spanish		-0.003			-0.017	
		[0.050]			[0.035]	
*Primary education, mother			-0.022			-0.090***
			[0.044]			[0.034]
Female (=1)	0.009	0.004	0.004	-0.012	0.006	0.007
	[0.019]	[0.009]	[0.009]	[0.017]	[0.006]	[0.006]
Primary education, mother (=1)	0.007	0.007	0.001	0.007	0.008	0
	[0.012]	[0.012]	[0.022]	[0.008]	[0.008]	[0.017]
Indigenous language, HH head (=1)	0.003	0.017	0.003	0.004	-0.048**	-0.003
	[0.012]	[0.024]	[0.012]	[0.008]	[0.019]	[0.008]
Other controls	Y	Y	Y	Y	Y	Y
Observations	5667	5667	5667	6783	6783	6783
Adjusted R-square	0	0.01	0	0.01	0.01	0.01
Mean of Dependent Variable	0.9	0.89	0.9	0.93	0.93	0.93

Notes:

1. Standard errors are in brackets and clustered at the village level.
2. * significant at 10%; ** significant at 5%; *** significant at 1%.
3. Controls include sex of child, and parent and health supply characteristics.

Table 20: Heterogeneity of the Impact by Health Supply.

	TB (<12 Month Olds)			Measles (12-23 Month Olds)		
	[1]	[2]	[3]	[4]	[5]	[6]
Program	-0.039**	0.002	-0.04	-0.027*	-0.01	-0.008
	[0.018]	[0.029]	[0.028]	[0.014]	[0.026]	[0.019]
*Health clinic	0.118			-0.021		
	[0.102]	-0.043		[0.040]		
*Mobile clinic		[0.036]			-0.027	
			0.023		[0.029]	
*Distance to health clinic			[0.037]			
						-0.041
						[0.025]
Program * 6 months PBL (=1)	0.058**	0.043	0.069*	0.032**	0.011	0.011
	[0.027]	[0.042]	[0.038]	[0.016]	[0.029]	[0.023]
*Health clinic	-0.064			0.01		
	[0.131]			[0.064]	0.032	
*Mobile clinic		0.01			[0.034]	
		[0.054]				0.042
*Distance to health clinic			-0.035			[0.031]
			[0.052]			
Program * 12 months PBL (=1)	0.019	0.011	0.039	0.022	0.031	-0.004
	[0.025]	[0.046]	[0.038]	[0.019]	[0.033]	[0.023]
*Health clinic	-0.029			0.069		
	[0.132]			[0.060]		
*Mobile clinic		0			-0.005	
		[0.054]			[0.039]	
*Distance to health clinic			-0.051			0.063*
			[0.049]			[0.036]
Health clinic	-0.078	0.008	0.011	-0.002	-0.013	-0.012
	[0.098]	[0.019]	[0.020]	[0.030]	[0.012]	[0.012]
Mobile clinic	0.006	0.017	0.005	0.001	0.023	0.001
	[0.012]	[0.025]	[0.012]	[0.008]	[0.020]	[0.008]
Distance to health clinic	-0.007	-0.007	-0.025	-0.012	-0.012	0.01
	[0.012]	[0.012]	[0.024]	[0.008]	[0.008]	[0.017]
Other controls	Y	Y	Y	Y	Y	Y
Observations	5667	5667	5667	6783	6783	6783
Adjusted R-square	0	0	0	0.01	0.01	0.01
Mean of Dependent Variable	0.9	0.9	0.9	0.93	0.93	0.93

Notes:

1. Standard errors are in brackets and clustered at the village level.
2. * significant at 10%; ** significant at 5%; *** significant at 1%
3. Controls include sex of child, and parent and health supply characteristics.

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